+VG ARCHITECTS
THE VENTIN GROUP LTD

S P E C I F I C A T I O N S

NEW PORT ELGIN COMMUNITY SCHOOL

1107 WATERLOO STREET
PORT ELGIN, ONTARIO

+VG Project No. 22562

for the

BLUEWATER DISTRICT SCHOOL BOARD

SSPS Rfx # 27-00007

ISSUED FOR TENDER: AUGUST 27, 2026.
TENDER CLOSE SEPTEMBER 24, 2026.

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1.1 TENDER TIME-TABLE

Tender Issue	Aua 27. 2026
Deadline for Questions	Sept. 16 2026, 2:00:00 p.m.
Tender Form Closing	Sept 24, 2026, 2:00:00 p.m.
Supplementary Tender Form Closing	Sept 24, 2026, 4:00:00 p.m.

1.2 BUY ONTARIO PROCUREMENT DIRECTIVE AND DOMESTIC SUPPLY CHAIN PLAN

.1 It is the intent of this project design, tender and construction to comply with the Buy Ontario Procurement Directive. The objective is to maximize the use of Ontario-Made and Canadian-Made Goods and Ontario Services, while maintaining value for money and the timely delivery of infrastructure projects. This includes construction, fixtures, furniture and equipment that are included in and incidental to the construction of the school facility and required to support school operational readiness immediately following completion of construction.

.2 Efforts have been made to specific Ontario and Canadian made goods. In instances where goods and services have been specified that are not Ontario or Canadian made, if there are alternates that are Ontario and Canadian produced, meet the performance of the specified items and are available within the project construction budget and schedule, they will be allowed to be supplied as part of this project upon review and approval by the Consultant team.

.3 As the School Board is governed under procurement legislation applicable to the Broader Public Sector (BPS) entity, they are required by the Buy Ontario Procurement Directive to exclude U.S. businesses from procurements; however, procuring from U.S. businesses is allowed if any of the following circumstances apply:

.1 A U.S. business is the only viable source for the good/service, and the procurement cannot be delayed.

.2 For procurements for services, the U.S. business commits to having at least 90 percent of the required staff to deliver the contracted services located in Canada.

.4 For any goods or services from a U.S. business, regardless of the value, approval must be obtained from the appropriate government authority prior to procurement. To determine if the goods or services from a U.S. business qualify for approval or any goods or services from a U.S. business, visit:

https://www.ontario.ca/page/buy-ontario-procurement-directive

.5 As part of the requirements under the Buy Ontario Procurement Directive and the Capital Infrastructure Policy, Bidders are required to complete and submit the Bid Form Supplement – Domestic Supply Chain Plan Commitment Form with their Bid submission.

1.2.1 ELECTRONIC TENDERING SYSTEM:

.1 All Bidders shall have a Bidding System Vendor account and be registered as a Plan Taker for this Bid opportunity, which will enable the Proponent to

.2 To ensure receipt of the latest information and updates via email regarding the bid or if a Bidder has obtained this Bid Document from a third party, the onus is on the Bidder to create a Bidding System Vendor account and register as a Plan Taker for the bid opportunity at: bidsandtenders.ca

.3 The Owner will **only** accept and receive electronic Bid submissions through the Owner's Bidding System, hereafter called the "BIDDING SYSTEM".

.4 The Bidding System will send a confirmation email to the Bidder advising that their bid was submitted successfully.

.5 **Note that hard copy bid submissions will not be accepted.**

1.3.0 BID CLOSING DATE AND TIME:

.1 **ELECTRONIC BID SUBMISSIONS ONLY, tender forms** shall be received by the Bidding System, **before 2:00:00 p.m. Eastern daylight time, on Sept 24, 2026.**

Supplementary Tender Form shall be received by email to Rfxsubmissions@sharedschoolservices.ca before **4:00:00 p.m. Eastern daylight time on Sept 24, 2026.**

Roofing, Mechanical and Electrical Supplemental forms must be received not later than **24 hours after tender close** by email to Rfxsubmissions@sharedschoolservices.ca

.2 The closing time shall be determined by the Bidding System web clock.

.3 Proponents are cautioned that the timing of their Bid Submission is based on when the Bid is **RECEIVED** by the Bidding System, & the shared school services site and **not when a bid is submitted** by a Proponent, as bid transmission can be delayed in an ***"Internet Traffic Jam"*** due to file transfer size, transmission speed and other electronic or cyber issues.

.4 For the above reasons, the Owner recommends that Proponents allow sufficient time to upload their Bid Submission and attachment(s) (if applicable) and to resolve any issues that may arise. The closing time and date shall be determined by the Owner's Bidding System web clock.

.5 The Bidding system will send a confirmation email to the Proponent advising that their bid was submitted successfully. If you do not receive a confirmation email, contact technical support at Bids & Tenders via email: support@bidsandtenders.ca

.6 All Bids shall be irrevocable and shall remain open for acceptance, at the prices quoted, for up to sixty (60) business days from the Bid Submission Deadline. In submitting a Bid, each Proponent agrees that, notwithstanding anything to the contrary, the Owner may notify the Successful Proponent at any time within the Bid validity period that is Bid has been awarded.

.7 Late Proposals shall not be accepted by the Owner's Bidding System and the Owner will not be held liable or accept any responsibility for any bids that can be successfully uploaded by a Proponent.

.8 Unofficial tender results will be posted publicly on the Owner's Bidding System shortly after the time of closing.

1.4.0 BID SUBMISSIONS

.1 Complete electronic bid submissions to the bidding system shall include:

.1 Complete Tender Form including DSCP form, signed, sealed and dated; and

.2 Bid Bond; and

.3 Consent of Surety/Agreement to Bond; and

.4 Undertaking of Insurance as noted in this Section; and

.5 WSIB Certificate of good standing.

.6 Supplemental Tender Form to be received by email to Rfxsubmissions@sharedschoolservices.ca before 4:00pm Eastern Daylight Time.

.7 Supplemental Roofing, Mechanical and Electrical forms shall be received not later than 24 hours after tender closing to Rfxsubmissions@sharedschoolservices.ca

.2 Tenders must be submitted on the Tender Form and Supplementary Tender Form issued with Tender Documents.

.3 All blanks on Tender Form and Supplementary Tender Form must be filled in. Failure of a Bidder to insert a value for any Value or Unit Price shall be deemed to be a "zero dollar" ($0) value.

.4 Tenders shall not be qualified by any condition without express written consent of the Consultant clarified by an Addendum only prior to submission of Tender.

.5 All requirements of the Tender Form and Supplementary Tender Form must be completed.

.6 Bidders shall be solely responsible for delivery of Tender in the manner and time prescribed.

.7 Bidders shall be solely responsible for verifying they have received all of the Addenda issued.

1.5.0 WITHDRAWAL/AMENDMENT OF SUBMISSION

.1 Bidders may amend or withdraw their submission prior to the closing time and date. However, it is the Bidders responsibility to:

.1 Withdrawal - Ensure the submission is **withdrawn** from the Bidding System before the time of closing, on the bid closing date;

.2 Amendment – Ensure the re-submitted bid is **received** by the Bidding System before the time of closing, on the bid closing date.

.3 Proposals shall be for a stipulated sum without escalator clause or other qualification.

.2 Tenders shall be submitted electronically using the Tender Form and Supplementary Tender Form issued as part of the Tender Documents through the Owner's designated electronic bidding system. Bidders shall acknowledge receipt of all Addenda in the Tender Form and shall be responsible for verifying within the electronic bidding system that all Addenda have been received prior to submitting their Bid.

.3 The successful bidders stipulated sum shall apply to the "total performance" of the specified work and shall be understood to include the supply of all labour, supervision, material and equipment to construct, completely finish and install fixtures and items of construction as listed herein and on drawings provided and include other expenses such as customs, duties, excise taxes as well as Goods and Services and Provincial Sales Taxes as noted in the Tender Form, fees for all approvals, permits and inspections, insurances, Workers' Compensation Insurance as well as overhead and profit.

4. In the reception of tenders for the work, no obligation is incurred to accept the lowest or any proposal provided by a prequalified General Contractor. The Owner reserves the right to refuse any or all tenders for any sub-division of the work or to decline to proceed with all the work if the Board so determines.

5. A Bid may be withdrawn or modified only prior to the Bid Submission Deadline and only in accordance with the requirements of the Owner's designated electronic bidding system. Bids received after the Bid Submission Deadline will not be accepted by the electronic bidding system. Oral, telephone, facsimile, email, text message, or hand-delivered bids, modifications, or withdrawals will not be accepted.

6. The Owner reserves the power and right to reject tenders received from parties who cannot show a reasonable acquaintance of the class of work herein specified and shown on the drawings. Evidence of such competency must be furnished by tenderer when requested.

7. Tender shall remain open for acceptance for a period of **60 days** and until a formal contract, Bonding and Insurance for the work is executed by the successful tenderer as approved by the Owner.

8. Tenders shall furnish all information requested on the tender form and should any uncertainty arise as to the proper manner of completing the form, the requisite information will be given by the Consultant. Tender forms shall be completed in long hand in a legible manner in ink or type written without alterations or erasures. **Incomplete tenders may be**

disqualified.

9. Incorporated Companies must attach Corporate Seal and signature of proper officers shall be affixed.

10. The Bidder shall include in their proposal a very carefully considered estimate of the time required after receiving the Letter of Intent, to perform the work, including the time required to obtain building permit: Indicate the total number of weeks to perform the work from date of contract award on the Tender Form provided Item 7.

11. The Tenderer shall name under list of subcontractors on the tender form and supplementary tender form, the subcontractors they propose to perform the work under the contract and to be included in the Contract Agreement the Contractor would sign with the Owner. No substitution shall be made without the approval in writing by the Consultant and Owner.

1.6.0 INFORMAL OR UNBALANCED TENDERS

Tenders which are incomplete, conditional, illegible, or obscure, or that contain reservations, erasures, alterations, or irregularities of any kind may be rejected as informal.

1.7.0 OMISSIONS AND DISCREPANCIES

Bidders shall identify any discrepancies, omissions, errors, or required clarification of the Tender Documents by submitting a question through the Owner's designated electronic bidding system prior to the deadline for questions specified in the Tender Documents.

Responses to bidder questions and any resulting revisions to the Tender Documents will be issued by Addendum through the electronic bidding system and shall form part of the Tender Documents.

Neither the Owner nor Consultant shall be responsible for verbal instructions, interpretations, or information provided outside of the electronic bidding system.

Should any discrepancies or omissions go unreported during tendering period, the proper interpretation of the bid documents shall be at the discretion of the Consultant.

2.0 AWARD OF CONTRACT

1. FACTORS AFFECTING CONTRACT AWARD

The Owner reserves the right to award the Contract based on the Base Bid only or on any combination of the Base Bid, Alternate Prices and Separate Prices that, in the opinion of the Owner, best meetings the requirements of the Project.

The lowest compliant Bid will not necessarily be accepted.

2. CONCURRENT PROJECT CAPACITY CONSIDERATIONS

The Owner is undertaking multiple capital projects within a similar timeframe. Bidders may want to submit bids for one or more of these projects.

Where a Bidder is determined to be the lowest compliant bidder on more than one project, the Owner reserves the right to assess the Bidder's demonstrated capacity to successfully deliver multiple projects concurrently.

Such assessment may include, but is not limited to:

- availability of key personnel and project management resources;
- availability of equipment and supervisor staff;
- available bonding and surety capacity; and
- demonstrated ability to meet the project schedules for all projects under consideration.

Where, in the Owner's assessment, a Bidder does not demonstrate sufficient capacity to undertake multiple projects concurrently, the Owner reserves the right to limit the award of projects and may award any remaining project(s) to the next lowest compliant bidder.

2. AWARD OR REJECTION OF TENDER

The Owner reserves the right to reject any or all tenders and to waive any irregularity therein the lowest tender may not necessarily be accepted.

3. ACCEPTANCE OF TENDER

No Bidder shall be considered under Contract after the opening and reading of Tenders until the AGREEMENT is signed and compliance therewith has been made.

3.0 DELETION OF WORK UNDER THE CONTRACT

1. WORK DELETED FROM THE CONTRACT

The Owner reserves the right to delete any or all work from the contract.

The contract amount will be the tender amount less an amount for the work deleted as determined by the Architect.

4.0 BID BOND

1. Every tender shall be accompanied by a Bid Bond (with a recognized Guarantee or Insuring company - approved by the Canadian Construction Association) in the amount of 10% of the Tender Sum being quoted which may be forfeited. The tenderer agrees that, if they withdraw this tender within 60 days after the closing date, the deposit made with this tender shall be forfeited to the Owner.

5.0 BONDS

1. PERFORMANCE BOND
An Agreement to Bond for 50% of the Tender amount must accompany each tender and the tenderers shall include for the cost to provide a 50% Performance Bond in their Tender Amount. Refer to CCDC Document 2 (Revised 2020). The format must conform to CCDC Document 2 (Revised 2020) General Conditions and as amended in the Supplementary General Conditions. The issuing company of the Bond must be approved by the Canadian Construction Association.
NOTE: At Substantial Performance of the contract, this bond shall be converted to cover the warranty period and shall remain in force for a period of 24 months after the date of substantial performance.

2. LABOUR AND MATERIAL BOND

An Agreement to Bond for 50% of the Tender amount must accompany each Tender and the Tenderers shall include for the cost to provide a 50% Labour and Material Bond in their Tender Amount. Refer to CCDC Document 2 (Revised 2020) The format must conform to CCDC Document 2 (Revised 2020) General Conditions and as amended in the Supplementary General Conditions. The issuing company of the Bond must be acceptable to the Owner and approved by the Canadian Construction Association.

3. Both Performance Bonds and Labour and Materials Bonds are to be provided within seven (7) days for each school awarded, after receiving notification of acceptance of their quotation from the Owner, or forfeit the amount of the Bid Bond enclosed with the tender.

6.0 CONTRACT

1. The successful tenderer shall execute the said formal contract as called for, within 7 days after notification of the acceptance of their tender or forfeit the amount of the Bid Bond enclosed with the tender.

2. The successful tenderer will be required to execute a "Canadian Standard Form of Construction Contract to a Stipulated Sum" (Revised 2020) CCDC Document No. 2, including Amendments thereto as set out in the Supplementary General Conditions.

7.0 SITE

1. The work is to be performed at the site located at 1107 Waterloo Street Port Elgin Ontario

8.0 CLIENT / OWNER

1. The Client is the Bluewater District School Board, 351 – 1st Avenue N. Chesley, Ontario. N0G 1L0.

9.0 CONSULTANTS

1.	The Prime Consultant is:	+VG - The Ventin Group Ltd., Architects 50 Dalhousie Street Brantford, Ontario N3T 2H8 T: 519-754-1652 Contact Person: Edward Bourdeau
2.	The Structural Engineer is:	+VG Structures Ltd. 50 Dalhousie Street Brantford, Ontario N3T 2H8 T: 519-754-1652 Contact Person: Michael Lin
3.	The Mechanical/ Electrical Engineer is:	DEI & Associates 55 Northland Rd. Waterloo, ON N2V 1Y8 T: 519-725-3555 Contact Persons: Michael & Stephen Demaiter
4.	Site Servicing Engineer is:	Cobide Engineering Ltd. 571 10th Street Hanover, ON N4N 1R4 Contact Person: Travis Burnside
5.	Landscape Architect is:	MHBC Inc. 230-7050 Weston Rd. Woodbridge, Ontario T: 905-761-5588 Contact Person: Philip Dixon

10.0 LIST OF PRE-QUALIFIED GENERAL CONTRACTORS AND MAJOR SUBCONTRACTORS APPROVED TO BID ON THIS PROJECT

1. The General contracting firms PREQUALIFIED TO BID on the work are as follows:

Garritano Bros. Ltd.
JP Commercial Contractors
Norlon Builders
Percon Construction Ltd
Pre-Eng Contracting Ltd.
Quad Pro Construction Inc.
Tambro Construction Ltd
TRP Construction General Contractors

NOTE: This School Project can be tendered by the above **Pre-Qualified General Contractors Only.**

2. The Mechanical contracting firms PREQUALIFIED TO BID to the general contractors on the work are as follows:

Conestogo Mechanical Inc.
Culliton Inc.
Dean Lane Contractors Ltd.
J.M.R. Electric Ltd.
Kittel Mechanical (2003) Ltd.

3. The Electrical contracting firms PREQUALIFIED TO BID to the general contractors on the work are as follows:

Bennedict Electrical Contracting Ltd.
Bram-K Enterprises
Culliton Inc.
J.M.R. Electric Ltd.
MJM Electric Ltd.
Yake Electric Limited

4. The Masonry contracting firms PREQUALIFIED TO BID to the general contractors on the work are as follows:

1138483 ONT LTD
Blockwall Masonry 19 Inc.
Brownstone Masonry
Burling Ranger Company Inc.
Konia Masonry Corporation
Render Construction Inc.

5. Tenders received including non-prequalified Subontractors may not be considered.

11.0 BID DOCUMENTS

1. The Tender Documents shall be made available through the Owner's designated electronic bidding system:
https://gbsharedschoolservices.bidsandtenders.ca/Module/Tenders/

2. The Tender Documents include the Drawings, Specifications, and all other documents identified in the Specifications book.

3. Addenda issued during the tender period shall form part of the Tender Documents and shall be acknowledged by tenderers in accordance with these Instructions to Bidders.

4. The Tender Documents remain the property of the Owner.

12.0 EXAMINATION

1. The site shall be accepted by the Contractor in its present condition. The Contractor will be held to have visited the site and carefully examined all conditions affecting the site and the work to be performed thereon, including the location of all services that may have to be protected, removed, or relocated. The Contractor shall accept sole responsibility for any error or neglect on their part in this respect. Submission of a Tender shall be deemed confirmation that the Tendered has inspected the site and is thoroughly conversant with the existing conditions. No claims for extra payment will be considered for extra work, expense, or difficulties encountered due to conditions on the site that were visible upon, or reasonably inferable from, an examination of the site prior to the closing of tenders.

2. Examine the Specifications and Drawings thoroughly. Report all ambiguities, discrepancies, omissions, errors, departures from Building By-Laws, or from good practice discovered during examination by submitting a question through the Owner's designated electronic bidding system as early in the tender period as possible to allow clarification by Addendum to all Tenderers. No claims for extra payment will be considered for work, expense, or difficulties that are reasonably inferable from an examination of the Tender Documents prior to the closing of tenders.

3. The Drawings and Specifications complement each other, and neither is to be considered alone. Any item omitted in either Drawings or Specifications, but shown, specified, or reasonably implied in the other, shall be deemed to form part of the Tender Documents.

4. All changes to the contract documents which result in an extra or a credit to the contract amount are not to be executed until written instructions have been received and the extra or credit agreed to in writing by all parties to the contract.

5. The Contractor shall execute variations, alterations and substitutions which do not affect the contract amount as instructed by the Board or its representatives.

6. Prior to the closing date of tenders, any and all necessary clarifications of the Specifications or other Tender Documents shall be issued through the Owner's designated electronic bidding system in the form of written Addenda. Neither the Owner nor the Consultant shall be responsible for verbal instructions, explanations, or interpretations of the Drawings, Specifications, or other Tender Documents.

7. A final Addendum will be issued through the Owner's designated electronic bidding system no later than seventy-two (72) hours prior to the Tender Closing. No questions concerning the project will be accepted after that time.

13.0 UNIT PRICES

1 At time of submission include in the Supplementary tender form all the unit prices in accordance with the Supplementary Tender Form. These unit prices will be included in the agreement.

2 Unit prices shall include labour, material and applicable taxes , overhead and

profit, and other relative charges, but shall be exclusive of HST. Any work done on the basis of unit prices shall be carried out generally in accordance with the specifications for similar work and shall be to the Architect's approval.

3 The Owner reserves the right to accept or reject any or all of the Unit Prices prior to entering in the construction contract. The owner reserves the right to negotiate these unit prices rejected or proposed prior to entering into a contract. The owner reserves the right to renegotiate unit prices on any value over $30,000 at the time of the proposed change.

14.0 BASE BID TENDERS

1. Materials and equipment are specifically described and named in this specification to establish a standard of materials and workmanship to which the tenderers shall strictly adhere. Where manufacturer's trade names are used, the first named or specified by catalogue numbers meets specifications in all respects regarding performance, quality of material and workmanship, and is acceptable to the Architect.

2. Where the contractor uses equivalent products other than the first named, on which design is based, they shall be responsible for all details of installation including product size, arrangement, fit, colour, etc. and maintenance of all required clearances. Contractor shall prepare and submit revised layouts to indicate arrangement of all affected surrounding equipment, etc. Failure by Contractor to provide such drawings may be considered indication that original arrangements, and space allocations are adequate. All additional costs associated with equivalent products such as revisions to surrounding architectural finishes, structural components, or the need for larger motor starters, larger power feeders, space revisions to associated product, equipment, controls, etc. shall be provided by the General Contractor and be included in Bid price.

3. Tenders may include with their lump sum tenders, alternative proposals based on the use of alternative material equivalent to the materials or equipment specified, in quality and performance, provided clearances and dimensions shown on the drawings are maintained. For all such alternative proposals, the tenderer shall include such proposals and the following information, in a letter accompanying his tender, for consideration by the Architect at the time of opening tenders. Under no circumstances shall the bid for an alternative material or equipment be included in the tender amount.

    1. Manufacturer's name and supplier's name.
    2. Change in price, if any.
    3. Reason for proposing alternative.
    4. Detailed description of alternative.
    5. Statement assuming full responsibility that any equipment shall not exceed the space requirement allocated on the drawings. This contractor shall be responsible for any additional installation cost resulting from the acceptance of a substitute piece of equipment or product.

4. Under no circumstances will alternatives submitted after the closing of tenders, be considered.

5. The Architect reserves the right to accept or reject proposed alternatives as the Architect sees fit, and also to claim for the Owner, the financial benefit of a substitution, if a substitute is accepted. A rejection by the Architect does not become obligated to give any reason for his action.

15.0 PROCEDURES AND SUPPLY OF CRITICAL MATERIALS

1. Submission of a tender shall constitute the Tenderer's agreement that they will commence work immediately upon award of the Contract, and that they will execute the same without interruption until completion, including the furnishing of all necessary supplies and equipment for winter operations. Contractor shall assure themselves before submitting a tender that they are in a position to furnish adequate supplies of all materials, critical or otherwise, at such times necessary to ensure immediate commencement of the work and continuous operation without delays on the project. The Contractor shall include in their tender amount, sufficient sums for the purchase of critical materials from any source available. After award of the contract, the Owner will not grant increases to the tender amount to obtain critical materials at premium prices, nor will delays or interruption of the work be tolerated.

16.0 LAWS, CODES AND REGULATIONS

1. The tenderer is assumed to have made themselves familiar with and abide by the Federal National Authorities, Provincial, Municipal and local laws, rules and regulations which in any manner affect those engaged or employed in the work, or in any way affect the work, and no plea of misunderstanding will be considered on account of ignorance thereof. If the Bidder shall discover any provisions in the drawings, specifications or contract which are contrary to or inconsistent with any law, rule of regulation, Contractor shall at once report it to the architect in writing.

17.0 WAGES

1. The General Contractor and all subcontractors shall adhere to the hours of work, the working conditions and rate of wages paid under the prevailing local conditions and/or requirements, paying not less than minimum wages established by customary standard in the locality for the same or similar class of work.

18.0 PERMITS

1. The Owner will be applying and paying for Building Permit and the Contractor shall expedite it from the Municipality. The Contractor shall be responsible for expediting, obtaining, paying for and picking up all other necessary permits, relative inspection fees, licences, notices, certificates of inspection, approval required to carry out work and provide the Owner with proof of same.

2. It is the responsibility of this Contractor to expedite and obtain the required building permit prior to commencing the work. Contractor must allow for time to obtain all required permits within the project completion schedule.

3. Proof of issue of Building Permit must be submitted before any progress payments

can be released for the project.

19.0 HOLDBACK

1. A holdback of 10% of the contract price shall be held by the Owner for a period of 60 days after substantial completion and approval of the work as per specifications. Pursuant to the requirements of the Construction Act as currently amended, the holdback will be released after the expiration of 60-day lien waiting period, provided no liens are then registered. The date of advertisement in a construction trade newspaper shall commence the lien period.

2. At the end of 60 days waiting period, the Contractor will submit to the Owner, an invoice for the amount of the 10% holdback, at which time affidavits will be submitted to the Owner ensuring there are no liens against the job at that time.

3. An additional sum of $50,000.00 (Coordinate with Supplementary General Conditions) will be withheld for the one-year warranty maintenance period as provided in the Supplementary General Conditions. This sum will be retained until all outstanding deficiencies and one-year guarantee items have been corrected to the satisfaction of the Architect.

20.0 INSURANCE

1. All Risk Property Insurance, including fire insurance, to be provided by the General Contractor and shall be in joint names of the School Board, Architect and Consultants.

2. The Contractor shall provide a minimum of $5,000,000.00 Public Liability Insurance. The Contractor shall indemnify and save harmless the Bluewater District School Board, +VG The Ventin Group Ltd., Architects, Consultants, and their officers and agents from all claims relating to labour, materials and equipment furnished for the work and to inventions, patents or patent rights used in doing the work. The Contractor shall be responsible for any and all damages or claims for damages or injuries or accidents done to or caused by them or their employees or relating to the prosecution of the works, or any of their operations or caused by reason of the existence or location or condition of any materials, plant or machinery used there on, or which may happen by reason thereof, or arising from any failure, neglect or omissions on their part, or on the part of any of their employees to do or perform any or all of the several acts or things required to be done by them under and by these conditions and covenants and agrees to hold the Board, The Ventin Group Ltd., Architects and Consultants, harmless and indemnified for all such damages and claims for damages.

3. Automobile Liability Insurance and Contractor's Equipment Insurance and all other insurances shall be provided by the General Contractor and shall be in joint names of the Contractor, the School Board, the Architect, and Consultants.

4. Undertaking of Insurances and the named insured showing the Owner as an additional named insured for the project shall be submitted to the Owner upon execution of

the Contract. Insurance Certificate shall provide that the insuring company will give 60 days' notice to the Board of an intention to cancel.

21.0 WORK PLACE SAFETY AND INSURANCE

1. Submit proof of Workplace Safety and Insurance coverage. The contractor shall provide the owner with written documentation that all Workplace Safety and Insurance and Employment Insurance payments are up to date and in order.

22.0 IMPERIAL/METRIC DIMENSIONS

1. Where both imperial and metric dimensions are given in this specification, the metric dimensions apply for this project.

23.0 SITE ACCESS

1. Contractor to remove all debris from site daily.

2. Location of all trailers, storage units, and construction fences by contractor shall be reviewed and approved by the Owner and Architect at a preliminary site meeting prior to contractor moving on to site.

3. Parking for construction workers shall be off site unless space is available on site and only if approved by the school principal.

4. Site access for construction to be confirmed at first site meeting.

24.0 CONSTRUCTION SAFETY

1. Safety measures or procedures taken by the Contractor, i.e. site safety meetings, site construction fences, etc. will not relieve the contractor of their responsibilities for the safety of persons and property, and for compliance with the federal, provincial and local statues, rules, regulations and orders applicable to the conduct of the work.

2. This Contractor shall be liable for any costs, fines, penalties, etc. levelled against the Owner or Consultant due to violation of the Construction Safety Act by this Contractor or any Subcontractors on this project.

3. This Contractor will be responsible for submitting to the Owner their safety program used in ongoing operation of their company and safety recommendations specifically relating to the tendered project.

4. Do not lift any materials or equipment over existing school or port-a-pack classrooms while these spaces are occupied by students or staff.

25.0 TAXES AND DUTIES

1. The Base Bid Price shall be exclusive of any value added taxes ie. HST. Should other unforeseen tax changes occur, the Owner would only be required to remit the

legally required amount of tax.

2. The successful General Contractor will indicate on each application for payment **as a separate amount** the appropriate HST the Owner is legally obliged to pay.

26.0 CASH ALLOWANCES

1. The Contractor shall include in the contract the sum of all cash allowances specified in the specifications, which allowances shall be expended in whole or in part as the Architect shall direct, and the amount of the contract sum being adjusted accordingly. The contract sum shall include such sums for expenses and profit on account of such cash allowances as the Contractor and all subcontractors require.

3. In the event that the cost of work covered by a cash allowance shall be greater than or less than the cash allowance, the contract sum shall be adjusted accordingly, there shall be no adjustment in the contract sum for expenses and profit; it being understood and agreed that the contract sum includes the Contractor's and Subcontractor's expenses and profit for all cash allowances whether or not they are exceeded. The Sub-contractor shall submit to the General Contractor copies of all invoices and statements from their suppliers furnishing materials, equipment, etc. purchased under the cash allowances.

27.0 PROJECT SCHEDULE

1. In addition to the construction scheduling requirements set forth in CCDC 2 (2020), as amended by the Supplementary Conditions, the successful Contractor shall, within 10 days of receiving the Letter of Intent, submit to the Owner and Consultant a preliminary construction schedule identifying the proposed construction sequencing and major activities required to complete the Work. The construction schedule shall be maintained on site throughout the Project and updated in accordance with the Contract Documents.

2. In addition to the Contractor's obligations respecting the construction schedule under CCDC 2 (2020), as amended by the Supplementary Conditions, where the Consultant determines that the Work has fallen behind schedule, the Contractor shall promptly implement appropriate recovery measures, including the provision of additional labour, supervision, equipment, or overtime, as necessary to restore the Work to the approved construction schedule, at no additional cost to the Owner.

3.Contractor shall commence shop drawings immediately once acceptance of tender has been given by Owner. A complete shop drawing and sample submission schedule is to be provided within seven days of tender award. This will be reviewed by Architect.

4. A Building Permit has been released by the municipality. The new building is intended to start construction **October of 2026** & must achieve occupancy by June 1, 2028 and be ready for students for the beginning of the school year in **September 2028**. Work shall be carried out in a continuous process.

5. The land developer has turned over the site to BWDSB.

The streets and services around the site are in place and have been constructed by the subdivision developer. The streets and associated facilities will be ready for site access by **the start of construction in the fall 2026.**

28.0 GENERAL NOTES TO CONTRACTOR

1. The contractor will be required to keep and maintain a set of as-built drawings for each project. These drawings will be used for no other purpose than recording the exact location of buried or covered services and all changes to the contract documents. The as-built drawings will be kept up to date on a daily basis. The Architect will review drawings for completeness prior to approving monthly draw. The as-built drawings will be submitted to the Architect along with guarantees, maintenance data, extra supplies, etc. at the substantial completion of the contract.

2. The contractor will turn over to the Architect at the completion of the contract all project close out documents, material, etc. These documents, material, etc. including occupancy permit, will be accepted only with a transmittal and at no other time than when submitting a written request for substantial completion of the contract. For purposes of determining a value of this work it will be considered as **$30,000.** Note this amount is in addition to any values identified in Mechanical and Electrical sections.

3. The contractor is not to act on verbal instruction from the Owner, Consultants, or Architect on work they consider to be extra to their contract scope. Extra work can only be authorized by the Architect and in a written form only. The written form must also include that this work is an extra to the contract scope, and the method by which extra costs will be tabulated.

4. Remove and dispose of all resultant debris.

5. Work shall be done in accordance with best standard practice, unless special methods or performance standards are specified or given in writing by the Owner. Only skilled mechanics shall be used where such are required to produce a first class job. Where required by code or other by-laws and regulations, trades people shall be licensed in their trades.

6. Use, install and handle manufactured materials in accordance with manufacturer's instructions.

1. Conform to the Ontario Building Code (latest Edition as currently amended), CEC CSA C22, (latest Edition as currently amended) CAN3-B44, and CSA W59.1, where applicable, to the Canadian Code for Construction Safety, as currently amended, and to the Construction Safety Act, Ont. as currently amended, and to all other applicable codes and Building By-Laws hereinafter referred to as Codes; and to the requirements of the authorities having jurisdiction, including public utilities, referred to in the Contract Documents as the authorities.

7. Conform to regulations of Municipality having jurisdiction regarding clean-up of tracking on streets and protection of sidewalks and curbs, and all other applicable

laws, By-laws and Regulations.

8. Any work not acceptable to the Architect or Owner or local authorities shall be removed and replaced when and as directed by them. The cost of re-executing such work shall be borne by the Contractor.

29.0 PROTECTION AND MAKING GOOD

1. Protect existing property, adjacent public and private property and work of other sections from damage while doing work.

2. Damaged work and property shall be made good wherever possible by those performing work originally, but at expense of those causing damage. The General Contractor is solely responsible for all subtrades and any damage.

3. Attach and fasten fixtures and fittings in place in safe, sturdy secure manner so that they cannot work loose or fall or shift out of position during construction or occupancy of building as a result of vibration or other causes in normal use of building.

4. If, during performance of the work, any buildings, curbs, walks, road, storm water management pond work, or landscaping are damaged, repair or replace them to the satisfaction of Architect and the local jurisdiction at no additional cost to the Owner.

30.0 MATERIALS AND EQUIPMENT

1. All materials and equipment supplied for the work shall be new, of the best quality, and in accordance with the latest applicable specifications of the Canadian Standards Association.

2. The particular method, material, procedure or equipment specified in this tender shall be used as a standard.

3. A bidder may submit an alternative method, material, procedure or equipment to that specified in the tender specifications. All alternatives shall be equal or superior to the standard specified in these tender documents. Alternates may not necessarily by accepted by the Architect.

4. The bidder who furnishes an alternative method, material, procedure or equipment in place of the standard item specified shall furnish complete documented data including such information as chemical content and performance under laboratory tests which proves the quality and equality of the proposed alternative. This information shall accompany the bid. Note that the bidder who furnishes an alternative method, material, procedure or equipment in place of the standard item specified is responsible that the alternative will work with the Architectural layout, equipment will fit in the provided space and any revisions that will be required will be at the bidder's cost.

5. In all cases where alternative methods, materials, procedures or equipment are offered in response to this tender, the Board shall make the final ruling on their

acceptability.

6. During and upon completion of the work, the Contractor shall remove from the premises all surplus materials, equipment and debris.

31.0 ACCESS TO INFORMATION

1.All tenders, quotes and proposals are subject to the Municipal Freedom of Information and Protection of Privacy Act and will be disclosed where the Board is required to do so for the purposes of complying with an Order of the Information and Privacy Commissioner.

32.0 SECURITY BACKGROUND CHECKS

1. Under the "Collection of Personal Information Regulation", made under the Education Act, the Board reserves the right to require that a criminal background check (at no cost to the Board) be conducted on, and/or an offence declaration obtained from, the Service Provider and/or his or her employees and sub-consultants/sub-contractors who are deemed by the Board to come into direct contact with pupils on a regular basis. As a condition to the Service Provider providing or continuing to provide services, the Board may require the replacement of an individual(s) employed/retained/contracted by the Service Provider (at no cost to the Board) if the individual:

    2. has prior convictions for offences under the Criminal Code (Canada) for which a pardon under section 4.1 of the Criminal Records Act (Canada) has not been issued or granted and which indicate that the individual could pose a threat to pupils, or
    3. has made a false Offence Declaration, and/or
    4. declines to provide a verification of criminal record.

    The Board will ensure that personal information collected or conveyed to it under this regulation meets the requirements of the Municipal Freedom of Information and Protection of Privacy Act.

33.0 WHMIS REQUIREMENTS REQUESTED BY THE OWNER

1. Contractors shall comply with WHMIS requirements in accordance with the Occupational Health and Safety Act (Ontario). Before commencement of work and during the full term of the Contract, the Contractor shall provide a list with current MSDS for all hazardous materials proposed for use on the Project. The Contractor shall label hazardous materials used and/or supplied on the Project in accordance with WHMIS requirements. The Contractor shall conform to the Environmental Protection Act for disposal and clean-up requirements. The Contractor shall obtain from the Owner, where applicable, a list and MSDS of hazardous materials that may be handled, stored or used by the Owner's employees and/or other contractors retained by the Owner at the location where work of this Contract will be performed. The Contractor shall ensure that those who handle and/or are exposed to or are likely to handle or to be exposed to hazardous materials, are fully instructed and trained in accordance with WHMIS requirements.

2. The Contractor shall provide Material Safety Data Sheets for all WHMIS regulated products brought into the school, provide WHMIS training for specific regulated products brought into the school, to any school staff who will be working in the proximity of or who may be exposed to the product.

3. Also refer to Section 01545 - Safety Requirements.

END OF SECTION

TENDER FORM

FOR

NEW PORT ELGIN K-6 JUNIOR SCHOOL
PORT ELGIN, ONTARIO
FOR THE
BLUEWATER DISTRICT SCHOOL BOARD

SUBMITTED BY: _____

DATE: _____

1. Having carefully examined the Drawings and Specifications, including all Addendum thereto, issued prior to this date and numbered ____ to ____ inclusive, and the General Conditions of the Contract as amended by the Supplementary General Conditions, and having examined and complied with the Instructions to Bidders as prepared by The Ventin Group Ltd., Architects for the Port Elgin Community School, Port Elgin, Ontario, we hereby offer to furnish all the materials, plant and labour necessary for the proper completion of the work set forth in the aforesaid Drawings, Specifications, General Conditions, and Addenda, including all prime costs, Allowances, Goods and Services, and all applicable Taxes in force at this date **but not including Harmonized Sales Tax** and any additional or deductible Allowances or taxes that have not been announced and that may be imposed subsequent to this date, which shall be payable by or to the Owner in accordance with the aforesaid documents for the sum of:

TOTAL BASE BID SUM AMOUNT:

_____

$ _____ **(not incl. HST)**
in lawful money of Canada

2. The above stipulated tender sum includes all necessary overtime or premium work that will be required to complete this project on schedule.

3. We propose to use the following Mechanical and Electrical Subcontractors, included in the above Base Bid Stipulated Tender Sum:

1. Mechanical Contractor (including controls & sprinklers)

Sub-Contractor's Base Tender Sum $_____ (+ HST)

Mechanical Contractor's Name _____

1. Electrical Contractor

Sub-Contractor's Base Tender Sum $_____ (+ HST)

Electrical Contractor's Name _____

5. BID BOND

We enclose herewith, in the amount of 10% of the Tender Price, a Bid Bond in the form approved by the Canadian Construction Association. In the event of this tender being accepted within the time stated herein, and our failure to enter into a contract in the form hereinafter mentioned, for the amount of our tender, the said security, limited to the lesser of the face value or the security or the difference between this tender and the tender for which the contract is signed, may be forfeited in lieu of damages to which the Owner may be entitled by reason of our failure or refusal to enter into a contract.

6. AGREEMENT TO BOND

We enclose herewith an Agreement to Bond for a 50% Performance Bond and a 50% Labour and Material Payment Bond, all in the form approved by the Canadian Construction Association issued by same surety who has issued the Bid Bond.

We the undersigned agree that if I/we default in executing a Contract or providing the required performance security in accordance with the terms of the bid documents, the Owner shall have sustained liquidated damages in the amount equal to the difference between the amount of this bid and the amount for which the Owner legally contracts with another party to perform the Work. If the latter amount be in excess of the former up to the amount of the bid bond and such amount shall become the property of the Owner.

7. **ALL WORK MUST PROCEED IN A CONTINUOUS MANNER AND MUST BE COMPLETED & READY FOR THE OWNER'S OCCUPANCY in the spring of 2028. It is required that the work must be substantially complete no later than June 1, 2028.**

8. In submitting this tender, it is understood that revised tenders shall not be called if minor changes only are contemplated.

9. MARK-UP

1. The following mark-up shall apply to work added to the Contract.
    1. General Contractor's and Subcontractor's overhead and profit.
    Note: Overhead and profit mark-up shall include increased bonding, site supervision, additional permit fees and all office overhead, and travel expenses. The cost for these items shall not be added onto any cost for changes prior to mark-up. Refer to Supplementary General Conditions SGC 16.

    General Contractors may charge mark-up of **10%** on their own work and only **5%** on their subcontractors work and are not allowed to treat their own forces as Subcontractors.
    Subcontractors may charge a maximum of **5%** fee for their own work.
    Subcontractors shall charge only **5%** on extras for their subcontractors work who can only charge a maximum of **5%,** for a total max. combined

subcontractor mark up of 10%.
For deleted work, the credit for mark-up shall be zero (0) per cent.

10. SUBSTITUTIONS

The Tender amount must be based on materials as specified but Bidders may list any substitutions on the following lines for the Owner's consideration. (See General Conditions and Supplementary General Conditions.)

	ADD TO TENDER	**DEDUCT FROM TENDER**
1.		
2.		
3.		
4.		

11. IF WE ARE NOTIFIED OF THE ACCEPTANCE OF THIS TENDER WITHIN **60 DAYS** FROM THIS DATE, WE WILL:

1. Execute a Contract on the Canadian Standard Construction Document, Stipulated Price Contract (CCDC Document 2, Revised 2020), as amended by the Supplementary General Conditions.

2. Furnish a General Analysis of the Contract Sum, the total aggregating the amount of our Tender.

3. Furnish a Performance Bond and Labour and Material Bond both in the amount of 50% of the Contract Sum, all in accordance with GC.11.2 of the General Conditions and Supplementary General Conditions of the Contract and in the form approved by the Canadian Construction Association.

4. Furnish proof of Workplace Safety and Insurance Board coverage.

5. Certificate of Insurances: Minimum insurance requirements are set out in the Instructions to Bidders and Supplementary General Conditions.

12. CONFLICT DECLARATIONS

1.We declare that this Tender is made without any connection, knowledge, comparison of figures, or arrangements with any other company, film or person making a Tender for the same work and is in respects fair and without collusion or fraud.

13. SUPPLEMENTARY TENDER FORM

1. The submission of the Supplementary Tender Form is a mandatory requirement of

this tender. The failure to submit may result in rejection of your tender.

2. The mechanical and electrical Supplementary Tender Forms **ONLY** may be emailed to the Owner, Architect and Mechanical and Electrical Consultant in lieu of being inserted in the General Contractor's sealed envelope.

14. SIGNING OF TENDER

a. We are submitting this stipulated sum tender under Corporate Seal as a limited company or witnessed as an individual or partnership.

NAME _____

TITLE _____

SIGNATURE OF AUTHORIZED OFFICER OF COMPANY

_____

NAME OF COMPANY _____

ADDRESS _____

PHONE NUMBER _____

CONTACT PERSON _____
COMPANY SEAL:

WITNESS NAME & TITLE _____

WITNESS SIGNATURE _____

DATED AT _____ ON THE _____ 2026.

NEW PORT ELGIN K-6 JUNIOR SCHOOL
PORT ELGIN, ONTARIO
FOR THE
BLUEWATER DISTRICT SCHOOL BOARD

SUBMITTED BY: _____

DATE: _____

1. We hereby submit our Separate Prices, Alternate Prices, Unit Prices and List of Subcontractors, including all taxes, excluding HST, in accordance with the Drawings and Specifications prepared by +VG (The Ventin Group Ltd.) Architects, 50 Dalhousie Street, Brantford, Ontario.

2. SEPARATE PRICES

   1. Indicate the extra cost for the following Separate Price items which are not included in the base bid amount. All prices shall include all applicable taxes. overhead and profit, bonding, insurances and permit and inspection fees, but **EXCLUDE** H.S.T.

Separate Price 1	
To add the cost of providing rolling blinds as specified to each classroom and office space.	ADD: $_____

3. ALTERNATE PRICES

   1. The base bid amount is to include all items as specified. Indicate the add or deduct cost for the following Alternate Price items. All prices shall include all applicable taxes, overhead and profit, bonding, insurances and permit and inspection fees, but **EXCLUDE** H.S.T.

Alternate Price 1 Delete the 13mm Protective Board from the roofing systems R1& R2 Provide peel & stick type vapour barrier directly to metal deck. Warranty to remain as specified	DEDUCT: $_____
Alternate Price 2 To provide a standard (no brick ledge) top of foundation detail instead of the typical insulated brick ledge detail indicated on the drawings	DEDUCT: $_____
Alternate Price 3 To change the brick veneer to colored ashlar concrete block as specified	DEDUCT: $_____

Alternate Price 4 To change the colour of the aluminium framing from Black anodized to clear anodized.	DEDUCT: $_____
Alternate price 5 Change the specified S & V wood doors to painted hollow metal doors	DEDUCT: $_____
Alternate Price 6 To provide the adhesive adhered TPO roof system as specified instead of the roofing specified by Pretium in the base bid amount	DEDUCT: $_____
Alternate Price 7 To provide bullnose window stool detail instead of plam. stools indicated on the drawings	DEDUCT: $_____
Alternate Price 8 To change the specified 6mm ACP material to 4mm solid aluminium panels	DEDUCT: $_____
Alternate Price 9 Provide Porcelain title to both Change Rooms	ADD: $_____
Alternate Price 10 To provide black coated galvanized chain link fencing around the kindergarten play area instead of the ornamental iron fencing specified	DEDUCT: $_____
Alternate Price 11 To provide AEON mechanical equipment instead of the basis of design Daikin equipment. This price is to include all costs related to any reworking of the plans and layouts to suit the AEON equipment, including but not limited to structural framing, electrical breakers and feeders, gas piping and ductwork revisions. No extra will be allowed for unforeseen items related to this substitution	ADD/DEDUCT: $_____

4. ITEMIZED PRICES

1. Show the amount included in the base bid amount for the following Itemized Price items. All prices shall include all applicable taxes, overhead and profit, bonding, insurances and permit and inspection fees, but EXCLUDE H.S.T.

Itemized Price #1 Reserved	$ _____

5. UNIT RATES

1. The following unit rates shall be used for the purpose of valuing changes to the Contract in accordance with the CCDC Document 2 (Revised 2020).
Unit rates shall include all cost for labour, transportation, other installation costs, materials, overhead and profit, applicable bonding and other relative charges excluding H.S.T. only.

2. The unit rates shall be used for both additions and deductions to the Contract.

1 EARTH EXCAVATION (Including Trucking Charges – off site

1 Asphalt Paving (supply and installation)

H.L. 3 at specified thickness	$_____	per m^2
H.L. 4 at specified thickness	$_____	per m2
Granular "A" installed and compacted	$_____	per m^3
Granular "B" installed and compacted	$_____	per m^3

2 Exterior Work

Sod (supply and installation)	$_____	per m^2
6'-0" (1800 mm) Ht. Chain Link Fences (supply and installation).	$_____	per lin. m
Bulk Excavation	$_____	per m^3
Trench Excavation by machine	$_____	per m^3
Hand Excavation	$_____	per m^3

2 FILL MATERIALS IN-PLACE COMPACTED

Class "A"	$_____	per m^3
Class "B"	$_____	per m^3
Class "C"	$_____	per m^3
Clear 3/4" (19 mm) stone	$_____	per m^3
Crusher Run	$_____	per m^3

3 CONCRETE (supply and installation)

	Lean concrete fill, 10 MPa	$_____	per m^3
	Formwork walls	$_____	per lin. m
	Formwork in piers	$_____	per lin. m
	Concrete in footings, 25 MPa	$_____	per m^3
	Concrete in walls, 25 MPa with 6% air entrainment	$_____	per m^3
	Concrete in slabs-on-grade, 25 MPa	$_____	per m^3
	Concrete reinforcement	$_____	per tonne
	2m wide concrete walkway, including compacted granular "A" and granular "B" bases as specified	$_____	per lin. m
4	MASONRY (supply and installation)		
	Brick Unit Masonry (type 1)	$_____	per m^2
	Arch. Block	$_____	per m^2
	140 mm lt. wt. concrete block	$_____	per m^2
	190 mm lt. wt. concrete block	$_____	per m^2
	240 mm lt. wt. concrete block	$_____	per m^2
	290 mm lt. wt. concrete block	$_____	per m^2
	Air/Vapour membrane with rigid insulation	$_____	per m^2
	16 oz. per sq. ft. copper flashings	$_____	per m^2
	Membrane Reinforced Flashings	$_____	per m^2
	Sprayfoam Insulation/Air Barrier System	$_____	per m^2
5	STRUCTURAL STEEL (supply only)		
	Structural steel rolled shapes greater than 31 lb/ft	$_____	per tonne
	Structural steel rolled shapes less than 31 lb/ft	$_____	per tonne
	Structural steel HSS members	$_____	per tonne
	Galvanized steel lintels - supply only	$_____	per tonne
	Steel lintels - supply only	$_____	per tonne
6	ACOUSTICAL (supply and installation)		

Type "ACT 1" Grid & Tile	$_____	per m^2
Type "ACT 2" Grid & Tile	$_____	per m^2
Type "ACT 3" Grid & Tile	$_____	per m^2
Type "ACT 4" Grid & Tile	$_____	per m^2

7 CARPENTRY & DRYWALL READY FOR PAINTING (supply & install, including taping)

5/8" drywall (15.9 mm) both sides (at wall locations including 3 5/8" metal studs)	$_____	per m^2
5/8" drywall (15.9 mm) drywall at ceiling locations (including metal suspended ceiling system)	$_____	per m^2

8 FLOORING (supply and installation)

Porcelain Tile (floor)	$_____	per m^2
Vinyl Composition Tile	$_____	per m^2
Carpet Tile	$_____	per m2
Sheet Vinyl	$_____	per m^2
Sports Flooring 3mm	$_____	per m2
Porcelain Tile Base	$_____	per lin. m.
Rubber Base	$_____	per lin. m.

6. SCHEDULE OF HOURLY RATES

1. The Contractor and Subcontractors will supply hourly tradesmen for additional work requested to be completed on a "cost plus basis". The rates shall be cost plus markup at rate allowed in this contract.

2. Cost shall include and be limited to payroll plus statutory charges. No cost for office charges, supervision or bonuses, etc. are accepted.

1	Carpenter	$_____	per hr.
2	Labourer	$_____	per hr.
3	Cement Finisher	$_____	per hr.
4	Electrician Journeyman	$_____	per hr.
5	Plumber Journeyman	$_____	per hr.

6	Sheet Metal Mechanic Journeyman	$_____	per hr.
7	Masonry Journeyman	$_____	per hr.
8	Painter	$_____	per hr.
9	Drywaller	$_____	per hr.
10	Steam Fitter Journeyman	$_____	per hr.
11	Refrigeration Journeyman	$_____	per hr.
12	Controls Journeyman	$_____	per hr.

7. LIST OF SUBCONTRACTORS

1. We submit herewith a list of the subcontractors for Division 2 to 14 we propose to use on this Contract, together with the sections of the work to be done by each of them, reserving to use however, the right to substitute other subcontractors for any of them in the event of any subcontractor withdrawing their tender or becoming bankrupt after the date hereof.

2. Any substitution shall be subject to the approval of the Owner and contingent upon evidence of withdrawal or bankruptcy, satisfactory to the Architect. Fill in the appropriate names for each trade.

	TITLE	NAME OF SUBCONTRACTOR
1	Excavation, Backfilling and Rough Grading	
2	Asphalt Paving	
3	Curbs and Sidewalks	
4	Landscaping, Seed & Sod	
5	Concrete work	
6	Precast concrete	
7	Fences	
8	Masonry	
9	Structural Steel	

10	Miscellaneous Metals	
11	Finish Carpentry	
12	Architectural Woodwork	
13	Air/Vapour Barrier System	
14	Sprayed-On Insulation Air Barrier	
15	Firestopping	
16	Aluminium Cladding System	
17	Membrane Roofing	
18	Sealants	
19	Hollow Metal Doors, Frames, Screens	
20	Wood Doors	
21	Aluminum Doors, Entrances and Curtain Wall Framing	
	1 Product	
	2 Installer	
22	Glass & Glazing	
23	Gypsum Drywall	
24	Acoustical Tile	
25	Ceramic Tile & Porcelain Tile	
26	Gymnasium Flooring	
27	Resilient Flooring/Sheet Flooring	
28	Special Coatings	

29	Painting	
30	Tack boards and Whiteboards	
31	Compartments & Cubicles	
32	Lockers	
33	Athletic Equipment	
34	LULA Elevator	
35	reserved	
36	Folding Partitions	
37	Site Services	
38	Data & Communications	
39	MECHANICAL	
40	ELECTRICAL	

8. SIGNING OF SUPPLEMENTARY TENDER FORM

We are submitting this Supplementary Tender Form under Corporate Seal as a Limited Company or witnessed as an individual or partnership.

NAME _____

TITLE _____

SIGNATURE OF AUTHORIZED OFFICER OF COMPANY _____

NAME OF COMPANY _____

ADDRESS _____

_____

PHONE NUMBER _____

CONTACT PERSON _____

ADDRESS: _____

EMAIL ADDRESS: _____

COMPANY SEAL:

WITNESS NAME _____

WITNESS TITLE _____

WITNESS SIGNATURE _____

DATED AT _____ ON THE _____, 2026

Project: Construction of the New Port Elgin Community School

Located At: **Waterloo Street**
1107 Port Elgin, Ontario

From (Bidder):

(Business Name)

DOMESTIC SUPPLY CHAIN COMMITMENT FORM

The Domestic Supply Chain Commitment Form is a mandatory submission requirement.

The Board has adopted a commitment-based approach to domestic supply chain requirements. Under this approach, Bidders are required to commit to supporting the achievement of the Ontario and Canadian domestic content targets identified below.

This requirement is a mandatory eligibility requirement and is not subject to evaluation or scoring.

Failure to submit a completed and signed Domestic Supply Chain Commitment Form may result in the Bid being deemed non-compliant.

Definitions

Ontario-Made Good means a good that:

- is wholly manufactured or originating in Ontario; or
- has at least 51 % of the total direct costs of producing or manufacturing the good incurred in Ontario.

Canadian-Made Good means a good that:

- is wholly manufactured or originating in Canada;
- has at least 51 % of the total direct costs of producing or manufacturing the good incurred in Canada; or
- is labelled as "Made in Canada" or "Product of Canada".

Major Good Category

Concrete	**Minimum% Ontario Content**	**Total Minimum% Domestic Content**
Masonry	85%	90%
	65%	75%

Major Good Category	**Minimum% Ontario Content**	**Total Minimum% Domestic Content**
Metals	40%	60%
Wood & Plastics	55%	65%
Thermal & Moisture Protection	30%	50%
Openings	30%	50%
Finishes	45%	60%
Specialties	45%	60%
Equipment	20%	30%
Furnishings	25%	40%
Special Construction	20%	30%
Conveying Systems	10%	20%
Fire Suppression	45%	60%
Plumbing	35%	50%
HVAC	25%	40%
Electrical	25%	40%
Communications	15%	25%
Electronic Safety & Security	15%	25%
Earthwork	80%	85%
Exterior Improvements	75%	80%
Utilities	75%	80%

BIDDER DECLARATION AND COMMITMENT

The Bidder hereby declares and confirms that:

1. The Bidder has reviewed the identified major goods categories and associated domestic content targets.
1. The Bidder commits to achieving the identified domestic content targets.
2. The Bidder shall prioritize the procurement of Ontario-made goods and Ontario services and, where Ontario-made goods or Ontario services are not available or suitable, shall give preference to Canadian-made goods and Canadian services.
3. The Bidder shall work with its subcontractors, suppliers and manufacturers, as applicable, to support achievement of the identified domestic content targets.
4. The Bidder acknowledges that the domestic content targets form part of its submission and commitment under this procurement.

The undersigned certifies that they are authorized to bind the Bidder and commit, on behalf of the Bidder, to the declarations and commitments contained herein.

ACKNOWLEDGMENT

The Bidder acknowledges and agrees to the declarations and commitments contained in this Domestic Supply Chain Commitment Form.

Authorized Signature: _____

Name: _____

Title: _____

END OF SECTION

These Supplementary Conditions modify, delete and/or add to the Agreement between Owner and Contractor, the Definitions, and the General Conditions of the Stipulated Price Contract, Standard Construction Document CCDC 2 – 2020.

SC 1. AGREEMENT BETWEEN OWNER AND CONTRACTOR

SC 1.1 ARTICLE A-5 PAYMENT

1.1.1 Delete paragraph 5.2 and replace it with the following:

"5.2 Should either party fail to make payments as they become due under this *Contract* or in an award by arbitration, adjudication or court, interest will begin to accrue on the amount that is not paid from the date when it is due until the date it is paid at the prejudgment interest rate prescribed by the Courts of Justice Act (Ontario)."

SC 1.2 ARTICLE A-6 RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

1.2.1 Amend paragraph 6.2 by deleting the words "other form of electronic" and replacing them with "e-mail".

1.2.2 Amend paragraph 6.4 by deleting the words "any form of electronic" and replacing them with "e-mail".

SC 1.3 ARTICLE A-9 TIME IS OF THE ESSENCE

1.3.1 Add a new Article A-9 as follows:

"**ARTICLE A-9 TIME IS OF THE ESSENCE**

9.1 The *Contractor* represents and warrants that it will attain *Ready-for-Takeover* by the date stipulated in paragraph 1.3 of Article A-1 of the Agreement – THE WORK, as such date may be adjusted in accordance with this *Contract*, and agrees that time shall be of the essence in the performance of the *Contractor's* obligations under this *Contract*."

SC 1.4 ARTICLE A-10 EXECUTION OF THE CONTRACT

1.4.1 Add a new Article A-10 as follows:

"**ARTICLE A-10 EXECUTION OF THE CONTRACT**

10.1 This *Contract* may be executed in counterparts, each of which shall be deemed an original and both of which, taken together, shall constitute one and the same instrument. Delivery by e-mail of a PDF copy of any executed counterpart shall be deemed to be an original and of full force and effect and equally as effective as delivery of a manually executed original counterpart thereof."

SC 2. DEFINITIONS

2.1.1 Add the following new Definitions:

(a) **Act**

"*Act* means the Construction Act (Ontario), as amended."

(b) **As-Built Drawings**

"*As-Built Drawings* means the drawings prepared by the *Contractor* by marking on

a copy of the *Drawings* the changes from the *Drawings* which occur during the course of the *Work* including, but not limited to, the exact location of major building components and structures that were shown generally on the *Drawings*. For certainty, *As-Built Drawings* shall be prepared using the most current version of Autodesk AutoCad as well as in paper and PDF formats."

(c) **Environmental Programs**

"*Environmental Programs* means the environmental plans, programs, procedures and requirements of the *Owner*, known as the 'Main Legislative Building Environmental Management Program'."

(d) **OHSA**

"*OHSA* means the Occupational Health and Safety Act (Ontario), as amended, and all rules and regulations passed under it."

(e) **Proper Invoice**

"*Proper Invoice* means an application for payment given by the *Contractor* to the *Owner* that fully complies with the requirements of GC 5.1A – PROPER INVOICE."

(f) **WSIB**

"*WSIB* means the Ontario Workplace Safety & Insurance Board."

SC 3. GENERAL CONDITIONS

SC 3.1 GC 1.1 CONTRACT DOCUMENTS

3.1.1 Amend paragraph 1.1.2 by adding the following to the end:

"The intent of the *Contract Documents* is to include all labour, *Products*, materials, *Construction Equipment* and services necessary or normally considered necessary for the performance of the *Work* in accordance with the *Contract Documents*. Any item of *Work* mentioned in the *Contract Documents* or reasonably inferable from the *Contract Documents* but not otherwise shown or described, shall be provided by the *Contractor* as if shown or otherwise described or inferable. Any items omitted from the *Contract Documents* which are reasonably necessary or inferable for the completion of the *Work* shall be considered a portion of the *Work* and included in the scope of *Work* to be performed under this *Contract*."

3.1.2 Amend paragraph 1.1.5.1 by changing the order of the first four bullet points so that, as reordered, the bullet points read as follows:

"1.1.5.1 the order of priority of documents, from highest to lowest, shall be

- Supplementary Conditions,
- the Agreement between *Owner* and *Contractor*,
- the Definitions,
- the General Conditions"

3.1.3 Amend paragraph 1.1.9 by adding new paragraphs 1.1.9.1 and 1.1.9.2 as follows:

"1.1.9.1 The *Specifications* shall be read as a whole and are the minimum construction requirements. Neither the organization nor the division of the *Specifications* nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* in respect to such organization or division.

1.1.9.2 The *Drawings* are intended to convey the scope of the *Work* and indicate elevations and general and approximate locations, arrangement and sizes of fixtures, equipment, outlets, utilities and underground services. The *Contractor*

shall obtain more accurate information and shall satisfy itself as to the conditions of the pre-grade elevations and the locations, arrangement and sizes of fixtures, equipment, outlets, utilities and underground services from study and coordination of the *Drawings*, including *Shop Drawings*, and shall satisfy itself and become familiar with conditions and spaces affecting these matters before proceeding with the *Work*. Where site conditions require reasonable minor changes to indicated locations and arrangements, the *Contractor* shall make such changes at no additional cost to the *Owner*."

3.1.4 Amend paragraph 1.1.11 by deleting the words "at the *Owner's* expense".

3.1.5 Add new paragraphs 1.1.12 to 1.1.15 as follows

"1.1.12 The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency or omission the *Contractor* may discover. Except for the obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or the *Consultant* for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in paragraph 3.11.1 of GC 3.11 – STANDARD OF CARE, the *Contractor* will not be liable for damages or costs resulting from such errors, inconsistencies or omissions in the *Contract Documents* which the *Contractor* did not discover.

1.1.13 If the *Contractor* finds any error, inconsistency or omission in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, the *Contractor* shall immediately notify the *Consultant*, who will provide written instructions or explanations.
Neither the *Owner* nor the *Consultant* will be responsible for oral instructions.

1.1.14 Notwithstanding paragraphs 1.1.12 and 1.1.13, errors, inconsistencies and/or omissions shall not include lack of reference on the *Drawings* or in the *Specifications* to labour and/or *Products* that are normally required or normally recognized within respective trade practices as being necessary for the complete execution of the *Work*.

1.1.15 The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, proposed or contemplated change notices, *Change Orders*, *Change Directives* record drawings marked up with any changes to be included in *As-Built Drawings*, cash allowance disbursement authorizations, reviewed *Shop Drawings*, reports and records of meetings at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*."

SC 3.2 **GC 2.2 ROLE OF THE CONSULTANT**

3.2.1 Amend paragraph 2.2.12 by adding the following to the end:

"If, in the opinion of the *Contractor*, a *Supplemental Instruction* involves an adjustment in the *Contract Price* or the *Contract Time*, the *Contractor* shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* with a *Notice in Writing* to that effect and shall await further instructions. The *Contractor's* failure to provide such *Notice in Writing* within the time stipulated in this paragraph 2.2.12 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor* without adjustment to the *Contract Price* or *Contract Time*."

SC 3.3 **GC 2.3 REVIEW AND INSPECTION OF THE WORK**

3.3.1 Amend paragraph 2.3.5 by adding the following to the end of the second sentence:

"and there shall be no extension of the *Contract Time* resulting from any delay caused by such examination and correction."

SC 3.4 **GC 2.4 DEFECTIVE WORK**

3.4.1 Amend paragraph 2.4.1 by adding new paragraphs 2.4.1.1 and 2.4.1.2 as follows:

"2.4.1.1 The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective *Work* and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*.

2.4.1.2 The *Contractor* shall prioritize the correction of defective work or deficiencies identified as priorities by the *Owner* or the *Consultant*."

SC 3.5 **GC 3.0 PRECONSTRUCTION SUBMITTALS**

3.5.1 Add a new GC 3.0 as follows:

"**GC 3.0 PRECONSTRUCTION SUBMITTALS**

3.0.1 Within 10 *Working Days* of signing this *Contract* and, in any event, before commencing any *Work* the *Contractor* shall submit to the *Owner* all of the following:

.1 a current *WSIB* clearance certificate;

.2 true copies of certificates of insurance evidencing the *Contractor* has secured the insurance policies required by the *Contract Documents*;

.3 where applicable, the bonds described in GC 14.7 – CONTRACT SECURITY;

.4 documentation of the *Contractor's* safety program to be implemented for the *Project*;

.5 a copy of the "Notice of Project" filed with the appropriate government agency or ministry naming the *Contractor* as the "constructor" under *OHSA*; and

.6 the construction schedule referred to in paragraph 3.4.1.1 of GC 3.4 – CONSTRUCTION SCHEDULE."

SC 3.6 **GC 3.1 CONTROL OF THE WORK**

3.6.1 Add new paragraphs 3.1.3 to 3.1.6 as follows:

"3.1.3 The *Contractor* is solely responsible for the quality of the *Work* and shall undertake any quality control activities specified in the *Contract Documents* or, if none are specified, as may be reasonably required to ensure such quality. The *Contractor* shall perform the *Work* in accordance with modern practice and in accordance with applicable laws, ordinances, rules, regulations or codes relating to the performance of the *Work*. Without limiting the generality of the foregoing, the *Contractor* is responsible for coordinating the *Work* so that no part shall be left in an unfinished or incomplete condition.

3.1.4 The *Contractor* shall abide by and shall enforce directives and policies regarding signs, advertisements, fires, smoking and vaping at the *Place of the Work* as directed by the *Owner*.

3.1.5 The *Contractor*, without in any way limiting its responsibilities under this *Contract*, shall:

.1 perform the *Work* so as to avoid disturbing the occupants of the *Place of the Work* or the occupants of adjacent premises or the public in general,

.2 respect and comply with local regulations and all *Owner's* requirements regarding permitted work hours, noise levels and work conditions,

.3 take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise, to avoid conditions likely to propagate mould or fungus of any kind, and shall take all other steps reasonably necessary to promote and maintain the safety and comfort of the occupants of the *Place of the Work* or the occupants of adjacent premises and the public in general, and to maintain access to and the operation of any existing facilities at the *Place of the Work*,

.4 take precautions not to allow any unauthorized visitors entry to the *Place of the Work*.

The *Contractor* shall not permit any workers, *Subcontractors* or *Suppliers* to use any existing facilities including, without limitation, elevators, lavatories, toilets, entrances, and parking areas other than those designated by the *Owner*.

3.1.6 Before commencing the *Work* the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent in the *Contract Documents*, the *Contractor* shall immediately notify the *Consultant* in writing and shall obtain written instructions before proceeding with any part of the affected *Work*. Failure to do so shall be at the sole risk and cost of the *Contractor*."

SC 3.7 **GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS**

3.7.1 Amend paragraph 3.2.2 by deleting the word "*Owner*" in the second line and replacing it with the word "*Contractor*".

3.7.2 Delete paragraphs 3.2.2.2 and 3.2.2.3.

3.7.3 Amend paragraph 3.2.3.4 by adding the following to the end:

"Failure by the *Contractor* to so report shall invalidate any claims against the *Owner* by reason of the deficiencies in the work of *Other Contractors* or *Owner's* own forces except for those deficiencies not then reasonably discoverable; and"

3.7.4 Add a new paragraph 3.2.3.5 as follows:

"3.2.3.5 assume overall responsibility for the *Owner's* own forces and *Other Contractors* for compliance with all aspects of the applicable health and construction safety legislation at the *Place of the Work*, including all of the responsibilities of the "constructor" under the *OHSA*."

3.7.5 Add a new paragraph 3.2.7 as follows:

"3.2.7 The placement, installation, application and connection of work by the *Owner's* own forces or by *Other Contractors* on and to the *Work* shall not relieve the *Contractor* of its responsibility to provide and maintain the warranties specified in this *Contract*. If the *Contractor* is of the view that the work of *Other Contractors* or the work of the *Owner's* own forces will compromise, void or nullify any of the warranties to be provided pursuant to this *Contract*, the *Contractor* shall immediately give *Notice in Writing* to the *Owner* and shall include in such notice the reasons why, in the *Contractor's* view, a warranty or warranties will be compromised, voided or nullified, together with the *Contractor's* recommendations for avoiding such result."

SC 3.8 **GC 3.4 CONSTRUCTION SCHEDULE**

3.8.1 Delete paragraph 3.4.1 and replace it with the following:

"3.4.1 The *Contractor* shall:

.1 within ten (10) *Working Days* of entering into this *Contract*, or within such further time agreed to by the *Owner*, submit to the *Owner* and the *Consultant*, for the *Owner's* approval, a construction schedule that indicates the timing of major activities and critical milestone dates for the *Work*, demonstrating that the *Work* will be performed in conformity with the *Contract Time*. Such schedule:

(a) shall be prepared using the scheduling program specified by the *Owner*,

(b) shall be provided in native editable electronic format that includes and shows all logic links between activities, as well as in PDF and in paper copy, and

(c) shall be prepared in collaboration with *Subcontractors* and *Suppliers* whose activities affect the critical path of the *Work*, and

(d) shall include and make provision for statutory holidays, weather conditions that are normally experienced at the *Place of the Work*, and the rectification of defects and deficiencies; and

(e) shall provide sufficient detail of the critical events and their inter-relationship and shall include a baseline schedule indicating the critical path for the *Project*; and

.2 provide the expertise and resources, including labour and *Construction Equipment*, as are necessary to maintain progress under the construction schedule; and

.3 monitor the adequacy of *Subcontractor* and *Supplier* personnel and equipment and the availability of *Products* to meet the construction schedule and take appropriate action when requirements of a contract with a *Subcontractor* or *Supplier* are not being met; and

.4 monitor the progress of the *Work* on a weekly basis relative to the construction schedule, update the schedule on a monthly basis, and advise the *Owner* and the *Consultant* in writing of any variation from the baseline or slippage in the schedule; and

.5 at each site meeting provide to the *Owner* and the *Consultant* a written report on the activities completed since the last meeting and indicating the activities planned to be undertaken in the next two (2) weeks.

3.4.2 If at any time it should appear that the actual progress of the *Work* is behind schedule or is likely to fall behind schedule, or if the *Contractor* has so advised the *Owner* and the *Consultant*, the *Contractor* shall take appropriate steps, at the *Contractor's* own expense, to cause the actual progress of the *Work* to conform to the schedule and shall produce and present to the *Owner* and the *Consultant*, for review and approval, a recovery plan demonstrating how the *Contractor* will achieve the recovery of the schedule.

3.4.3 If after applying the expertise and resources required under paragraphs 3.4.1.2 and 3.4.2 the *Contractor* forms the opinion that the slippage in the construction schedule cannot be recovered, the *Contractor* shall give *Notice in Writing* to the *Owner* and the *Consultant* of any revisions required to the schedule.

3.4.4 The *Contractor* shall not change the scheduled *Ready-for-Takeover* date."

SC 3.9 **GC 3.5 SUPERVISION**

3.9.1 Delete paragraph 3.5.1 and replace it with the following:

"3.5.1 The *Contractor* shall provide all necessary supervision and shall appoint a full-time superintendent who shall be in full time attendance at

the *Place of the Work* while the *Work* is being performed. The superintendent shall not be changed by the *Contractor* without valid reason, and upon the *Contractor* obtaining the *Owner's* prior written consent, which consent will not be unreasonably withheld."

SC 3.10 **GC 3.6 SUBCONTRACTORS AND SUPPLIERS**

3.10.1 Add a new paragraph 3.6.1.4 as follows:

"3.6.1.4 ensure that all *Subcontractors* and *Suppliers* and anyone employed or engaged by them directly or indirectly have the qualifications, technical skills, levels of experience and knowledge required (including with respect to all applicable construction safety rules and regulations), and all applicable permits, licenses and approvals necessary to perform the work assigned to them in accordance with the terms of this *Contract*."

3.10.2 Amend paragraph 3.6.2 as follows:

(a) delete the words "before signing the *Contract*" in the third line of that paragraph; and

(b) add the following to the end:

"The *Contractor* agrees not to change *Subcontractors* or *Suppliers* without the prior written approval of the *Owner*, which approval will not be unreasonably withheld."

3.10.3 Amend paragraph 3.6.3 by deleting the words "before the *Owner* has signed the *Contract*" in the first line.

3.10.4 Add new paragraphs 3.6.7 and 3.6.8 as follows:

"3.6.7 If the *Contractor* intends to change any *Subcontractors* or *Suppliers*, the *Contractor* shall advise the *Owner* in writing, giving the *Contractor*'s reasons for the proposed change. No change of *Subcontractors* or *Suppliers* may be made without the prior written approval of the *Owner*.

3.6.8 Notwithstanding paragraph 3.6.5, the *Owner* may assign to the *Contractor*, and the *Contractor* shall accept the assignment of, any contract procured by the *Owner* for *Work* or *Products* required on the *Project* that has been pre-tendered or pre-negotiated by or on behalf of the *Owner*. In such event the *Contract Price* shall be increased by the balance of the contract price remaining under such assigned contract by way of *Change Order*."

SC 3.11 **GC 3.7 LABOUR AND PRODUCTS**

3.11.1 Amend paragraph 3.7.1 as follows:

(a) insert the words "agents, *Subcontractors* and *Suppliers*" after the word "employees" in the first line; and

(b) add the following to the end:

"Without in any way limiting the generality of the foregoing, the *Contractor* shall prepare and implement the job site rules more particularly described in the *Contract Documents*. If no job site rules are described in the *Contract Documents*, the *Contractor* shall draft job site rules for the review and approval of the *Owner*. Any such job site rules prepared by the *Contractor* shall be consistent with the *Contractor*'s duties and obligations under *OHSA* and shall also include provisions

making smoking, vaping and the consumption of alcohol or non-prescription drugs on the *Project* site the subject of discipline proceedings and/or termination of employment."

3.11.2 Amend paragraph 3.7.3 by adding the following to the end:

"The *Contractor* represents and warrants that the *Products* supplied are not subject to any conditional sales contracts and are not subject to any security rights claimed or obtained by any third party which may subject any of the *Products* to seizure and/or removal from the *Place of the Work*."

3.11.3 Add new paragraphs 3.7.4 to 3.7.8 as follows:

"3.7.4 *Products* provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, Ontario Building Code and all governmental authorities having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever, and such *Products* shall be at the sole risk of the *Contractor*.

3.7.5 The *Contractor* shall ensure that all materials and *Products* are delivered to the *Project* site in original containers and packages with labels and seals intact and that they are protected from the elements and visible for inspection by the *Owner* and/or the *Consultant*.

3.7.6 The *Contractor* is responsible for the safe on-site storage of *Products* and their protection (including *Products* supplied by the *Owner* and *Other Contractors*) so as to avoid dangerous conditions, deterioration, damage or contamination to the *Products*, persons or property and in locations at the *Place of the Work* to the satisfaction of the *Owner* and the *Consultant*.

3.7.7 The *Owner* or the *Consultant*, acting reasonably, shall have the right to order the *Contractor* to remove from the *Project*, without cost to the *Owner*, any representative or employee of the *Contractor*, *Subcontractor* or *Supplier* whose conduct, in the opinion of the *Owner* or the *Consultant*, jeopardizes the safety or security of the *Project*, any person, the *Owner's* operations, is a detriment to the *Project*, or whose conduct may be considered as harassment in the workplace. Immediately upon receipt of such order the *Contractor* shall make arrangements for the appointment of a replacement representative or employee acceptable to the *Owner*.

3.7.8 The *Contractor* shall not, and shall ensure that its *Subcontractors* and *Suppliers* do not, employ any person on the *Project* whose labour affiliation, or lack thereof, is incompatible with other labour employed on the *Project*. All costs arising from labour disputes arising from the *Contractor's* failure to comply with this paragraph shall be at the sole expense of the *Contractor*."

SC 3.12 **GC 3.8 SHOP DRAWINGS**

3.12.1 Amend paragraph 3.8.2 by adding the following to the end:

"Prior to the first application for payment, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings*."

3.12.2 Delete paragraph 3.8.3.1 and replace with the following

"3.8.3.1 the *Contractor* has determined and correlated the field measurements with the *Shop Drawings* and field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so if not possible at that time, and"

3.12.3 Add new paragraphs 3.8.8 to 3.8.11 as follows:

"3.8.8 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* or the *Contract Time*, unless there is a scope of work or design change initiated by the *Owner*.

3.8.9 The *Contractor* shall not use the term "by others" on *Shop Drawings* but shall identify the responsible *Subcontractor* or *Supplier* where such work is within the scope of the *Work*.

3.8.10 Where *Specifications* require the *Shop Drawings* to bear the seal and signature of a professional, such professional shall be registered in the jurisdiction of the *Place of the Work* and shall have expertise in the area of practice reflected in the *Shop Drawings*.

3.8.11 The *Consultant's* review of the *Shop Drawings* shall not relieve the *Contractor* from responsibility for defective *Work* resulting from errors or omissions of any kind on the reviewed *Shop Drawings* and shall not constitute authorization to the *Contractor* to perform additional *Work* or changed *Work*. The *Contractor* is solely responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes, and for techniques of construction and installation."

SC 3.13 **GC 3.9 USE OF THE WORK**

3.13.1 Add a new GC 3.9 as follows:

"**GC 3.9 USE OF THE WORK**

3.9.1 The *Contractor* shall confine *Construction Equipment, Temporary Work,* storage of *Products*, waste products and debris, and operations of employees and *Subcontractors* to limits indicated by laws, ordinances, permits, or the *Contract Documents* and shall not unreasonably encumber the *Place of the Work*.

3.9.2 The *Contractor* shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety of the *Work*.

3.9.3 The *Owner* shall have the right to enter, occupy, take possession of or use for any intended purpose any portion or all of the undelivered portion of the *Project*, even though *Ready-for- Takeover* may not have been attained, provided that such entry, occupation, taking of possession or use will not interfere, in any material way, with the progress of the *Work*. The entry, occupation, taking of possession or use of any such portion of the *Project* shall not be deemed to be the *Owner's* acknowledgement or acceptance of the *Work* or *Project*, nor shall it be deemed to be an acknowledgment or acceptance by the *Owner* that such *Work*, or portions of the *Work*, have met the *Ready-for-Takeover* requirements described in the *Contract Documents*, nor shall it entitle the *Contractor* to an adjustment in the *Contract Time* or *Contract Price*, nor shall it relieve the *Contractor* of any of its obligations under the *Contract*, including the *Contractor's* designation and obligations as "constructor" under *OHSA* and the *Contractor's* obligations respecting construction health and safety, and all of the *Contractor's* obligations, rules, regulations and practices shall continue to apply notwithstanding such entry,

occupation, taking of possession or use."

SC 3.14 **GC 3.10 CLEANUP**

3.14.1 Add a new GC 3.10 as follows:

"**GC 3.10 CLEANUP**

3.10.1 The *Contractor* shall maintain the *Work* and the *Place of the Work* in a safe and tidy condition and free from the accumulation of waste products and debris. The *Contractor* shall ensure the *Place of the Work* is cleaned and left in a tidy condition on a daily basis. In the event of any dispute regarding the removal of waste products and debris, the *Owner* may remove the said waste products and debris and charge the cost to the *Contractor*.

3.10.2 Before delivering the application for *Ready-for-Takeover* the *Contractor* shall remove any and all surplus *Products*, tools, *Construction Equipment, Temporary Work*, waste products and debris and shall ensure the *Place of the Work* is clean and tidy and suitable for occupancy by the *Owner*."

SC 3.15 **GC 3.11 STANDARD OF CARE**

3.15.1 Add a new GC 3.11 as follows:

"**GC 3.11 STANDARD OF CARE**

3.11.1 In performing this *Contract* the *Contractor* shall exercise a standard of care, skill, judgment and diligence that would normally be exercised by an experienced, skilled and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that, throughout this *Contract*, the *Contractor's* obligations, duties and responsibilities shall be interpreted in accordance with this standard. The *Contractor* shall exercise the same standard of care, skill, judgment and diligence in respect of any *Products*, *Subcontractors*, *Suppliers*, personnel or procedures which it may employ on the *Project*.

3.11.2 The *Contractor* represents, covenants and warrants to the *Owner* that:

.1 The personnel assigned to the *Project* are appropriately experienced and trained;

.2 It has sufficient qualified and competent personnel to replace its designated supervisor, superintendent and project manager, subject to the *Owner's* approval, in the event of incapacity, removal or resignation; and

.3 There are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the *Contractor* to perform this *Contract*."

SC 3.16 **GC 3.12 CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS**

3.16.1 Add a new GC 3.12 as follows:

"**GC 3.12 CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS**

3.12.1 The *Contractor* shall not make use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work*, including the HVAC system and elevators, without the *Owner's* prior express written consent obtained in accordance with this GC 3.12.

3.12.2 If the *Contractor* wishes to make use of such mechanical and electrical systems or equipment the *Contractor* shall:

.1 obtain the manufacturer's instructions regarding any preventative

maintenance services to be performed on such systems and equipment; and

.2 submit a written request to the *Owner* for consent to use such systems or equipment, which request shall include all of the information received from the manufacturer of such systems or equipment.

3.12.3 If the *Owner* consents to the *Contractor's* use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work*, the *Contractor* shall:

.1 operate and maintain such systems and equipment in strict compliance with the requirements set out in the *Specifications* and any instructions received from the manufacturers of such systems and equipment; and

.2 perform all preventative maintenance services on such systems and equipment in accordance with the *Specifications* and any instructions received from the manufacturers of such systems and equipment; and

.3 before applying for *Ready-for-Takeover*, clean and make good, to the satisfaction of the *Owner*, all such systems and equipment as it had been permitted to use; and

.4 pay any and all costs associated with such use, operation, preventative maintenance services, cleaning and making good, at no cost or charge to the *Owner*."

SC 3.17 **GC 4.1 CASH ALLOWANCES**

3.17.1 Add a new paragraph 4.1.8 as follows:

"4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the *Work* to be paid for from cash allowances."

SC 3.18 **GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER**

3.18.1 Delete GC 5.1.

SC 3.19 **GC 5.1A PROPER INVOICE**

3.19.1 Add a new GC 5.1A as follows:

"**GC 5.1A PROPER INVOICE**

5.1 A.1 In this *Contract* a *Proper Invoice* shall mean an application for payment made by the *Contractor* that:

.1 is given to the *Owner* by e-mail to the person / e-mail address designated by the *Owner*; and

.2 includes all of the following:

.1 the *Contractor's* name and address and HST registration number;

.2 the date of the application for payment and the period during which the *Work* was performed;

.3 information identifying the authority, whether in the *Contract* or otherwise, under which the *Work* was performed;

.4 a description, including quantities where appropriate, of the services and materials that were supplied;

.5 the amount payable for the services or materials that were supplied, and the payment terms;

.6 the name, title, telephone number and mailing address of the person to whom payment is to be sent;

.7 a statement based on the schedule of values for the *Work*;

.8 where the application includes amounts charged on the basis of hourly rates, documentation in support of the amount claimed, including dates that services were performed, identity of the person(s) involved, the hours spent, and a description of the services performed;

.9 where the application includes amounts expended under a cash allowance, documentation in support of the amount claimed, including copies of all invoices and charges incurred;

.10 copies of any *Change Orders* and *Change Directives* for which the *Contractor* is claiming payment;

.11 for all applications for payment except the final payment, an updated construction schedule that complies with the requirements of paragraph 3.4.1.1 of GC 3.4 – CONSTRUCTION SCHEDULE;

.12 a current valid clearance certificate issued by the *WSIB*;

.13 for the second and all subsequent applications for payment, a CCDC 9A Statutory Declaration stating that all accounts for services and materials and other indebtedness incurred by the *Contractor* for which the *Owner* may in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified matter in dispute."

SC 3.20 **GC 5.2 APPLICATIONS FOR PAYMENT**

3.20.1 Delete paragraphs 5.2.1 and 5.2.2 and replace them with the following:

"5.2.1 Subject to paragraph 5.2.2, *Proper Invoices* for progress payment shall be given monthly to the *Owner* and the *Consultant* simultaneously as the *Work* progresses on a day of the month agreed to by the parties.

5.2.2 The *Contractor* shall not give a *Proper Invoice* for progress payment between the date certified as the date of *Substantial Performance of the Work* and the date that the *Contract* is completed."

3.20.2 Amend paragraph 5.2.3 by adding the following to the end:

"No amount claimed shall include *Products* delivered to the *Place of the Work* unless the *Products* are free and clear of all security interests, liens, and other claims of third parties."

3.20.3 Amend paragraph 5.2.4 by adding the following to the end:

"Such schedule of values shall include line items which assign an appropriate portion of the *Contract Price* for the preparation and delivery of *As-Built Drawings*, quality control, and closeout of the *Work*."

3.20.4 Amend paragraph 5.2.5 by inserting the words ", or as directed by the *Consultant*" after the words "as specified in the *Contract*".

3.20.5 Amend paragraph 5.2.6 by adding the following to the end:

", as modified by paragraph 5.1A.1.2 of GC 5.1A – PROPER INVOICE."

3.20.6 Amend paragraph 5.2.8 by adding the following to the end:

"Any *Products* delivered to the *Place of the Work* but not yet incorporated into the

Work shall remain at the risk of the *Contractor* notwithstanding that title has passed to the *Owner* pursuant to GC 14.1 – OWNERSHIP OF MATERIALS."

SC 3.21 **GC 5.3 PAYMENT**

3.21.1 Delete paragraph 5.3.1 and replace it with the following:

"5.3.1 After the receipt by the *Consultant* and the *Owner* of an application for payment submitted by the *Contractor* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT, the *Consultant* will issue to the *Owner* and copy to the *Contractor*, no later than 10 calendar days after the date of receipt of the *Proper Invoice*, a certificate for payment in the amount applied for, or in such other amount as the *Consultant* determines to be properly due.

5.3.2 Subject to the *Owner's* right to give notice of non-payment in accordance with the *Act*, and subject to the holdback provisions of the *Act*, the *Owner* will pay the amount payable under a *Proper Invoice* for progress payment no later than 28 days after the date the *Owner* receives the *Proper Invoice*. Provided that the *Owner's* obligation to make payment shall not arise unless and until the *Contractor's* application for payment constitutes a complete *Proper Invoice* as provided in GC 5.1A – PROPER INVOICE. For certainty, and without limitation, the *Owner* may refuse to pay all or any portion of an application for progress payment where:

.1 the application does not comply with all of the requirements of a *Proper Invoice* in GC 5.1A – PROPER INVOICE; and/or

.2 the *Owner* is entitled to deduct and retain amounts in accordance with the *Contract Documents*; and/or

.3 the amount applied for exceeds the amount stated in the certificate for payment issued by the *Consultant* pursuant to paragraph 5.3.1."

SC 3.22 **GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK**

3.22.1 Delete paragraphs 5.4.2 through 5.4.5 and replace them with the following:

"5.4.2 Immediately after the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor*:

.1 shall, in consultation with the *Owner* and the *Consultant*, establish reasonable dates for finishing the *Work* and correcting deficient *Work*; and

.2 shall cause the certificate to be published in the manner prescribed by the *Act* and shall immediately thereafter deliver a copy of the published certificate to the *Owner*.

5.4.3 The *Contractor* shall submit an application for payment of the lien holdback amount which shall include all of the following.

.1 a written request for the release of the holdback amount;

.2 a declaration that no written notices of lien have been received by the *Contractor*;

.3 a copy of the published certificate of *Substantial Performance of the Work*;

.4 a current valid clearance certificate issued by the *WSIB*; and

.5 a CCDC 9A Statutory Declaration stating that all accounts for services and materials and other indebtedness incurred by the *Contractor* for which the *Owner* may in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified matter in

dispute.

5.4.4 Subject to the *Owner's* right to give notice of non-payment of holdback in accordance with the *Act*, the *Owner* will pay the amount authorized by the certificate for payment of the holdback in accordance with the provisions of the *Act*. For certainty, and without limitation, the *Owner* may refuse to pay a portion of the holdback where the *Owner* is entitled to deduct and retain amounts in accordance with the *Contract Documents*.

5.4.5 Where the *Consultant* has certified or verified that a portion of the *Work* is 100% complete prior to *Substantial Performance of the Work* the *Owner* may, in its sole and absolute discretion, and subject to the *Contractor's* compliance with the requirements set out below, agree to release to the *Contractor* a portion of the holdback related to the completed portion of the *Work*:

.1 description of the completed scope of *Work*;

.2 completed Declaration of Last Supply as prescribed in section 31(5) of the *Act* (Form 7);

.3 completed Certificate of Completion of Subcontract as prescribed in section 33(1) of the *Act* (Form 10);

.4 *WSIB* Clearance Certificate for the *Contractor*, the *Subcontractor* concerned, and any other subcontractors and *Suppliers* who have provided any services to the *Subcontractor*;

.5 statutory declaration by an officer of the *Subcontractor* in the form CCDC Document 9B-2001;

.6 *Contractor's* written acknowledgement to the *Owner* that the requirements of the *Contract Documents* will not be altered by early release of the holdback of the completed subcontract;

.7 where applicable, written confirmation by the surety company that issued the surety bonds specified in this *Contract* that it has been notified of the *Contractor's* intent to claim early release of holdback and does not object."

SC 3.23 **GC 5.5 FINAL PAYMENT**

3.23.1 Delete paragraph 5.5.1 and replace it with the following:

"5.5.1 When the *Contractor* considers that the *Contract* is completed, the *Contractor* shall deliver to the *Owner* and the *Consultant* a *Proper Invoice* for final payment."

3.23.2 Delete paragraphs 5.5.3 and 5.5.4 and replace them with the following:

"5.5.3 Subject to the *Owner's* right to give notice of non-payment in accordance with the *Act*, the *Owner* will pay the amount payable under a *Proper Invoice* for final payment no later than 28 days after the date the *Owner* receives the *Proper Invoice*. Provided that the *Owner's* obligation to make payment shall not arise unless and until the *Contractor's* application for payment constitutes a complete *Proper Invoice* as provided in GC 5.1A – PROPER INVOICE. For certainty, and without limitation, the *Owner* may refuse to pay all or any portion of an application for final payment where:

.1 the application does not comply with all of the requirements of a *Proper Invoice* in GC 5.1A – PROPER INVOICE; and/or

.2 the *Owner* is entitled to deduct and retain amounts in accordance with the *Contract Documents*; and/or

.3 the amount applied for exceeds the amount stated in the certificate for payment issued by the *Consultant* pursuant to paragraph 5.5.2."

SC 3.24 **GC 5.8 WITHHOLDING OF PAYMENT**

3.24.1 Add a new GC 5.8 as follows:

"**GC 5.8 WITHHOLDING OF PAYMENT**

5.8.1 Notwithstanding any provision in the *Contract Documents* to the contrary, the *Owner* may withhold payment of any amount claimed in an application for payment, in a *Proper Invoice*, or in any certificate for payment to the extent required to offset any claims the *Owner* may have against the *Contractor*, or to offset previous over-payment made to the *Contractor*, or for damages or costs incurred by the *Owner*, or to the extent as may be necessary to protect and/or indemnify the *Owner* from loss, claims, and/or damage, including as a result of:

.1 the *Contractor's* failure to perform any of its material obligations, or where the *Contractor* is otherwise in default under the *Contract Documents*;

.2 defective portions of the *Work* not remedied;

.3 damage done to work performed by *Other Contractors* or by the *Owner*'s own forces;

.4 the *Contractor's* failure to make prompt payments to its *Subcontractors* and *Suppliers* respecting *Work* for which the *Owner* has made payment to the *Contractor*;

.5 claims or reasonable evidence indicating possible commencement of claims for which the *Contractor* may be responsible to indemnify the *Owner*;

.6 the *Contractor's* failure to remove liens arising from the *Work* or to otherwise satisfy its obligations under GC 14.2 – LIENS AND ACTIONS;

.7 reasonable evidence the *Contractor* will not achieve *Ready-for-Takeover* in accordance with the construction schedule and/or within the *Contract Time*.

5.8.2 Where the *Owner* has withheld payment to the *Contractor* pursuant to the provisions of this *Contract*, the *Owner* shall be entitled to apply the funds withheld toward the costs of any required remedial work, completion costs, or toward damages or losses suffered and for which the *Owner* is entitled to compensation under this *Contract*, including legal costs and expenses."

SC 3.25 **GC 6.1 OWNER'S RIGHT TO MAKE CHANGES**

3.25.1 Amend paragraph 6.1.2 by adding the following to the end:

"This requirement is of the essence and it is the express intention of the parties that any claims by the *Contractor* for a change in the *Contract Price* and/or *Contract Time* shall be barred unless there is strict compliance with PART 6 – CHANGES IN THE WORK. No course of conduct or dealings between the parties, no express or implied acceptance of alterations or additions to the *Contract* or the *Work*, and no claims that the *Owner* has been unjustly enriched by any alteration or addition to the *Work*, whether or not there is any such unjust enrichment, shall be the basis of a claim for damages or additional payment or for a change in the *Contract Price* or *Contract Time*. Without limiting the generality of the foregoing, under circumstances of expediency the *Contractor* shall proceed with a change in the *Work* without first obtaining a *Change Order* or a *Change Directive* where it has received from the *Owner* or the *Owner's* authorized representative some form of written or e-mail direction agreeing to the

change, in which case such change, and the value of such change, if any, will be determined pursuant to GC 6.2 or GC 6.3, at the option of the *Owner*."

3.25.2 Add a new paragraph 6.1.3 as follows:

"6.1.3 The *Contractor* agrees that changes resulting from construction or *Subcontractor* or *Supplier* coordination are included in the *Contract Price* and shall not entitle the *Contractor* to claim any increase to the *Contract Price*."

SC 3.26 **GC 6.2 CHANGE ORDER**

3.26.1 Add new paragraphs 6.2.3 to 6.2.5 as follows:

"6.2.3 The value of a change shall be determined in one or more of the following methods as directed by the *Owner*:

.1 by estimate and acceptance of a lump sum. The lump sum shall include overhead, profit and other reasonable charges of the *Contractor* and shall be the total cost to the *Owner*; or

.2 by unit prices established in the *Contract* or subsequently agreed upon. Unit prices shall include all costs related to *Products*, labour, equipment, delivery and handling, statutory charges, overhead and profit, other related charges, and shall include all applicable duties (excluding *Value Added Taxes*), measured in place prior to excavation, or compacted/complete in place, and shall be the total cost to the *Owner*. Adjustment to the *Contract Price* shall be based on a net quantity difference from the original quantity; or

.3 by actual credits and cost to the *Owner*. The cost to the *Owner* shall be the actual cost of labour charged at the prevailing rates at the *Place of the Work* plus statutory charges on labour including workers' compensation, employment insurance, Canada Pension, vacation pay, medical and health benefits, together with the actual costs, without mark- up, of materials and *Products* utilized in the change, plus the percentage fees set out in the tables below for overhead and profit after all credits included in the change have been deducted. For certainty, no mark-up or other charges shall be permitted for overhead and profit where the change results in a net decrease (credit) to the *Contract Price*.

(a) On *Work* performed by the *Contractor's* own forces, the *Contractor* may charge the following maximum mark-ups as a combined percentage fee for overhead and profit:

Increase in *Contract Price*	***Contractor* Mark-Up**
$0 to less than $25,000	10%
$25,000 to $49,999.99	7.5%
$50,000 or more	5%

Interpretive Note: The mark-ups in the above table are flat not graduated. For example, a change valued at $60,000 attracts a mark-up of 5%.

(b) On *Work* performed by *Subcontractors*, the *Subcontractors* may charge the following maximum mark-ups as a combined percentage fee for overhead and profit, and the *Contractor* may charge the following maximum mark-ups as a combined percentage fee for overhead and profit on *Work* performed by *Subcontractors*:

Increase in *Contract Price*	***Subcontractor* Mark-Up**	***Contractor* Mark-Up**
$0 to less than $25,000	10%	5%
$25,000 to $49,999.99	10%	5%
$50,000 or more	5%	5%

Interpretive Note: The mark-ups in the above table are flat not graduated. For example, a Subcontractor performed change valued at $60,000 attracts a mark-up of 5% for the Subcontractor and 5% for the Contractor.

The mark-ups set out in the above tables shall constitute the only compensation the *Contractor* shall be entitled to for any and all overhead, profit, general expenses, incidental and administrative costs whatsoever related to the change including, but not limited to, costs relating to superintendence and supervision, general cleanup, *Shop Drawing* production, estimating, site office and head office expenses and personnel, administration costs, workers' tools, temporary facilities and controls, record drawings, *As-Built Drawings*, warranty, insurance, bonding, job safety costs, and coordination of any and all *Work*-related activities.

6.2.4 No claim whatsoever for a change in the *Contract Time*, delay, prolongation charges, remobilization or otherwise shall be permitted with respect to a change, unless first authorized by the *Consultant* and approved by the *Owner* and set out in a *Change Order*. For certainty, an adjustment to the *Contract Time* will be considered only when the *Contractor* demonstrates to the *Owner* that a change in the *Work* affects the critical path of the *Work*. Any costs associated with an adjustment to the *Contract Time* shall be identified by the *Contractor* and shall be limited to the reasonable direct costs directly attributable to the adjustment to the *Contract Time*.

6.2.5 The *Contractor* shall not be entitled to any additional compensation or an adjustment to the *Contract Time* arising out of changes to the *Work* aside from the amounts stated in a *Change Order*. In no event shall the *Owner* be liable to the *Contractor* for any costs, including indirect, impact or consequential costs, arising out of changes to the *Work* beyond the agreed upon amount of the *Change Order*."

SC 3.27 **GC 6.3 CHANGE DIRECTIVE**

3.27.1 Delete paragraph 6.3.6.3 and replace it with the following:

"6.3.6.3 The *Contractor's* fee shall be equal to the applicable percentage mark-up rates set out in paragraph 6.2.3.3 of GC 6.2 – CHANGE ORDER or as otherwise agreed by the parties."

3.27.2 Amend paragraph 6.3.7 as follows:

(a) insert the words "Subject to paragraph 6.3.14," at the beginning; and

(b) delete paragraphs 6.3.7.1(1), (2), (3) and (4) and replace them with the following:

"(1) performing the *Work*, including necessary supervisory services;

(2) engaged in the preparation of *Shop Drawings*, fabrication drawings, coordination drawings and *As-Built Drawings*; or

(3) including clerical staff engaged in processing changes in the *Work*."

3.27.3 Amend paragraph 6.3.12 by adding the following to the beginning:

"An adjustment to the *Contract Time* will be considered only where the change affects the critical path of the *Work*."

3.27.4 Add a new paragraph 6.3.14 as follows:

"6.3.14 Without limitation, the following shall not form part of the cost of performing the work attributable to a *Change Directive*, and shall not be recoverable by the *Contractor*:

.1 head office salaries and benefits and all other overhead or general expenses, except only for the amounts described in paragraph 6.3.7.1;

.2 capital expenses and interest on capital;

.3 general clean-up, except where the performance of the work attributed to the *Change Directive* causes specific additional clean-up requirements;

.4 wages paid for project managers, superintendents, assistants, watch persons and administrative personnel;

.5 wages, salaries, rentals, or other expenses that exceed the rates that are standard in the locality of the *Place of the Work* or that are otherwise deemed unreasonable by the *Consultant*;

.6 costs or expenses attributable to the negligence, improper work, deficiencies, or breaches of contract by the *Contractor*;

.7 costs of quality assurance, such as inspection and testing services, charges levied by authorities having jurisdiction, and any legal fees unless any such costs or fees are pre- approved in writing by the *Owner*;

.8 amounts for small tools;

.9 insurance and bonding premiums, unless such costs or fees are approved in writing by the *Owner*; and

.10 preparation of *As-Built Drawings*."

SC 3.28 **GC 6.4 CONCEALED OR UNKNOWN CONDITIONS**

3.28.1 Add a new paragraph 6.4.0 as follows:

"6.4.0 The *Contractor* confirms that, before entering into this *Contract*, it carefully investigated and examined the *Place of the Work*, the *Contract Documents* and any other documents made available by the *Owner*, and applied to such investigation and examinations the degree of care, skill, judgment and diligence described in paragraph 3.11.1 of GC 3.11 – STANDARD OF CARE. If the *Contractor* has not conducted the investigations and examinations described in this paragraph, it is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the *Work* which could make the *Work* more expensive or more difficult to perform than was contemplated at the time the *Contract* was entered into. No allowances will be made for additional costs and no claims by the *Contractor* will be considered for an adjustment in the *Contract Price* or *Contract Time* in connection with conditions which were reasonably apparent or which could reasonably have been discovered by such investigations or examinations

made before entering into this *Contract*."

3.28.2 Amend paragraphs 6.4.1.1 and 6.4.1.2 by adding the following to the end of each paragraph:

"and which were concealed from discovery notwithstanding the conduct of the investigations and examinations described in paragraph 6.4.0."

3.28.3 Amend paragraph 6.4.2 as follows:

(a) add a new first sentence as follows:

"Having regard to paragraph 6.4.0, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those reasonably anticipated, or differ materially from those indicated in the *Contract Documents*, or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.0, it shall notify the *Owner* and *Consultant* in writing no later than five (5) *Working Days* after first observing such conditions."

(b) insert the words "and were concealed from discovery notwithstanding the conduct of the investigations and examinations described in paragraph 6.4.0" after the word "materially" in the second line.

SC 3.29 **GC 6.5 DELAYS**

3.29.1 Amend paragraph 6.5.1 by deleting the last sentence and replacing it with the following:

"The *Contractor* shall be reimbursed by the *Owner* for reasonable direct costs directly flowing from the delay, but excluding the costs of the *Contractor's* head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such delay, regardless of whether any such excluded costs, damages or claims are made or incurred by the *Contractor* or any *Subcontractor* or *Supplier*."

3.29.2 Amend paragraph 6.5.2 by deleting the last sentence and replacing it with the following:

"The *Contractor* shall be reimbursed by the *Owner* for reasonable direct costs directly flowing from the delay, but excluding the costs of the *Contractor's* head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such delay, regardless of whether any such excluded costs, damages or claims are made or incurred by the *Contractor* or any *Subcontractor* or *Supplier*. Provided that this paragraph 6.5.2 shall not apply where the stop work order is issued as a result of a declaration of a state of emergency or the occurrence of an epidemic or pandemic, in which case any resulting delay shall be governed by paragraph 6.5.3."

3.29.3 Amend paragraph 6.5.3 as follows:

(a) add a new subparagraph 6.5.3.0 as follows:

"6.5.3.0 acts, orders, legislation, regulations or directives of any court, government or other public authority, including stop work orders or *Project* closures or suspensions, made or issued as a result of a declaration of a state of emergency or the occurrence of an epidemic or pandemic,"

(b) delete the last sentence of paragraph 6.5.3 and replace it with the following:

"The *Contractor* shall not be entitled to payment for costs incurred by such delays."

3.29.4 Amend paragraph 6.5.4 by adding the following to the end:

"For greater certainty, it is the intention of the parties that an extension for delay will be considered only when the *Contractor* demonstrates that the delay affects the critical path of the *Work* and any adjustment to the *Contract Time* shall only be to the extent that the critical path of the *Work* is affected. Without in any way limiting the generality of the foregoing, it is a condition precedent to the *Contractor's* claim for extension of the *Contract Time* and for additional compensation or reimbursement of costs that the notice provisions in this paragraph be strictly adhered to in each instance, except where the event of delay itself reasonably precludes strict adherence to such notice provisions. If the *Contractor* fails to comply with such notice provisions, it shall be deemed to have waived the right to claim for the effects of delay."

3.29.5 Add new paragraphs 6.5.6 to 6.5.9 as follows:

"6.5.6 The *Contractor* shall take all reasonable steps to reschedule the *Work* and to minimize the effect of the delay referred to in paragraphs 6.5.1, 6.5.2 and 6.5.3. If the *Contractor* fails to do so, the extension of the *Contract Time* and/or any amounts payable to the *Contractor* will be reduced accordingly.

6.5.7 The *Contractor* shall be responsible for the care, maintenance and protection of the *Project* in the event of any suspension of the *Work* as a result of the delay described in paragraphs 6.5.1,
6.5.2 or 6.5.3, and the *Contractor* shall be reimbursed by the *Owner* for the reasonable direct costs incurred by the *Contractor* for such care, maintenance and protection, but excluding the *Contractor's* head office personnel and overhead costs.

6.5.8 The parties acknowledge and agree that the *Owner* shall not be liable for any delay or part thereof that occurs concurrently with an independent cause of delay for which the *Owner* is not responsible. In addition, in the event the *Owner* is responsible for two or more separate causes of delay that run in whole or in part parallel to each other, those two or more events shall be considered as one for the purpose of determining the duration of the extension of the *Contract Time* and/or any amount payable to the *Contractor*.

6.5.9 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone employed or engaged by the *Contractor* directly or indirectly, or by any cause within the *Contractor's* control, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may decide in consultation with the *Owner*. The *Contractor* shall be responsible for the care, maintenance and protection of the *Project* in the event of any suspension of the *Work* as a result of the delay described in this paragraph, at its sole cost and expense. In addition, the *Owner* shall be reimbursed by the *Contractor* for all reasonable costs and expenses incurred by the *Owner* as a result of such delay including, but not limited to, the costs of all additional services required by the *Owner* from the *Consultant* or any other consultants, project managers, contractors, or others employed or engaged by the *Owner*."

SC 3.30 **GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT**

3.30.1 Delete paragraph 7.1.2 and replace it with the following:

"7.1.2 If the *Contractor* neglects to prosecute the *Work* properly, fails or neglects to maintain the construction schedule, or otherwise fails to comply with the requirements of the *Contract*, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, notify the *Contractor* in writing that the *Contractor* is in default of the *Contractor's* contractual obligations and instruct the *Contractor* to correct the default in the 5 *Working Days* immediately following the receipt of such notice, but without affecting in any respect the liability of the *Contractor* in respect of earlier defaults."

3.30.2 Add new paragraphs 7.1.5A and 7.1.5B as follows:

"7.1.5A The *Owner* may terminate the *Contract* at any time for any or no reason. In such event, the *Owner* shall pay for the *Work* performed up to the effective date of termination and for such additional direct costs, if any, directly flowing from such termination which are a reasonable consequence of the termination, but excluding the costs of the *Contractor's* head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such termination, regardless of whether any such excluded costs, damages or claims are made or incurred by the *Contractor* or any *Subcontractor* or *Supplier*. The *Owner* shall not be liable to the *Contractor* for any other claims, costs or damages whatsoever arising from such termination of the *Contract*.

7.1.5B If the *Owner* terminates the *Contractor's* right to continue with the *Work* in whole or in part or terminates the *Contract* as provided in this GC 7.1, the *Contractor* shall deliver to the *Owner*, within 5 days of the effective date of the termination, all of the materials listed in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER in the possession of or available to the *Contractor*."

3.30.3 Add a new GC 7.1A as follows:

"**GC 7.1A OWNER'S RIGHT TO SUSPEND THE WORK**

7.1A.1 The *Owner* may, at any time and from time to time, suspend performance of the *Work* for up to 20 *Working Days* in the aggregate by giving *Notice in Writing* to the *Contractor* indicating the length of the suspension. Upon receiving a notice of suspension the *Contractor* shall, subject to any directions in the notice of suspension, suspend performance of the *Work*.

7.1A.2 The *Contractor* shall be responsible for the care, maintenance and protection of the *Project* during any period of suspension, and the *Contractor* shall be reimbursed by the *Owner* for the reasonable direct costs incurred by the *Contractor* for such care, maintenance and protection, but excluding the *Contractor's* head office personnel and overhead costs.

7.1A.3 If the *Work* is suspended pursuant to paragraph 7.1A.1 the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Owner* and the *Contractor*. The *Contractor* shall not be entitled to payment for costs incurred as a result of any suspension pursuant to this GC 7.1A.

SC 3.31 **GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT**

3.31.1 Delete paragraph 7.2.2.

3.31.2 Amend paragraph 7.2.3 as follows:

(a) delete paragraphs 7.2.3.1 and 7.2.3.2;

(b) delete paragraphs 7.2.3.3 and 7.2.3.4 and replace them with the following:

"7.2.3.3 the *Owner* fails to pay the *Contractor* when due the amount certified by the *Consultant* or awarded by arbitration or a court; provided that this paragraph shall not apply to the *Owner's* withholding of payments in accordance with the *Contract Documents*, or

7.2.3.4 the *Owner* violates the requirements of the *Contract* to a substantial degree, and the *Consultant* gives a written statement to the *Owner* and the *Contractor* that provides details of such violation and confirms to the *Contractor* and the *Owner* that sufficient cause exists to justify the *Contractor's* action."

3.31.3 Amend paragraph 7.2.4 by deleting the number "5" in the second line and replacing it with "10".

3.31.4 Delete paragraph 7.2.5 and replace it with the following:

"7.2.5 If the default cannot be corrected within the 10 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it

.1 commences the correction of the default within the specified time; and

.2 provides the *Contractor* with an acceptable schedule for such correction; and

.3 completes the correction in accordance with such schedule.

7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in this GC 7.2, the *Contractor* shall ensure the *Work* and the *Place of the Work* are left in a safe and secure condition as required by authorities having jurisdiction and the *Contract Documents*, and shall be entitled to be paid for all *Work* performed to the date of termination. Subject to the *Contractor's* obligation to mitigate costs, the *Contractor* shall also be entitled to recover the costs directly flowing from and which are a reasonable consequence of the termination, but excluding the costs of the *Contractor's* head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such termination, regardless of whether any such excluded costs, damages or claims are made or incurred by the *Contractor* or any *Subcontractor* or *Supplier*. Such payment is further subject to the *Owner's* right to claim damages or set off for any costs or loss or damage suffered or which will be suffered by the *Owner*. The *Owner* shall not be liable to the *Contractor* for any other claims, costs or damages whatsoever arising from such termination of the *Contract*."

SC 3.32 **GC 8.4 RETENTION OF RIGHTS**

3.32.1 Add a new paragraph 8.4.3 as follows:

"8.4.3 If either party elects to have a dispute resolved by arbitration, the *Contractor* agrees that this paragraph 8.4.3 shall be construed as a formal consent to the stay of any lien proceedings until an award is rendered in the arbitration or such dispute is otherwise resolved between the parties. Provided that nothing in this

paragraph shall prevent the *Contractor* from taking the steps required by the *Act* to preserve and/or perfect a lien to which it may be entitled."

SC 3.33 **GC 9.1 PROTECTION OF WORK AND PROPERTY**

3.33.1 Delete paragraph 9.1.1.1 and replace it with the following:

"9.1.1.1 errors or omissions in the *Contract Documents* which the *Contractor* could not reasonably have discovered; or"

3.33.2 Delete paragraph 9.1.2 and replace it with the following:

"9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents* or that are discoverable by applying to an inspection of the *Place of the Work* the degree of care and skill described in this *Contract*."

3.33.3 Add a new paragraph 9.1.5 as follows:

"9.1.5 Without in any way limiting the *Contractor*'s obligations under this GC 9.1, should the *Contractor* or any *Subcontractor* or *Supplier* cause loss or damage to property, including roads, buildings, structures, paving, grass, sod, trees or other plantings, whether owned by the *Owner* or others, and whether at the *Place of the Work* or adjoining it, the *Contractor* shall be liable for the cost of making good such damage and for the repair and any replacement costs, including the cost of any arborist or other consultant, and such costs may be deducted by the *Owner* from amounts otherwise owing to the *Contractor*."

SC 3.34 **GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES**

3.34.1 Amend paragraph 9.2.3 by deleting the words "The *Owner*" in the first line and replacing them with "The *Contractor*".

3.34.2 Amend paragraph 9.2.4 by deleting the words "Unless the *Contract* expressly provides otherwise, the *Owner*" in the first line and replacing them with "The *Contractor*".

3.34.3 Amend paragraph 9.2.5.3 by adding the following after the words "*Place of the Work*" in line two:

"and no property is damaged or destroyed as a result of exposure to or the presence of the toxic or hazardous substances,"

3.34.4 Add a new paragraph 9.2.5.5 as follows:

"9.2.5.5 take all necessary steps to mitigate the impact on *Contract Time* and *Contract Price*."

3.34.5 Amend paragraph 9.2.6 by inserting the following after the word "responsible":

"or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,"

3.34.6 Amend paragraph 9.2.7.3 by adding the following after the words "as a result of the delay" at the end:

", but excluding the costs of the *Contractor's* head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such delay, regardless of whether any such excluded costs, damages or claims are made or incurred by the *Contractor* or any *Subcontractor* or *Supplier*"

3.34.7 Delete paragraph 9.2.7.4.

3.34.8 Amend paragraph 9.2.8 by adding the following after the word "responsible" in the second line:

"or that any toxic or hazardous substances already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,"

3.34.9 Add new paragraphs 9.2.10 and 9.2.11 as follows:

"9.2.10 Without limiting its other obligations under this GC 9.2, the *Contractor* acknowledges that its obligations under the *Contract* include compliance with the *Environmental Programs*. The *Contractor* acknowledges that the *Owner* may suffer loss and damage should the *Contractor* fail to comply with the *Environmental Programs* and agrees to indemnify and hold harmless the *Owner* with respect to any loss or damage to which the *Owner* is exposed by the *Contractor*'s failure to comply. The *Contractor* acknowledges that should it fail to comply with the *Environmental Programs*, such failure will constitute a failure to comply with the requirements of the *Contract* in a material way within the meaning of paragraph 7.1.2 of GC
7.1 – OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT.

9.2.11 The *Contractor* shall indemnify the *Owner* and its agents, officers, directors, employees, consultants, successors and assigns in respect of any loss, costs, expense or fine which might be imposed in respect of any failure by the *Contractor* to satisfy its obligations under this GC
9.2 and, without limiting the general nature of this indemnity, the *Contractor* shall indemnify the *Owner* and its agents, officers, directors, employees, consultants, successors and assigns in respect of any loss, costs, expense or fine if the *Project* is made subject to an order from a court or government agency requiring remediation of any contamination caused as a result of the *Work* performed by the *Contractor* or its *Subcontractors* or *Suppliers*."

SC 3.35 **GC 9.4 CONSTRUCTION SAFETY**

3.35.1 Add new paragraphs 9.4.6 to 9.4.10 as follows:

"9.4.6 Without limiting the generality of paragraph 9.4.1, the *Contractor* shall be and shall assume all of the responsibilities of the "constructor" under *OHSA* for the *Project* and shall file the "Notice of Project" with the appropriate government agency naming the *Contractor* as the "constructor".

9.4.7 The *Contractor* shall be solely and exclusively responsible for controlling the workplace and the *Place of the Work* and shall take all steps to effectively direct and supervise the *Work* in order to ensure conformity and compliance with OHSA and all other applicable construction health and safety requirements, regulations, industry standards and guidelines, including COVID-19 protocols for construction sites. The *Contractor* represents and warrants to the *Owner* that appropriate health and construction safety instruction and training have been provided and will be provided to the *Contractor's* employees, *Subcontractors*, *Suppliers* and all others attending at the *Place of the Work*, including the *Owner's* representatives, the *Owner's* own forces, and *Other Contractors*. No comments, suggestions or instructions from the *Owner*, the *Consultant* or any other representative of the *Owner* are to be relied upon or assumed to reduce or replace the *Contractor's* designation as the "constructor" or its responsibility for construction safety on the *Project*.

9.4.8 The *Contractor* shall indemnify and save harmless the *Owner* and its and its agents, officers, directors, employees, consultants, successors and assigns from and against any and all liability, costs, expenses, charges, fines, damages and all other consequences arising from any and all safety infractions on the *Project*, including the payment of legal fees and disbursements on a full indemnity basis.

9.4.9 Without limiting the generality of the foregoing, the *Contractor* shall follow all general instructions and work procedures specified in the *Environmental Programs* and sign and return the acknowledgment form. The *Contractor* shall also ensure that their employees, *Subcontractors* and *Suppliers* who will work at the *Place of the Work* have the appropriate asbestos awareness training certificates.

9.4.10 The *Contractor* shall comply with all site access and entry protocols and guidelines established by the *Owner*."

SC 3.36 **GC 9.5 MOULD**

3.36.1 Amend paragraph 9.5.3.3 by adding the following after the words "as a result of the delay" at the end:

", but excluding the costs of the *Contractor's* head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such delay, regardless of whether any such excluded costs, damages or claims are made or incurred by the *Contractor* or any *Subcontractor* or *Supplier*"

SC 3.37 **GC 10.1 TAXES AND DUTIES**

3.37.1 Amend paragraph 10.1.2 by adding the following to the end:

"For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled

to any credit relating to mark-up for overhead or profit on any decrease in such taxes and duties."

3.37.2 Add new paragraphs 10.1.3 to 10.1.6 as follows:

"10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.

10.1.4 The *Contractor* shall maintain accurate records of equipment, material and component costs reflecting the sales taxes, customs duties, excise taxes and *Value Added Taxes* paid.

10.1.5 Any refund of taxes including, without limitation, any government sales tax, customs duty, excise tax or *Value Added Tax*, whether or not paid, which is found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the *Owner*. The *Contractor* agrees to cooperate with the *Owner* and to cause all *Subcontractors* and *Suppliers* to cooperate with the *Owner* in the application for any refund of any taxes, which cooperation shall include, but not be limited to, making or concurring in the making of an application for any such refund or exemption and providing to the *Owner* copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications or exemptions or refunds. All such refunds shall either be paid to the *Owner* or shall be a credit to the *Owner* against the *Contract Price*, in the *Owner's* discretion.

10.1.6 Customs duties and penalties or any other penalty, fine or assessment levied against the *Contractor* shall not be treated as a tax or customs duty for the purposes of this GC 10.1."

SC 3.38 **GC 10.2 LAWS, NOTICES, PERMITS, AND FEES**

3.38.1 Amend paragraph 10.2.2 by adding the following to the end:

"The Contractor shall pay any construction damage deposits levied by the authorities having jurisdiction in connection with the issuance of the building permit."

3.38.2 Amend paragraph 10.2.4 by adding the following to the end:

"The *Contractor* shall notify the *Consultant* and the chief building official or the registered code agency where applicable, of the readiness, substantial completion, and completion of the stages of construction set out in the Ontario Building Code. The *Contractor* shall be present at each site inspection by an inspector or registered code agency. If any laws, ordinances, rules, regulations, or codes conflict, the more stringent shall govern."

3.38.3 Amend paragraph 10.2.5 by deleting the word "The" in the first line and replacing it with the words "Subject to paragraph 1.1.12 of GC 1.1 – CONTRACT DOCUMENTS, the".

3.38.4 Amend paragraph 10.2.6 as follows:

(a) delete the words "performs work knowing it to be" and replace them with "performs work when it knew or ought to have known that such work is"; and

(b) delete the words "bear the" in the third line and replace them with "indemnify and save the *Owner* harmless against all".

3.38.5 Amend paragraph 10.2.7 by adding the following to the end:

", provided that any claims arising from any delays due to such changes will be dealt with in accordance with GC 6.5 – DELAYS."

SC 3.40 **GC 12.1 READY-FOR-TAKEOVER**

3.40.1 Delete paragraphs 12.1.1.4 and 12.1.1.5 and replace them with the following:

"12.1.1.4 The delivery to the *Owner* of guarantees, warranties, certificates, testing and balancing reports and spare parts, distribution system diagrams, *Shop Drawings*, maintenance and operating manuals, instructions, samples, existing reports and correspondence from authorities having jurisdiction, and all other close-out materials or documents specified in the *Contract Documents*.

12.1.1.5 The delivery to the *Owner* of the final *As-Built Drawings* acceptable to the *Consultant*."

3.40.2 Add a new paragraph 12.1.1.9 as follows:

"12.1.1.9 Written confirmation by the *Consultant* that the aggregate cost of completing the remaining *Work* and correcting known defects and deficiencies is not more than the lesser of $5,000 and 1% of the *Contract Price*."

3.40.3 Amend paragraph 12.1.5 by adding the following to the end:

", which shall be no later than thirty (30) days after *Ready-for-Takeover*."

3.40.4 Delete paragraph 12.1.6.

SC 3.41 **GC 12.2 EARLY OCCUPANCY BY THE OWNER**

3.41.1 Delete GC 12.2.

SC 3.42 **GC 12.3 WARRANTY**

3.42.1 Amend paragraph 12.3.1 by adding the following to the end:

"Notwithstanding the foregoing, if an item of *Work* is not completed at *Ready-for-Takeover*, except for extended warranties as described in paragraph 12.3.6, the warranty period for such item of *Work* shall be one year from the date that such item of *Work* has been completed and accepted in writing by the *Owner*."

3.42.2 Amend paragraph 12.3.3 by adding the following to the end:

"The *Contractor* shall correct all remedial and warranty work identified in the *Notice in Writing* within 30 days of receipt of such notice, or within such other time as the parties may agree, failing which the *Owner* may engage others to perform the work necessary to complete and rectify such warranty work at the risk and cost of the *Contractor*."

3.42.3 Amend paragraph 12.3.4 by adding the following to the end:

"The *Contractor* shall perform all remedial and warranty work at its own cost and expense and at a time convenient to the *Owner*, which may be outside of normal working hours. Before performing the remedial and warranty work the *Contractor* shall provide, for the *Owner's* review and approval, a proposed schedule for the performance of such work."

SC 3.43 **GC13.1 INDEMNIFICATION**

3.43.1 Delete paragraphs 13.1.1 through 13.1.6 and replace them with the following:

"13.1.1 The *Contractor* shall defend, indemnify and hold harmless the *Owner* and the *Consultant*, their agents and employees from and against all claims, demands, damages, losses, expenses, costs including legal fees, actions, causes of action, suits, charges or other proceedings (collectively "Claims"), by whomsoever made, brought or prosecuted in any manner, arising out of, resulting from or attributable to, directly or indirectly, the *Contractor's* or any *Subcontractor's* performance or non-performance of the *Work* or the *Contract*, regardless of whether or not caused in part by a party indemnified hereunder. It is expressly understood that the *Contractor* will save harmless the *Owner* from all *Claims* made by any person other than the *Contractor* itself, financial or otherwise, relating to or arising from the *Work*.

13.1.2 The *Owner* shall indemnify and hold harmless the *Contractor* and its agents and employees from and against all *Claims* arising out of the *Contractor's* performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of the Work*."

SC 3.44 **GC 13.2 WAIVER OF CLAIMS**

3.44.1 Delete paragraphs 13.2.1 through 13.2.10 and replace them with the following:

"13.2.1 As of the date on which the *Owner* makes final payment to the *Contractor*, the *Owner* expressly waives and releases the *Contractor* from all claims against the *Contractor* including, without limitation, those that might arise from negligence or breach of contract by the *Contractor* except for one or more of the following:

.1 those made in writing prior to the date of the final payment and still unsettled;

.2 those arising from the provisions of GC 13.1 – INDEMNIFICATION or GC 12.3 – WARRANTY;

.3 those arising from GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES and arising from the *Contractor* bringing or introducing any toxic or hazardous substances to the *Place of the Work* after the *Contractor* commences the *Work*;

.4 those made by *Notice in Writing* within a period of six years from *Ready-for-Takeover*, or within such shorter period as may be prescribed in any limitation statute of the province or territory of the *Place of the Work* and arising from any liability of the *Contractor* for damages resulting from the *Contractor's* performance of the *Contract* or substantial defects or deficiencies in the *Work* for which the *Contractor* is proven responsible.

13.2.2 As of the date of *Ready-for-Takeover*, the *Contractor* expressly waives and releases the *Owner* from all claims which it has or reasonably ought to have knowledge of that could be advanced against the *Owner* including, without limitation, those that might arise from the negligence or breach of contract by

the *Owner* except:

.1 those for which *Notice in Writing* was given prior to the *Contractor's* application for *Ready-for-Takeover* and still unsettled; and

.2 claims for payment for *Work* completed after the *Contractor's* application for *Ready-for- Takeover*; and

.3 those arising from the provisions of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES or GC 10.3 – PATENT FEES."

SC 3.45 **PART 14 – OTHER PROVISIONS**

3.45.1 Add a new "**PART 14 – OTHER PROVISIONS**" as follows:

"**PART 14 OTHER PROVISIONS**

GC 14.1 OWNERSHIP OF MATERIALS

14.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time this *Contract* is entered into shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work*, or to a pre-approved off site storage area, shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials from the *Place of the Work* as its property when notified in writing to do so by the *Consultant*.

GC 14.2 LIENS AND ACTIONS

14.2.1 The *Contractor* shall save and keep the *Owner* and the *Place of the Work* free from all construction liens and all other liens whatsoever arising out of the *Work*. If any lien is claimed, filed or registered or any written notice of a lien is received by reason of any *Work* supplied or claimed to have been supplied by or through a *Subcontractor* or *Supplier*, the *Contractor* shall, at its own expense, within ten (10) *Working Days* of being notified of the lien or written notice of a lien, secure the discharge, release, vacating or withdrawal of such lien or written notice of a lien by payment or by giving security or in such other manner as is or may be required or permitted by law, failing which the *Owner* may, but shall not be required, take such steps as it, in its absolute discretion, may deem necessary to release, vacate or discharge the lien or written notice of a lien.

14.2.2 If a lien action is commenced arising out of a lien described in paragraph 14.2.1, the *Contractor* shall take all reasonable steps to remove the *Owner* from such action, and shall indemnify the *Owner* and hold it harmless in such action.

14.2.3 All amounts, including legal costs on a full indemnity basis, disbursements, interest, borrowing, premium or other bonding costs and/or charges incurred by the *Owner* in releasing, vacating, discharging and/or otherwise dealing with a *Subcontractor* or *Supplier* lien, written notice of a lien and/or defending or otherwise dealing with a lien action, shall be charged to the *Contractor* and shall be set off and deducted from any amount owing to the *Contractor*. If there is no amount owing by the *Owner* to the *Contractor* at that time, then the *Contractor* shall reimburse the *Owner* for all amounts incurred by the *Owner*.

GC 14.3 CONTRACTOR LIABILITY FOR DAMAGES

14.3.1 Notwithstanding any other provision in this *Contract*, if the *Owner*, as a result of the *Contractor's* act or omission or breach of this *Contract*, incurs damages, costs, fees or expenses, including costs of additional services performed by the *Consultant* and including legal fees, whether or not such act, omission or breach results in any lien, lien action or other legal proceeding, and whether or not such act, omission or breach results in the *Owner* taking any of the steps provided for in GC 7.1, all such damages, costs, fees (including legal fees on a

full indemnity basis) and expenses shall be charged to the *Contractor* and the *Owner* shall be entitled to set off and deduct all such damages, costs, fees (including legal fees on a full indemnity basis) and expenses from any amount owing to the *Contractor*. If there is no amount owing by the *Owner* to the *Contractor* at that time, then the *Contractor* shall reimburse the *Owner* for all of the said damages, costs, fees and expenses.

GC 14.4 DAILY REPORTS / DAILY LOGS

14.4.1 The *Contractor* shall cause its supervisor, or such competent person as it may delegate, to prepare and maintain a daily site log or diary recording, at least, the following: (a) daily weather conditions and temperatures at the *Place of the Work*, (b) the number of workers of the *Contractor, Subcontractors, Suppliers* and any other forces at the *Place of the Work*, (c) the *Construction Equipment* at the *Place of the Work*, (d) the descriptions and quantities of *Products* delivered and utilized, and (e) the general nature of *Project* activities. Such log or diary shall also record any extraordinary or emergency events which may occur and also the

identities of any persons who visit the *Place of the Work* who are not part of the day-to-day workforce. The *Contractor* shall also take or arrange for the taking of *Project* photographs to record the progress of the *Work*.

14.4.2 The *Contractor* shall maintain, either at its head office or at the *Project* site, records recording labour and material resourcing on the *Project*, including the records identified in paragraph
14.4.1 and other records which document the activities of the *Contractor*.

14.4.3 Upon request by the *Owner* or the *Consultant*, the *Contractor* shall make available for inspection and copying all of the records generated pursuant to this GC 14.4, along with any other routine *Project* records ordinarily maintained by the *Contractor*.

GC 14.5 PUBLIC STATEMENTS

14.5.1 The *Contractor* shall not, and shall ensure its employees, *Subcontractors* and *Suppliers* do not, publish any photographs or images, issue or make any statements or news releases, electronic or otherwise, on any website or social media or other communications platform, concerning the *Owner*, the *Contract*, the *Work*, or the *Project*, without the prior express written consent of the *Owner*. For greater certainty, the *Contractor* shall obtain the prior written approval of the *Owner* for any public advertising, written public sales promotions, press release or other general publicity matter by the *Contractor*, its employees, *Subcontractors* and *Suppliers* in which the *Owner* is mentioned or in which words are used from which any connection with the *Owner* may be inferred. The *Contractor* will not erect or permit the erection of any sign or advertising without the prior written approval of the *Owner*.

GC 14.6 AMENDMENTS TO THE CONTRACT

14.6.1 Except for the written or e-mail direction referred to in paragraph 6.1.2 of GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, no alteration or amendment to this *Contract*, no course of conduct or dealing between the parties, and no express or implied acceptance of alterations or amendments to the *Contract* shall be binding unless it is in writing and signed by each party.

14.6.2 No waiver by or on behalf of a party of any breach of a provision of this *Contract* shall be binding upon the party unless it is expressed in writing and duly executed by the party or signed by its fully authorized representative, and such a waiver shall not operate as a waiver of any future breach, whether of a like or different character. No waiver shall be inferred from or implied by the

conduct of any party.

GC 14.7 CONTRACT SECURITY

14.7.1 The *Contractor* shall, after receiving written notification from the Owner, and prior to commencing the *Work*, deliver to the *Owner* the performance bond and labour and material payment bond specified in the *Contract Documents*, each in the amount specified by the *Owner*.

14.7.2 The form of such bonds shall be in accordance with the latest edition of the CCDC approved bond forms and shall be issued by a duly licensed surety company authorized to transact the business of suretyship in Ontario and shall be maintained in good standing until the fulfillment of the *Contract*. All premiums and other costs of the bonds are included in the *Contract Price*."

END OF SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.1 INSTRUCTIONS

1. Unless specified otherwise, the following instructions shall apply to all sections of the work.

2. Conform to the Procurement Restriction Policy of Ontario.

Procurement Restriction Policy (PRP)

The Province of Ontario has issued the Procurement Restriction Policy (PRP), which is binding on all Broader Public Sector (BPS) entities, including the Boards. The Policy is designed to restrict United States (U.S.) businesses from accessing public sector procurements in Ontario and remains in force until further notice.

For the purposes of this procurement, the Board is required to comply with the PRP as issued by the Province.

Accordingly:

- Bidders must not be a U.S. business as defined by the Policy.
- A U.S. business means a supplier, manufacturer, or distributor that:
  - has its headquarters or main office located in the U.S., and
  - has fewer than 250 full-time employees in Canada at the time of the applicable procurement process.
- If a bidder or vendor is a subsidiary, it is considered a U.S. business if controlled by a corporation headquartered in the U.S.
- The PRP applies to the contractual relationship between the Boards and the successful Bidder.
- For clarity, the PRP restricts the Board from contracting directly with U.S. businesses as defined by the Province. The Policy does not extend to the General Contractor's own subcontractors or suppliers, nor does it prohibit the use of goods manufactured in the United States when those goods are supplied through a compliant Canadian vendor.

Tariffs

In accordance with GC 10.1.1 of CCDC 2, the Contract Price shall include all taxes and customs duties in effect at the time of bid closing. Tariffs are considered to be customs duties and must therefore be included in the bid price. Any tariffs or other duties in place prior to bid closing must be accounted for in the bid price, and the Owner will not compensate the Bidder for failure to do so. Changes imposed by governing authorities to taxes or customs duties after bid closing will be addressed through an adjustment to the Contract Price in accordance with GC 10.1.2 of CCDC 2.

3. Conform to The latest Ontario Building Code, CEC CSA C22, CAN3-B44 and CSA W59.1 - latest amendments, where applicable, to the Canadian Code for Construction Safety, as currently amended, and to the Construction Safety Act, Ont. as currently amended, and to all other applicable codes and Building By-Laws hereinafter referred to as Codes; and to the requirements of the authorities having jurisdiction, including public utilities, referred to in the Contract Documents as the authorities.

4. Conform to regulations of Municipality having jurisdiction regarding clean up of tracking on streets and protection of sidewalks and curbs, and all other applicable laws, By-laws and Regulations.

5. Read General Work - Section 01015, for instructions and requirements regarding General Work and Services, Miscellaneous Work and Services and Temporary Work and Services. Trades requiring own offices, sheds, etc. shall provide, maintain, relocate and remove same in a manner satisfactory to Contractor.

6. Establish rates of wages, hours and conditions of work, in accordance with Provincial Codes and as generally recognized and accepted in locality. Wherever possible, give preference to use of local labour, building mechanics, suppliers and subcontractors.

7. Install and arrange ducts, piping, tubing, conduit, equipment and fixtures in such a way as to conserve head room and space as much as possible, to provide minimum interference and to be neat, orderly and tidy. Unless otherwise noted, run pipes, ducts, tubing and conduit vertical, horizontal and square with building grid. Conceal pipes, ducts, tubing and conduit above ceilings, behind furrings, in walls, except in mechanical rooms, equipment rooms and unfinished spaces, unless indicated or specified otherwise.

8. In all cases where a device or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

9. Definitions

    1. Wherever the words 'approved', 'satisfactory', 'directed', 'permitted', 'inspected', 'instructed', 'required', 'submit', 'ordered', or similar words or phrases are used in the Contract Documents, it shall be understood, unless the context provides otherwise, that the words 'by (to) the Architect' follow.

    2. The words 'by others' when used in the Specifications or on the Drawings shall not mean by someone other than the Trade Contractor. The only means by which something shown or specified shall be indicated as not being in the Contract is by the use of the initials 'NIC' or the words 'not in (the) Contract', 'by Client', or by another Contractor.

    3. Exposed: means when visible by the occupants at completion of the work, unless scheduled or specified otherwise.

    4. The use of scope, related work, or similar articles in the specifications shall

not relieve the contractor from their responsibility to assign the various parts of the work to the appropriate subcontractors and forces and shall not impose upon the Architect or Client the duty to arbitrate disputes between the Contractor and the Subcontractor, nor shall it relieve the subcontractors from their responsibility for carefully examining all the Drawings and Specifications and coordinating their work with each other and the Contractor.

1.2 CO-OPERATION

1. Co-operate and co-ordinate with other trades as required, for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to, or inserted in work, and set in place or instruct related trades as to their location. Pay cost of extra work caused by and make up time lost, as a result of failure to provide in adequate time, the necessary co-operative information of items to be fixed to, or built in.

1.3 MATERIALS

1. See Article 27 of the General Conditions.

2. Reject material damaged in transit. Store packaged materials in original undamaged containers with manufacturer's labels and seals intact. Handle and store materials in accordance with manufacturers' and suppliers' recommendations. Prevent damage. Remove from site and replace damaged materials.

3. Conform to the Products, tables and standards in Section 01016 for the following:

    1. Metals

    2. Gauges & Equivalent Thickness

    3. Glass

    4. Concrete, Masonry, Paving

    5. Finish for Aluminum, Baked on Coatings

    6. Pencil Hardness Test

    7. Finish for Aluminum, Hard Anodizing

1.4 EXAMINATION

1. The Contractor affirms that before tendering, they did examine the site and ascertain the extent and nature of all conditions affecting the performance of the work including the existing conditions; and including the location of all buried services which may have to be protected, removed or relocated. No extras will

be allowed for anything which would have been revealed in the course of such an examination.

2. The Contractor affirms that before tendering they did examine the Specifications, Drawings, and other tender documents thoroughly. It shall be assumed that the Contractor thoroughly understands these documents, including those particular items about which questions have been asked and written instructions given.

3. Examine work upon which your work depends. Application of your work or any part of it shall be deemed acceptance of work upon which your work, or that part of it which has been applied, depends.

4. Drawings are in part, diagrammatic and incomplete, and are intended to convey scope of work and indicate general and approximate location, arrangement and size of fixtures, equipment, ducts, piping, conduit and outlets. Obtain more accurate information about locations, arrangement and sizes, from study and coordination of construction drawings, including architectural, structural, mechanical and electrical and become familiar with conditions and spaces affecting these matters before proceeding with work.

5. Where job conditions require reasonable changes in indicated location and arrangements, make changes at no extra cost to Client. Install and arrange ducts, piping, conduit, equipment and fixtures in such a way as to conserve head room and space as much as possible.

1.5 SCAFFOLDING

1. The Contractor shall provide at their own expense all manner of materials, labour, scaffolding, ladders, hand tools, and appliances necessary for the due execution and proper completion of work described herein, unless otherwise specified in tender specifications.

2. Erect scaffolding independent of walls. Use scaffolding so as to interfere as little as possible with other trades. When not in use, move scaffolding as necessary to permit installation of other work. Construct and maintain scaffolding in rigid, secure and safe manner. Remove scaffolding promptly when no longer required. Scaffolding must comply to Occupational Health and Safety Act.

1.6 FLOOR SURFACES

1. Adequately protect existing and new floors and finishes from damage. Take special measures when moving heavy loads or equipment on them.

2. Keep floors free of oils, grease, or other material likely to damage them, discolour them, or affect bond of applied finishes.

3. Once building is enclosed, keep floors as dry as possible after curing.

1.7 PROTECTION AND MAKING GOOD

1. Protect existing property, adjacent public and private property and work of other

sections from damage while doing work.

2. Damaged work and property shall be made good (includes replacing, fixing, re-finishing) wherever possible by those performing work originally, but at expense of those causing damage.

3. Attach and fasten fixtures and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building as a result of vibration or other causes in normal use of building.

4. If, during work, any buildings, curbs, walks, roads or landscaping are damaged, repair or replace them to the satisfaction of Architect and the local jurisdiction.

5. Protect glass and other finishes against heat, slag and weld spatter, by erecting sturdy plywood or other heavy shield.

6. If tape or strippable coatings are used to protect finished metal surfaces, do not allow them to become baked on or to thermoset.

1.8 IMPACT DRIVEN FASTENINGS

1. Do not use impact driven (explosive, hammer, etc., but not twist driven) fastening devices without written approval. Properly size holes in concrete and drill cleanly to avoid oversizing for expansion anchors. When drilling upward, use jig to hold drill steady and plumb.

1.9 ALTERATIONS AND MAKING GOOD

1. Wherever it becomes necessary to cut or interfere in any manner with existing services and apparatus, do so at such times as approved by the Architect. Give minimum advance notice of one week and provide sufficient information of such requirements.

2. Take into account existing installations to ensure best arrangement of pipes, conduit, ducts and mechanical, electrical and other equipment in available space. For critical locations, prepare interference and installation drawings showing work of various sections as well as existing installations, for approval, before commencing work.

3. Comply with Section 01045 Cutting and Patching for additional information

1.10 STANDARDS

1. Where initials of an organization are used, followed by number or combination of numerals and letters, this designates a standard produced by the organization. Conform to issue of standard so designated, as amended and revised to date of contract. When designation does not indicate particular edition of standard edition current at date of Contract shall apply.

2. Wherever a standard confers upon a person, a body politic or a body corporate the right to approve, to select, to exercise authority or to interpret the standard,

and refers to that person, body politic or body corporate as the Authority having jurisdiction, the Authority, the Engineer, the Department, the Purchaser, the Contracting Officer (e.g. U.S. Fed. Spec.) or by some other such designation, the Architect shall have the right to exercise the powers of any such person, body politic, or body corporate.

3. Where standards and manufacturer's instructions conflict with the Contract Documents, the Contract Documents shall govern.

1.11 FINISHED DIMENSIONS AND ELEVATIONS

1. See Article on Setting Out, in Section 01015. Give particular attention to finished dimensions and elevations of the work. Make finished work fit indicated spaces accurately. Make finished work flush, plumb, true to lines and levels and accurate in all respects

1.12 NON-PAYMENT

2. All those doing work or supplying materials shall notify the Architect in writing if the Contractor fails to make payment when due. Failing such notice, the Architect will assume that payments have been duly made.

1.13 CLEANING AND CONTRACT CLOSE-OUT

1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

2. Store volatile wastes in covered metal containers and remove from premises daily.

3. Prevent accumulation of wastes which create hazardous conditions.

4. Provide adequate ventilation during use of volatile or noxious substances.

5. Use only cleaning materials recommended by manufacturer on surface to be cleaned, and as recommended by cleaning material manufacturer.

6. See G.C. 3 of the General Conditions of the Contract.

7. Cleaning During Construction

1. The successful Contractor will be responsible to maintain the work areas and designated storage areas in a neat, orderly and clean condition and remove all excess materials and/or garbage from the site, daily.

2. Provide on-site containers for collection of waste materials and rubbish. Location to be co-ordinated with Architect.

3. Remove waste materials and rubbish from site on an ongoing basis.

4. Clean interior building work areas daily or as needed, until work is complete

5. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

6. Promptly as the work proceeds and on completion, each Contractor shall clean up and remove from the premises all rubbish, surplus materials and equipment resulting from their work. Follow General Contractor's instructions regarding disposal of rubbish.

7. Before final inspection, replace glass and mirrors that have been broken, damaged and/or etched during construction, or which are otherwise defective.

8. Include in Work final cleaning by skilled cleaning specialists on completion of construction.

9. Remove temporary protections and make good defects before commencement of final cleaning.

10. Remove dust, stains, paint spots, soil, grease, fingerprints and accumulations of construction materials, interior and exterior to the building. Perform cleaning in accordance with installer's instructions for each material. Final cleaning shall include:

    1. Cleaning and polishing of glass; porcelain, enamel and finish metals; washroom accessories.

    2. Vacuum cleaning of ceilings, walls and floors.

    3. Cleaning of floors.

    4. Cleaning of glazed wall surfaces.
    5. Cleaning of hardware, mechanical fixtures, lighting fixtures, cover plates, and equipment, including polishing of their finish metal, porcelain, vitreous, and glass components.

    6. Removing of visible labels and temporary protection coverings left on materials, components and equipment.

    7. Cleaning of masonry and concrete, if so directed by the Architect.

    8. Cleaning of wood panelling, millwork and doors.

8. <u>Final Inspection and Closeout</u>

    1. Submit proposed closeout procedures and schedule of inspection to Architect for approval before final inspections commence.

    2. Arrange for, conduct and document final inspections, closeout and take-over at completion of work of this specification in accordance with procedures described in OAA/OGCA TAKE-OVER PROCEDURES,

OAA/OCGA Document No. 100, December 2007.

3. Substantial completion cannot be applied for until the building is approved for occupancy by the local Building Authority, maintenance manuals and as-builts have been submitted, operating instructions to the Client have been completed and percentage of completion as per the Construction Lien Act has been obtained.

4. Comply with Section 01700.

1.14 TRADEMARKS AND LABELS

1. Trademarks and labels shall not be visible in the finished work except for labels of ULC and other similar authorities and except where necessary to identify mechanical and electrical equipment, for maintenance and replacement and except where specified otherwise.

2. Except as provided in the foregoing paragraph, locate trademarks and labels on concealed or inconspicuous surfaces or remove by grinding if necessary or paint out where surface painted, if located conspicuously.

1.15 BURIED SERVICES

1. The Contractor shall be responsible for keeping records of all buried services. The subcontractors concerned shall provide the Contractor with all necessary dimensions required to accurately locate those services.

1.16 EXISTING SERVICES

1. Where work involves breaking into or connecting existing services, carry out work at times directed by governing authorities, with minimum of disturbance to the operation of the facility, pedestrian and vehicular traffic.

2. Before commencing work, establish location and extent of service lines in area of work and notify Architect of findings.

3. Where unknown services are encountered, immediately advise Architect and confirm findings in writing.

4. Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

5. Remove abandoned service lines to distance of six feet from foundations. Cap or otherwise seal lines at cut-off points, in manner approved by authorities having jurisdiction over service.

6. Record locations of maintained, re-routed and abandoned service lines. The sub-contractors concerned shall provide the General Contractor with all necessary dimensions required to accurately locate those services.

7. The appropriate Sub-contractor shall assume full responsibility for the locations and

protection of all under and above ground utilities, such as water, sewer and gas mains and building connections, hydro and telephone poles, wires and conduits, etc. when excavating or digging below grade whether they are shown on the plans or not.

8. Where the location of any of these utilities has been shown on the plans, such information is not guaranteed. It is the appropriate Sub-contractor's responsibility to verify locations, invert elevations, etc., immediately after moving on the site. If for any reason the information obtained necessitates changes in procedures or design, advise the Architect at once. If this verification of existing conditions is not done at the outset and any problems arise, the responsibility for same will be entirely the Contractor's.

9. Contractor to provide temporary support of existing service lines and pipes where work requires excavation below existing lines for construction of new footings, foundations, etc.

1.17 EMBEDDED CONDUIT, PIPE AND SLEEVES

1. Concrete Slabs

1. All pipes and conduits shall be depressed to pass under concrete slabs on grade.

2. Sleeves, conduits and pipes which pass through suspended slabs, beams or walls, shall be in approved locations which do not impair the strength of the construction. Space them all not less than three diameters o.c.

1.18 SOUND ATTENUATING PARTITIONS

1. Avoid "short circuiting" sound attenuating partitions by the careful location and treatment of ducts, grilles, diffusers, etc., and of electrical outlets and boxes, etc. Where electrical boxes are back to back, serving each side, locate them at least 10 inches (250 mm) apart laterally and if interconnected, use flexible connections.

1.19 SAFETY

1. The General Contractor will be responsible for submitting their safety program used in the ongoing operation of their company and any safety recommendations specifically relating to the tendered project.

2. Safety measures or procedures taken by the General Contractor i.e. site safety meetings, site construction fences, etc., will not relieve the Contractor of their responsibilities for the safety of persons and property, and for compliance with the federal, provincial and local statutes, rules, regulations and orders applicable to the conduct of the work.

3. Submit copies of all Safety Meeting Minutes to Architect and Client.

4. Comply with Section 01545.

1.20 OMISSIONS AND DISCREPANCIES

1. Notify Architect at once of discrepancies found in, or omissions from the drawings, specifications or other documents or if in doubt as to their meaning; Architect will send a written instruction to all Bidders. If a discrepancy exists, the Architect will issue an addendum to all Bidders to clarify or correct such discrepancies.

2. Neither Client nor Architect will be responsible for any verbal instructions.

3. Should any discrepancies or omissions go unreported to the Architect during tendering period, the proper interpretation shall be at the discretion of the Architect.

1.21 EXAMINATION

1. The site shall be accepted by the Contractor in their present condition. The Contractor will be held to have visited the site and to have carefully examined all conditions affecting the site, the work to be done there on, including the location of all services which may have to be protected, removed or relocated. The Contractor shall accept sole responsibility for any error or neglect on their part in this respect. Submission of Tender shall be deemed confirmation that tenderer has inspected site and is thoroughly conversant with existing conditions. No claims for extra payment will be considered for extra work, expense or difficulties encountered due to conditions on the site which were visible upon or reasonably inferable from an examination of the said site prior to the closing of tenders.

2. Examine the specifications, drawings and soils report thoroughly. Report to Architect all ambiguities, discrepancies, omissions, errors, departures from Building By Laws, or from good practice, discovered during examination as early in the tender period as possible to allow clarification by addenda to be issued to all bidders. No claims for extra payment will be considered for work, expense or difficulties which are reasonably inferable from an examination of the documents prior to the closing of tenders.

3. The drawings and specifications complement each other and neither is to be considered alone. Hence, any item omitted in one, but mentioned or implied in the other, must be provided.

4. All changes to the contract documents which result in an extra or a credit to the contract amount are not to be executed until written instructions have been received and the extra or credit agreed to in writing by all parties to the contract.

5. The Contractor shall execute variations, alterations and substitutions which do not affect the contract amount as instructed by the Owner or its representatives.

6. Bidders finding discrepancies or omissions in the drawings or specifications shall at once notify the Architect who shall send written instructions to all bidders. Bidders may, during the tender period, be advised by addenda of any additions, alterations or deletions to the specifications and drawings. All such changes shall be covered by the tender and become part of the contract documents.

7. If any person submitting a bid on this project is in doubt as to the true meaning and intent of any part of the specifications or other documents, he must request an interpretation from the Architect. If such interpretation is not requested, the bids will be presumed to be based on the interpretation or directions that may be subsequently given by the Architect after award of the Contract, in accordance with the provisions of the Contract.

8. Prior to the closing date of tenders, any and all necessary clarifications of the specifications or other Tender documents will be in the form of written Addenda. The Architect will NOT be responsible for verbal instructions or any explanations or interpretation of Drawings and Specifications.

9. No questions concerning this project will be accepted by the Architect during the day of the tender closing date for 48 hours prior to the tender closing date.

1.22 UNIT PRICES

1. At time of submission include in the tender form all the unit prices in accordance with the Tender Form. These unit prices will be included in the agreement.

2. Unit prices shall include labour, material, overhead and profit, supervision, and other relative charges, but shall be exclusive of all value added taxes, and HST. Any work done on the basis of unit prices shall be carried out generally in accordance with the specifications for similar work and shall be to the Architect's approval.

3. The Client reserves the right to accept or reject any or all of the Unit Prices proposed prior to entering in the construction contract. The Client reserves the right to negotiate these unit prices rejected or proposed.

1.23 PROCEDURES AND SUPPLY OF CRITICAL MATERIALS

1. Submission of a tender shall constitute the Tenderer's agreement that they will commence work immediately upon award of the Contract, and that they will execute the same without interruption until completion, including the furnishing of all necessary supplies and equipment for winter operations. Contractor shall assure themselves before submitting a tender that they are in a position to furnish adequate supplies of all materials, critical or otherwise, at such times necessary to ensure immediate commencement of the work and continuous operation without delays on the project. The Contractor shall include in their tender amount, sufficient sums for the purchase of critical materials from any source available. After award of the contract, the Client will not grant increases to the tender amount to obtain critical materials at premium prices, nor will delays or interruption of the work be tolerated.

1.24 LAWS, CODES AND REGULATIONS

1. The tenderer is assumed to have made themselves familiar with and abide by the Federal National Authorities, Provincial, Municipal and local laws, rules and regulations which in any manner affect those engaged or employed in the work, or in any way affect the work, and no plea of misunderstanding will be considered

on account of ignorance thereof. If the Bidder shall discover any provisions in the drawings, specifications or contract which are contrary to or inconsistent with any law, rule of regulation, Contractor shall at once report it to the architect in writing.

1.25 WAGES

1. The General Contractor and all subcontractors shall adhere to the hours of work, the working conditions and rate of wages paid under the prevailing local conditions and/or requirements, paying not less than minimum wages established by customary standard in the locality for the same or similar class of work.

1.26 SITE ACCESS

1. Contractor to remove all debris from site daily.

2. Location of all trailers, storage units, and construction fences by contractor shall be reviewed and approved by the Client and Architect at a preliminary site meeting prior to contractor moving on to site.

3. Parking for construction workers shall be on site as directed by the General Contractor, only when parking spaces are available.

4. Site access for construction to be confirmed at first site meeting.

1.27 CONSTRUCTION SAFETY

1. Safety measures or procedures taken by the Contractor, i.e. site safety meetings, protective street hoarding, site construction fences, etc. will not relieve the contractor of their responsibilities for the safety of persons and property, and for compliance with the federal, provincial and local statues, rules, regulations and orders applicable to the conduct of the work.

2. The Contractor shall be liable for any costs, fines, penalties, etc. levelled against the Client or Consultant due to violation of the Construction Safety Act by this Contractor or any Subcontractors on this project.

3. The Contractor shall be responsible for submitting to the Client their safety program used in ongoing operation of their company and any safety recommendations specifically relating to the tendered project.

1.28 PROJECT SCHEDULE

1. The successful bidder will be required within one (1) week after award of a Letter of Intent to forward to the Architect, a schedule indicating construction sequences, manpower and equipment required in order to complete the work. This schedule is to be posted on site at all times. Schedule is to be updated on a weekly basis.

2. When the Architect deems that the Contractor's work has fallen behind schedule, the contractor will provide the necessary manpower and work the necessary overtime to bring the work back on schedule at no cost to the Client.

3. Contractor shall commence shop drawings immediately once acceptance of tender has been given by the Client. A complete shop drawing and sample submission schedule is to be provided within seven days of tender award. This will be reviewed by Architect.

4. Commence construction on the Project as soon as Building Permit is obtained.

1.29 PROTECTION AND MAKING GOOD

1. Protect existing property, adjacent public and private property and work of other sections from damage while doing work.

2. Damaged work and property shall be made good wherever possible by those performing work originally, but at expense of those causing damage. The General Contractor is solely responsible for all subtrades and any damage.

3. Attach and fasten fixtures and fittings in place in safe, sturdy secure manner so that they cannot work loose or fall or shift out of position during occupancy of building as a result of vibration or other causes in normal use of building.

4. If, during performance of the work, any buildings, curbs, walks, roads or landscaping are damaged, repair or replace them to the satisfaction of Architect and the local jurisdiction at no additional cost to the Client.

1.30 MATERIALS AND EQUIPMENT

1. All materials and equipment supplied for the work shall be new, of the best quality, and in accordance with the latest applicable specifications of the Canadian Standards Association.

2. The particular method, material, procedure or equipment specified in this tender shall be used as a standard.

3. M.S.P.S. (Material Safety Data Sheets) for all materials being used on this project are to be kept on site and made available for use by all concerned.

4. Controlled substances: the use of any controlled substance of any kind must be reviewed by Client and written acceptance of its use obtained.

5. A bidder may submit an alternative method, material, procedure or equipment to that specified in the tender specifications. All alternatives shall be equal or superior to the standard specified in these tender documents and all unit prices along with overall product quantity cost is to be submitted. Alternates may not necessarily be accepted by the Architect.

   Where particular products are specified and approved alternate manufacturers are listed, it is the responsibility of the contractor to ensure that any products carried in their tender from one of the approved manufacturer's meets or exceeds the original specified product.

Upon the alternate product shop drawing submission to the architect for review, all product data sheets (for specified and alternates) comparing the two products are to be submitted.

6. The bidder who furnishes an alternative method, material, procedure or equipment in place of the standard item specified shall furnish complete documented data including such information as chemical content and performance under laboratory tests which proves the quality and equality of the proposed alternative. This information shall accompany the bid. Note that the bidder who furnishes an alternative method, material, procedure or equipment in place of the standard item specified is responsible that the alternative will work with the Architectural layout, equipment will fit in the provided space and any revisions that will be required will be at the bidder's cost.

7. In all cases where alternative methods, materials, procedures or equipment are offered in response to this tender, the Owner shall make the final ruling on their acceptability.

8. During and upon completion of the work, the Contractor shall remove from the premises all surplus materials, equipment and debris.

1.31 ACCESS TO INFORMATION

1. All tenders, quotes and proposals are subject to the Municipal Freedom of Information and Protection of Privacy Act and will be disclosed where the Owner is required to do so for the purposes of complying with an Order of the Information and Privacy Commissioner.

1.32 GENERAL NOTES TO CONTRACTOR

1. The contractor will be required to keep and maintain a set of as-built drawings for each project. These drawings will be used for no other purpose than recording the exact location of buried or covered services and all changes to the contract documents. The as-built drawings will be submitted to the Architect along with guarantees, maintenance data, extra supplies, etc. at the substantial completion of the contract.

2. The contractor will turn over to the Architect at the completion of the contract all projects' close out documents, material, etc. These documents, material, etc. including occupancy permit, will be accepted only with a transmittal and at no other time than when submitting a written request for substantial performance of the contract. For purposes of determining a value of this work it will be considered as **$30,000.**

3. The contractor is not to act on verbal instruction from the Client, Consultants, or Architect on work they consider to be extra to their contract scope. Extra work can only be authorized by the Architect and in a written form only. The written form must also include that this work is an extra to the contract scope, and the method by which extra costs will be tabulated.

4. Ensure the building is maintained weather tight, safe and secure. Furnish all

temporary protection as may be required.

5. Remove and dispose of all resultant debris.

6. Work shall be done in accordance with best standard practice, unless special methods or performance standards are specified or given in writing by the Client. Only skilled mechanics shall be used where such are required to produce a first class job. Where required by code or other by-laws and regulations, trades people shall be licensed in their trades.

7. Use, install and handle manufactured materials in accordance with manufacturer's instructions.

8. Conform to the latest Ontario Building Code, CEC CSA C22, (latest Edition as currently amended) CAN3-B44, and CSA W59.1, where applicable, to the Canadian Code for Construction Safety, as currently amended, and to the Construction Safety Act, Ont. as currently amended, and to all other applicable codes and Building By-Laws hereinafter referred to as Codes; and to the requirements of the authorities having jurisdiction, including public utilities, referred to in the Contract Documents as the authorities.

9. Conform to regulations of Municipality having jurisdiction regarding clean-up of tracking on streets and protection of sidewalks and curbs, and all other applicable laws, By-laws and Regulations.

10. Any work not acceptable to the Architect or Client or local authorities shall be removed and replaced when and as directed by them. The cost of re-executing such work shall be borne by the Contractor.

11. All mechanical maintenance pads and penetrations to be by Mechanical Sections, and all electrical maintenance pads and penetrations to be by Electrical Sections.

12. The contractor shall have internet service on the jobsite for transfer of documents and drawings and shall maintain this service until the date of substantial performance of the contract.

13. The contractor shall maintain access to the buildings and portable buildings on site and shall restrict access to construction areas.

14. The contractor shall provide temporary drainage as required at construction access points to prevent the build-up of dirt and mud and the migration of this onto municipal streets. Periodic cleaning of municipal streets is to be provided when required and whenever specifically requested by the municipality.

PART 2 – <u>PRODUCTS</u> Not Used

PART 3 – <u>EXECUTION</u> Not Used

END OF SECTION

PART 1 GENERAL

1. EXAMINATION

    1. Throughout the project, examine the work of all trades and promptly notify the Architect if any conditions do not or will not comply with the drawings and specifications.

2. SETTING OUT

    1. Lay out work from control benchmarks and indicated verified reference points. The General Contractor shall have a qualified land surveyor, registered to practice in Province of Ontario and approved by Architect, verify accuracy of layout and certify that building foundations and finish grade levels and locations are in accordance with the contract documents. File certification with Building Department and Architect immediately after foundations are completed. Payment for the Land Surveyor will be carried out by the General Contractor not under the Cash Allowance.

    2. The Land Surveyor shall provide four lines and one benchmark for the General Contractor to layout their work to. The General Contractor will provide these layout lines and benchmarks for work on all other areas once they begin work on the site.

    3. Protect and preserve benchmarks and reference points. Inform Consultant immediately if bench marks or reference points are disturbed or damaged by any work and pay for their repair and/or replacement.

    4. Locate and fix grid lines and locations of walls, partitions, shafts and all parts of the construction as work proceeds.

    5. Verify grades, lines, levels and dimensions indicated, particularly with road and sidewalk elevation, and report any errors or inconsistencies to the Architect before commencing work. Confirm job dimensions at once to allow prompt checking of shop and other drawings.

    6. As work progresses, provide and maintain benchmarks at each floor, giving exact elevation of finished floor.

3. PROTECTION

    1. Conform to Ontario Building Code, latest amendments, and The Construction Health and Safety Act, all as currently amended.

    2. Provide spare safety helmets for and enforce their use by Owner, Architect, their representatives and any authorized visitors to site.

    3. Protect excavation, trenches, and buildings from damage by rain, water, ground water, backing up of drains or sewers and other water, frost and all other weather conditions. Do not allow footings or slabs to be placed on frozen ground. Do not permit excavations to reach full depth indicated when freezing temperature may be expected unless footings or slabs can be placed immediately after excavation has been completed. Protect excavations from frost by placing of suitable approved insulating material to adequate depth, if placing of concrete is

delayed and after placing of concrete until backfilling occurs or freezing conditions terminate. Provide necessary pumps (including spare pumps) and temporary drainage for keeping project free of water throughout construction period. Pump water to public sewers or ditches by approved means. Refer to soils report for details. Control grading around excavations to prevent surface water from draining into excavation and from damaging adjoining property.

4. Protect building from movement and damage, especially during filling and compaction and until elements are securely anchored and cannot be damaged or moved by filling or compaction. Obtain approval of authorities having jurisdiction for such work and make changes as required by them.

5. Provide temporary 6'-0" (1800 mm) high chain link fences complete with steel tubular top rail supports and steel posts, with chain link gates and locks, (conforming to Section 02711 Fencing), to enclose construction area, and pavement protection as required for protection of public, and of public and private property and as required by law and by authorities having jurisdiction. Erect sturdy railings around shafts, stair wells and the like to protect workers and public from injury. Equip foregoing protection with warning lights and signs. Alter, remove and relocate or replace hoardings, barriers, and entrances therein as required by authorities having jurisdiction and by the work. Hazards requiring such protection shall be eliminated as soon as possible and protection devices removed. Maintain fences, gates until construction is complete. Keep free from unauthorized signs.

6. Provide and maintain in working order, adequate, temporary Canadian Underwriters labelled, chemical solution (soda acid) Class A.1, fire extinguishers and locate in prominent positions to approval of authorities having jurisdiction.

7. Utilities and Services - Before starting the work contact the Public Utilities for location of underground services.

4. AS BUILT DRAWINGS

1. Maintain as work progresses, accurate records of changes to the Drawings and concealed services. Accurate locations, depth, size, and type of underground utilities shall be included in these as-built drawings. The General Contractor will be supplied with clear prints of the floor plans for making these recordings. As built drawings will be reviewed at each site meeting and must be properly maintained to receive Architect's approval before the monthly certificate draw will be approved.

2. Keep a daily record showing progress of the work and all factors affecting the work, i.e., weather, strikes, accidents, shipping delay, etc.
3. The General Contractor shall also supply as built drawings in AutoCad 2012 (or later) by a professional drafting service. Approval shall be obtained by the Architect for approval of the professional drafting service.

4. Completed as built drawings and instruction and warranty manuals shall be submitted prior to requesting substantial completion.

5. FIELD OFFICE

1. Field Office: General Contractor to provide field office at site for Contractor's

and Consultants' use. Provide janitor service for periodic dusting, cleaning, and removal of rubbish. Include construction and operating hardware, with security locks, as required. Locate office where directed by Architect.

2. Storage Area: General Contractor to provide storage area at site for products and tools. Include construction and operating hardware, with security locks, as required. Separate storage for painter's materials and tools from other storage areas. Locate storage area where directed by Architect and provide security.

6. WASHROOM CONVENIENCES

1. General Contractor to provide washroom facilities as per the Construction Health and Safety Act updated as required for Covid -19. for use of subcontractors and employees. Facilities shall be provided with a screen and contents shall be removed regularly during construction. Maintain it without offense to neighbourhood. At completion of building, washroom facilities and contents shall be removed, and the ground carefully levelled and cleared. Employees on work must avail themselves of this convenience. It shall be to the satisfaction of local Health Authority.

2. Use of permanent toilets is forbidden.

7. TEMPORARY DRAINS

1. Excavations and building site shall be kept free from water at all times by means of trenches to sewers or pits from which it shall be pumped away and disposed from the site.

8. TEMPORARY WATER SERVICE

1. The General Contractor shall provide and pay for all temporary water and connections for water used for construction operations until the building is complete and turned over to the Owner. The Contractor will pay for the supply cost from the local municipality. Water for compaction and watering of sod shall be trucked to the site and paid by for the General Contractor.

9. TEMPORARY TELEPHONE

1. The General Contractor shall provide and pay for a private telephone until their work is complete.

10. TEMPORARY ELECTRICAL SERVICE

1. The General Contractor shall pay all temporary light and power necessary to the operations under this contract, including all connections necessary to supply to the Trade Contractors on site. The Contractor will pay for the cost of electrical power supply from the local P.U.C. utility only.

11. TEMPORARY HEATING

1. Provide temporary heat, heating equipment, and shelter, to keep that work which requires protection from cold, adequately warm and sheltered from elements and to allow it to be done safely and well, maintaining minimum temperature of 16 degrees Celsius (60 degrees F.) when finishing is being done and when building is

closed in, until completion of work. Provide heating for materials affected by cold, both in storage and during construction. Construction requiring heat shall be suitably enclosed.

2. Do not use salamanders. Use temporary heaters of forced warm air type, operated in well-ventilated location and vented to exterior, or radiant panel type. If used in areas of completed building, provide protection on floors and adjacent surfaces to prevent damage to floors and adjacent surfaces, particularly when re-fuelling.

3. Provide temporary heat for interior spaces to maintain a minimum temperature of 16 degrees Celsius (60 degrees F.) throughout the building at all times once the building is enclosed.

12. TEMPORARY USE OF PERMANENT HEATING SYSTEM

1. Permanent heating and ventilation system may be used for temporary heating and ventilation only if the Architect gives their approval to do so in writing, and when piping is complete, all units are connected, all pumps and valves are installed and operating properly, all strainers are installed and permanent or temporary filters are installed, and entire system has been tested and is safe operating condition, and when no further shut-down of system will be necessary for future conditions.

2. Do not use air distribution system until permanent or temporary filters are in place. Filter air distribution system to prevent dirt and dust from entering units via return air. Keep unused ducts sealed to prevent entry of air. Replace or clean filters frequently during construction to minimize entry of dirt. Clean (if cleanable) or replace filters before turning over system to Owner.

3. Put system in charge of fully trained and experienced operator at all times. If required, operators shall be selected jointly by Owner and Contractor with a view to permanent employment by Owner upon completion. Operators shall qualify as set out in Operating Engineers Act, if applicable.

4. Clean, maintain and repair heating and ventilation system as require throughout its use during construction. Notify manufacturer and Architect immediately before turning over new heating equipment to Owner so that heating items may be checked for possible damage during temporary heating period. Make good damage to heating and air distribution equipment. Replace all worn parts and turn over system to Owner in clean, new condition, operating with circulating water properly treated chemically.

5. Permission might be given by the Architect in writing only upon 100% operation completeness of the systems. Neither the Owner nor the Architect are under any obligation to grant permission to use permanent heating system during construction period.

13. TEMPORARY SERVICE ROADS

1. The Contractor work closely with the subdivision developer to shall construct and maintain in good condition, any such temporary service roads & culverts that may be necessary to provide safe, convenient and adequate access for materials, and other supplies at all times while the General Contractor is working on site, all to

the approval of the Architect. NOTE: The Contractor shall protect existing roads, sidewalks, curbs and provide mud mats to the satisfaction of the Local Authorities and the Subdivision developers and replace any that become damaged due to any operations under this contract.

14. STORAGE SHED

1. Provide and erect where directed, weathertight shed of suitable size, with loose plank floor at least 12" off ground for storage of cement and lime. Contractors and subcontractors shall provide their own workshops and storage sheds for entire length of construction. At no time may existing buildings or new additions be used for storage of materials.

15. DELIVERY AND STORAGE OF MATERIALS

1. Arrange for early deliveries necessary for execution of work without delay and have materials on job well in advance of the time it is needed.

2. Deliver, store and handle materials to exclude foreign material and prevent damage, soiling or breakage.

3. Materials to be stored on site, which need to be protected from weather shall be so protected.

4. Packaged materials shall be delivered in packages with manufacturer's seals and all labels intact.

16. BUILDING AND PREMISES

1. Owner reserves right to take over any completed portion prior to specified completion date, provided it does not affect completion of remaining work.

2. If Owner is forced to occupy building or parts thereof prior to completion, but after date of Occupancy or Substantial Performance, Contractor shall not be entitled to indemnity for interference with the performance of the work.

17. OWNERSHIP OF MATERIALS

1. All work or material delivered on the site or premises to form part of the works shall be considered the property of the Owner and shall not be removed without the consent of the Architect, but the Contractor shall have the right to and shall remove the surplus materials after he has completed the work. If so directed by the Architect, such surplus materials shall be removed at any time prior to the completion of the work.

2. All materials which are to be removed from the existing site and are not called for to be re-used or specifically called for in the specifications to be turned over to the Owner, shall become the property of the General Contractor and shall be removed from the site.

18. DETAILS AND MEASUREMENTS

1. Ensure that necessary job dimensions are taken and trades are coordinated for the proper execution of the work. Assume complete responsibility for the

accuracy and completeness of such dimensions, and for co-ordination.

2. Verify that work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the drawings, and ensure that work installed in error is rectified before construction continues.

3. Check and verify dimensions referring to work and interfacing of services. Dimensions, when pertaining to work of other trades, shall be verified with trade concerned.

4. Do not scale directly from the drawings. If there is ambiguity or lack of information, immediately inform the Consultant and await his instructions before proceeding. Be fully responsible for rectifying, altering or redoing any work resulting from disregarding this clause.

5. All details and measurements of any work which is to fit or to conform with work installed shall be taken at the site.

6. Should revised drawings be issued after work has commenced, Contractor shall immediately return to Architect previous drawings which refer to said work. The Contractor will be held responsible for work being carried out in accordance with said revised drawings.

19. WORKMANSHIP

1. Work shall be done in accordance with best standard practice. Only skilled mechanics shall be used where such are required to produce a first class job.

2. Use, install and handle manufactured materials, equipment and appliances in strict accordance with manufacturer's directions and instructions, unless specified otherwise.

20. FROST PROTECTION

1. Provide proper frost protection, including heating for materials to ensure scheduling of work without delay.

2. Similar protection shall be given to work done.

3. Work or materials damaged by frost shall be replaced by Contractor.

4. Snow and ice shall not be allowed to remain on any part of structure, except finished roofs, and shall be removed by Contractor.

21. PROJECT MEETINGS

1. Arrange regular meetings at two-week intervals and notify the representatives of the Owner, Architect, Engineer and each subcontractor concerned with the current progress.

2. Contact all subcontractors concerned at least 24 hours in advance and request their presence at job meeting.

3. Review approved progress schedule for rapid and efficient completion of work according to Contract requirements, with suppliers of materials and sub-contractors.

4. Post and forward copies of progress schedule for advice of interested parties.

5. Record the minutes of each meeting and send copies to all attending and interested parties not later than two days after the meeting. In addition, send copies to the Architect, Consultants and Owner. Contractor to provide updated change order register and shop drawing register attached to each record of minutes to indicate exactly what has been issued and the status of approvals and/or distribution.

6. Keep Architect informed of progress, delays and of potential delays during all stages of work to avoid delays.

22. BROKEN GLASS

1. Replace all broken, damaged or scratched glass and mirrors. Glass which has been broken, scratched or damaged in installation shall be replaced by installer.

23. TREE PROTECTION

1. Protect tops, trunks and roots of existing trees on project site that are to remain. Box, fence or otherwise protect trunks of existing trees which may be subject to construction damage before any work is started. Do not permit heavy equipment or stockpiles within branch spread. When approved, remove interfering branches without injury to trunks and cover scars with tree paint.

2. Wherever excavating is required within branch spread of trees that are to remain, do not cut tree roots, but tunnel or trench under or around roots by careful hand digging and without injury to roots.

24. PROGRESS SCHEDULE

1. Further to GC.2 of the General Conditions of the Contract, carefully prepare full progress schedules of the work in form to be mutually agreed upon by Contractor and Architect.

2. Prepare schedule immediately upon award of Contract and present three (3) copies to the Architect within a maximum of one week from Contract awarding date.

3. Update Project Schedule as directed & whenever the progress of work is not as per the current Schedule and keep the Construction Schedule updated at all times to reflect current conditions.

25. MAINTENANCE MANUALS

1. As soon as possible and in no event later than request for substantial completion check and assemble in three ring binder, all shop drawings, all warranties and guarantees submitted by manufacturers, suppliers and subcontractors and as called for throughout Specifications. Assemble three copies of recommended operation and maintenance procedures (such as flooring, equipment, roofing).

Present three matching binders to Architect for submission to Owner. Furnish a complete index in each binder listing its contents in detail and stamp and sign the cover page of each and every manual. Also ensure that the manuals are stamped and signed on the cover page by subcontractor submitting them. Note: A **$30,000.00** holdback will only be released when all documents approved by the Consultants have been turned over to the Owner. Note this amount is in addition to the values identified in Mechanical/Electrical Sections.

2. Recommended maintenance procedures shall contain warnings concerning the use of maintenance materials or practices which might injure the product covered by the recommended maintenance procedure. Should any product be injured or damaged by faulty maintenance or practices not warned against in the maintenance manual, then the Contractor shall rectify such damage or injury.

3. Complete maintenance manuals shall be submitted prior to requesting release of Holdback.

26. CHECK FLOOR DRAINS

1. Just before acceptance of building by Owner, check floor drains and see that they are clean, clear and functioning properly.

27. FIRE PROTECTION AND ACCESS TO EQUIPMENT AND EXITS

1. Take necessary precautions to eliminate fire hazards and to prevent damage to work, equipment and other property both public and private having to do with the work. Inspect work of this contract at least once a week for this purpose.

2. Provide and maintain in working order suitable Underwriters' labelled fire extinguishers and locate in prominent positions, to approval of authorities.

3. When welding, brazing and performing any operation with an open flame, a portable fire extinguisher shall be kept within 10 feet (3000 mm) of the operator at all times.

4. Store and locate materials and equipment packed in cardboard cartons, wood crates and other combustible containers in orderly and accessible manner. Place approved types of firefighting equipment in vicinity of materials or equipment packed in this type of crate or carton until permanent fire protection and equipment are available.

5. Store all rags and waste containing oil, grease or other flammable materials in an approved metal container and remove from the site at the end of each working day.

6. Only fire resistant tarpaulins are permitted on site.

7. Locate temporary buildings and storage areas in relation to their hazards and probability of damage to existing buildings under construction. Unless constructed of non-combustible materials, wherever possible locate them at least 33 feet (10 m) away from buildings. If constructed of combustible materials separate these structures into small, detached units.

8. Provide and maintain free access at all times from the street to fire hydrants and to

outside connections for standpipes or other fire extinguishing equipment whether permanent or temporary. Do not place material or construction equipment within 10 feet (3 m) of hydrants or connection, nor between them and centre line of the street.

Maintain free access at all times to control valves and hose on fire lines within building and to all portable extinguishers.

9. Install fire doors and put into operating condition at the earliest possible time.

10. Comply with requirements of 01545 Safety Requirements.

28. SAFETY

1. Take all precautions necessary to protect and safeguard workers from dangerous conditions including the recommended Covid -19 precautions as well as protection from fumes; lead paints, etc.; asbestos; and silica hazardous to health.

2. Comply with requirements of 01545 Safety Requirements.

29. ADJACENT BUILDINGs AND PROPERTIES

1. Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger new work or existing property.

2. No existing footings, foundations, pipelines, electrical conduit and wiring shall be undermined or otherwise damaged or endangered by digging, butting of any other operation in the performance of the work of this Contract. Any existing work so affected shall be immediately repaired and made good to the Architect's satisfaction at the Contractor's expense.

3. Active services to the adjacent buildings shall be protected.

4. In case of damage to active services, notify Architect, Utilities and Authorities immediately and make all required repairs under direction of appropriate utility. Carry out repairs during off hours if required.

30. NOTES TO GENERAL CONTRACTOR

1. Ensure that the building is maintained weathertight and secure. The General Contractor shall furnish all temporary protection, enclosures, tarpaulins, etc., as may be required to weatherproof openings in the work.

2. Demolish and clean up all existing trees, scrub and debris and any other items found on the site not indicated to remain.

3. The General Contractor shall carry out all removal and disposal of all resultant debris.

4. In case of damage to active services, notify Architect, Utilities and authorities immediately and make all required repairs under direction of appropriate utility. Carry out repairs during off hours if required. In absence of specific requirements or direction, plug or cap unused or abandoned utility lines at least 3 feet (1000 mm) outside of new building walls, or as required by utilities, codes and

authorities.

5. The location of construction shacks and trailers to be approved by the Architect and Owner.

6. Take all precautions necessary to protect and safeguard workers from dangerous conditions including fumes, lead and silica products that may be present during the construction that are hazardous to health.

7. Restore disturbed areas to original condition unless shown otherwise on drawings or stated in specifications.

31. CONSTRUCTION PARKING

1. Parking will be permitted on site provided it does not disrupt the performance of Work.

32. PROTECTION FOR OFF-SITE & PUBLIC PROPERTY

1. Protect surrounding private and public property from damage during performance of work.

2. Be responsible for damage incurred.

33. SIGN AND ADVERTISEMENTS

1. Construction sign to be supplied and installed by Contractor. Locate as directed by Architect. All costs for the installation of the sign to be included in Base Tender Sum (not part of Signage Allowance). The Board to approve sign layout prior to sign production.

2. Erect no other signs, except those signs which are necessary to give direction or for safety, or warning signs, without the Architect's permission. Where other signs are required or wanted, obtain Architect's approval.

34. PROTECTION OF BUILDING FINISHES & EQUIPMENT

1. Provide protection for finished and partially finished building finishes and equipment during performance of work.

2. Provide necessary screens, covers, hoardings as required.

3. Be responsible for damage incurred due to lack of or improper protection. Replace or repair finishes or equipment so damaged.

35. SECURITY

1. When work at site has progressed as to become attractive for vandalism or theft, engage a recognized security guard agency to provide security service at times when tradesmen are not present in substantial numbers. Continue service until after time of Substantial Performance and the Owner has occupied the building.

2. Extent of security services shall be at the discretion of the Contractor. Note that the fit, finish and new appearance of the finished building will not be comprised.

Materials, products, finishes, etc. damaged due to vandalism are to be restored and/or replaced to an as-new condition.

PART 2 – PRODUCTS Not Used

PART 3 – EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

1. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard, warranties on products; special warranties; and comparable products.

2. Related Requirements:

    1. Section 01500 – Substitutions (for requests for substitutions).

1.3 DEFINITIONS

1. **Products**: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

2. **Named Products**: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

3. **New Products**: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

4. **Comparable Product:** Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

5. **Basis-of-Design Product Specification**: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities

related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

6. **Subject to Compliance with Requirements:** Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. Submit a comparable product request, if applicable.

7. As per Provincial Trade Restriction Policy, All Products must be sourced from Canadian Manufacturers unless such products are unavailable or would severely impact the project schedule. Refer to the General Requirements section for additional information.

1.4 REFERENCE STANDARDS

1. The Standards listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

2. Aluminum Association (AA)

    1. AA ADM (2010) Aluminum Design Manual

    2. AA ASM-35 (2000) Specifications for Aluminum Sheet Metal Work in Building Construction Manual Series Section 5

    3. AA DAF-45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

    4. AA PK-1 (2009) Pink Sheets: Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings & Ingot

3. American National Standards Institute (ANSI)

    1. ANSI H35.1/H35.1M – Standard Specification for Aluminum-Alloy 6061-T6

4. American Standard for Testing and Materials (ASTM)

    1. ASTM A653/A653M-18: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

    2. ASTM B221M-14: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire Profiles and Tubes

3. ASTM B308/B308M-10: Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
4. ASTM B361-16: Standard Specification for Factory-Made Wrought Aluminum and Aluminum-Alloy Welding Fittings.

5. Canadian Standards Association

1. SA Standard CAN3-S157-M83: Strength Design in Aluminum.

2. CSA Standard S190-1969: Design of Light Gauge Aluminum Products.

3. CSA Standard S244-1969 "Welded Aluminum Design and Workmanship".

1.5 ACTION SUBMITTALS

1. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

1. Form of Architect's Approval of Submittal: As specified in Section 01300 – Submittals.

2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

3. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01300 submittals. Show compliance with requirements.

1.6 QUALITY ASSURANCE

1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

2. Delivery and Handling:

    1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

    2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

    3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

    4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

3. STORAGE:

    1. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

    2. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

    3. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

    4. Protect stored products from damage and liquids from freezing.

    5. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.8 PRODUCT WARRANTIES

1. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

2. **Manufacturer's Warranty**: Written warranty furnished by individual manufacturer for a product and specifically endorsed by manufacturer to Owner.

3. **Special Warranty**: Written warranty required by the Contract Documents to provide specific rights for Owner.

4. **Special Warranties**: Prepare a written document that contains appropriate terms and identification, ready for execution.

    1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

    2. See other Sections for specific content requirements and requirements for submitting special warranties.

    3. Submittal Time: Comply with requirements in Section 0700 – Contract Closeout.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

1. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

    1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

    2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

    3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.

    4. Where products are accompanied by the term "as selected," Architect will make selection.

    5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

    6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    7. Submit additional documentation required by Architect through

Construction Manager in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect; whose determination is final.

2. Product Selection Procedures:

    1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

        1. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"

    2. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

        1. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"

    3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

        1. For approval of products by unnamed manufacturers, comply with requirements in Section 01500 - Substitutions for convenience.

2.2 COMPARABLE PRODUCTS

1. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied.

2. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

    1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents,

will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.

2. Evidence that proposed product provides specified warranty.

3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

4. Samples, if requested.

3. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

2.3 METAL

1. Where a product is named in the Specifications by one of the following names or by any name followed by the number of one of the following articles, the product shall conform to the standard named in the corresponding article, except as specified or indicated otherwise.

2. Aluminum (A1)

1. Bar, rod, wire, extruded shapes; architectural: CSA HA. Series (AA/AnS1 6063) (Alcan 50S) condition T5.

2. Bar, rod, wire, extruded shapes; Structural: CSA HA Series (AA/ANS1 6061) (Alcan 65S) Condition T6.

3. Plate, sheet, coil; utility: CSA HA Series Alloy MC10, (AA/ANS1 3003) (Alcan D3S); condition H14 (sheet, coil), F (plate).

4. Plate, sheet, coil; anodizing: CSA HA Series Alloy 990C, (AA/ANS1 1100) (Alcan D2S); condition H14.

5. Specially anodized aluminum (hard anodized): (AA-M21 or M12C22A42) conform to Finishes, Aluminum, Hard Anodized (FA.HA) attached to Section 01016.

6. Painted aluminum: conform to Finishes, Aluminum, Baked on Coatings FABC attached to Section 01016.

7. Anodized Aluminum: AA-M21 or M12C22A31.

8. Aluminum for elevated floor plates: (Bruce EDP) US Fed. Spec.QQ-

A-591c, Ty A380 (mil-HDBK-H1C code 20087).

9. Aluminum sand casting: (signs, etc.) AA 443.0.

3. Sheet Gauges

1. Gauges and equivalent thicknesses of sheet, plate, coil and strip shall conform to the table of gauges and equivalent thicknesses (GET) attached to Section 01016. See 1.3.4 and 1.3.6 special application of gauges to structural sheet.

4. Galvanized Sheet Steel

1. ASTM A525 and 526, commercial quality sheets, plain commercial galvanized, stretcher levelled, or temper rolled to stretcher levelled standard of flatness if specified.

2. Same as 1.3.1 except wipe coated instead of plain commercial galvanized.

3. Same as 1.3.1 except mill phosphatized instead of plain commercial.

4. ASTM A446 structural quality, Grades A or B, max. permissible working stress: Grade A, 20,000 psi; Grade B, 22,400 psi. plain commercial galvanized. Gauges shall apply to core sheet and shall be msg. Coating thickness shall be added to core thickness to determine thickness of coated sheet (see 1.2 .1).

5. Same as 1.3.4 except wiped coated instead of plain commercial, with a coating not less than .050 oz. per sq. ft. (see 1.1.4).

6. Same as 1.3.4 except wiped coated instead of plain commercial galvanized (see 1.2.1).

7. Preparation for painting, in ship, ASTM D2092-68.

5. Copper Metals

1. Nickel Silver (white bronze): Anaconda American Brass Alloy 796 (leaded nickel silver) (has higher zinc content than any of the nickel silvers in ASTM B122-71a):

Copper	45%
Zinc	42%
Nickel	10%
Lead	1%
Manganese	2%

2. Sheet copper and strip copper for roofing, flashing and building construction: ASTM B370, cold rolled temper, 16 oz. or as specified otherwise.

3. Monel: (nickel 63-70%, approx. 5% other metals, remainder copper) plate, sheet, strip, hot rolled, annealed and pickled, AST B127; (Inco Monel 400).

4. All applicable copper metals: ASTM B248.

5. Architectural Bronze (Red Brass), ASTM B36, No. 3 (85% CU + 15% NI).

6. Stainless Steel

1. Plate, sheet and strip; CSA G110.6-1968, Type 302 or 304 as specified, or as specified otherwise; finish: No. 4 unless specified otherwise.

2. Structural shapes and bars, CSA G110, 4-1968, Type 302, 304 or 316 as specified; No. 4 finish unless specified otherwise.

7. Sheet Steel

1. Sheets, cold-rolled carbon steel, commercial quality, ASTM A366 stretcher levelled or temper rolled to stretcher levelled standard of flatness if specified.

2. Porcelain enamelling steel, ASTM A424, Commercial Quality, Type 1 or 2.

1. Same as 1.6.1 except special quality for electro deposited coatings.

2. Same as 1.3.4. except un-galvanized.

3. Hot-rolled, carbon steel sheets and strip, structural quality ASTM A570-70, 5 grades (stair treads, risers, etc.).

4. Hot-rolled carbon steel sheet and strip, commercial quality ASTM A569-66T.

5. Prepainted:

1. CSSB1 Technical Bulletin No. 5, as currently amended (modified silicone alkyd, 2000).

2. CSSB1 Technical Bulletin No. 5, as currently amended, except humidity resistance 5000 hours; salt spray resistance 400 hours; resistance to accelerated weathering 2500 hours (fluoropolymer, 10,000).

3. CSSB1 Technical Bulletin No. 5, as currently amended, except

humidity resistance 3000 hours (silicone alkyd, 5000).

2. Sheet Steel (Cold Rolled)/Structural Steel (Hot Rolled)

    1. When steel thickness is indicated by gauge or by decimal fractions of inches, it is sheet steel (1.6) or galvanized sheet steel (1.3) or stainless steel (1.5). When steel thickness is indicated by common fractions of inches, it is structural steel (1.8). However, some sheet steels are structural quality, (i.e. having guaranteed strength).

3. Structural Steel

    1. CAN/CSA G40.21-M87, 38W or 44.

4. Soldering Materials

    1. Solder: Solder for Div. 15 to conform to Div. 15 specifications. Under no circumstances shall any lead containing solder be used on any potable water piping systems throughout the project.

    2. Flux: on stainless steel:

        1. Muriatic acid killed by the addition of zinc until all effervescence stops and no excess of zinc remains; improved by the addition of a small amount of ammonium chloride, plus 10% acetic acid; or

        2. muriatic acid: ferric chloride: nitric acid 90:50:3, by weight; or

        3. Approved commercial flux designed especially for use with stainless steel, such as EutecSol 682, or approved equal.

    3. Flux: on copper and galvanized steel:

        1. killed muriatic acid as specified in 1.9 b.1; or

        2. suitable rosin type.

5. Galvanizing

    1. All steel except (1.3), CSA G164 Hot Dip Galvanizing of irregular Shaped Articles. Must be done after all welding complete. No welding of galvanized products allowed.

6. Welding Materials

    1. CSA W59, CSA W 55.2; for stainless steel, ASTM A371; for aluminum, ASTM B285.

7. Metal Filler

    1. Epoxy: Hysol 6C epoxy adhesive kit (or 4297 in bulk) manufactured by Hysol

(Canada) Limited or approved equal.

8. Plating (Electrodeposited Coatings)

1. Cadmium (on steel): ASTM A165, Type NS (13 mu), OS (7.6 mu), TS (3.8 mu).

2. *Chrome (on steel):* ASTM B.456, Fe Ni20b Cr r unless specified otherwise, bright unless dull specified.

3. Chrome (on copper and copper-base alloys): ASTM B456, Type FC unless KC or QC specified; bright unless dull specified. (In this case FC is thick and QC is thin.)

4. Weight of zinc coating and thickness to be added to base metal to determine thickness of coated material.

(Source: ASTM A-446, Tables 2 and 4)

Coating Class oz. Per sq. ft.	Triple-Spot Test, Minimum Check Limited oz. per sq. ft.	Thickness in
2.75	2.35	0.0041
2.5	2.1	0.0037
2.25	1.85	0.0033
2	1.65	0.003
1.75	1.4	0.0026
1.5	1.15	0.0022
1.25 commercial	0.9	0.0019
Wipe Coated (Colourbond or Satin coat in Canada only)	0.25	0.0005

NOTE: Light Commercial not available in Canada.

1. Paint

1. Shop primer on steel: CAN/CGSB 1-GP-40d.

2. Bituminous paint: CAN/CGSB 1-GP-108c.

3. Baked enamel on steel: primer, CA/CGSB 1-GP-81e, Type 2; finish CANCGSB 1-GP-88e, baking alkyd enamel.

4. Baked enamel on aluminum: FA.BTAE, attached to Section 01016.

END OF SECTION

PART 1 GENERAL

1.1 CONTINGENCY ALLOWANCE

1. Include the following Contingency Allowance not including HST in the Contract Price. Said Contingency Allowance shall be expended in whole or in part when authorized in writing by the Architect. Changes designated as Contingencies by the Architect, shall be paid for out of the Allowance and the Contract Sum shall not be adjusted until the accumulated value of changes so designated, exceeds the Allowance or until the completion of the work. Should the accumulated value of Contingencies be less than the Allowances on completion of the work, the Contract Sum shall be reduced by the difference between the value of the Contingencies and the Allowances. Should the total value of the Contingencies exceed the Allowance, the Contract sum shall be increased by the excess of the value over the Allowance.

2. The Contractor shall not include in his Contract Sum for overhead and profit. Such fees shall be included by the Contractor at the time any work is authorized.

3. **Contingency Allowance** (Amount to be included in the Contract Price):

1. **$500,000 + HST** (note this is in addition to the cash allowances listed below)

2.1 CASH ALLOWANCES

1. Comply with requirements of G.C. 4.1 Cash Allowances.

2. Include the following Cash Allowances in the Contract Price. These allowances shall be expended in whole or in part, when authorized by the Architect in writing. The unused portion of the Allowances shall be credited to the Owner.

3. The Contract Price and not the cash allowance, includes the Contractor's overhead and profit in connection with such cash allowance.

   No refund of overhead and profit will be expected on any unspent portion of Cash Allowances. Likewise, no overhead and profit will be allowed on total amount by which all Cash Allowances are exceeded.

4. Expend cash allowance as directed by the Consultant in writing. Allowance will be adjusted to actual cost, but no adjustment will be made to Contractor's charges including overhead and profit which are included in the Contract Price.

5. Cash allowances are designed for work and services deemed to be necessary by the Owner, from time to time, throughout the execution of the Work. Where a cash allowance refers to an item or category of work already included in the Contract Documents, it shall be assumed to cover work or services in addition to that included, unless specifically indicated otherwise.

6. Contractor may be required from time to time, to assist in tendering of certain items of work or services covered by allowance, as directed by Consultant.

7. Material Supply Items:

    1. Scope for material supply items covered by Cash Allowance includes:

        1. Net cost of material.

        2. Applicable taxes and duties.

        3. Delivery to site.

    2. In addition to above scope covered by Cash Allowance, include in Contract Price costs for:

        1. Handling at site, including unloading, uncrating, storage and hoisting.

        2. Protection from elements, from damage.

        3. Labour, installation, and finishing.

        4. Other expenses required to do cash allowance work (i.e., contract co-ordination).

        5. Overhead and Profit.

8. Material and Installation Items:

    1. Scope of each material and installation item covered by Cash Allowance includes:

        1. Net cost of material.

        2. Applicable taxes and duties.

        3. Delivery to site.

        4. Handling at site, including unloading, uncrating, storage and hoisting.

        5. Labour, installation, and finishing.

    2. In addition to above scope covered by Cash Allowance include in Contract Price costs for:

        1. Protection from elements, from damage.

        2. Overhead and Profit.

        3. Other expenses required to do cash allowance work (i.e., contract co-ordination).

9. Inspection and Testing Work:

    1. Scope for inspecting and testing covered by Cash Allowance includes:

        1. Net cost of testing laboratory services and field inspection.

        2. In addition to above scope covered by Cash Allowance include in Contract Prices for:

            1. Overhead and Profit.
            2. Supply of material tested, patching and completion of work tested.
            3. Other testing on re-testing work specified in Section 01400.
            4. Other expenses required to do cash allowance work (i.e., contract co-ordination)

10. The following is a breakdown of the Cash Allowance Items **to be included** in the Contract Price:

1.	**Inspection and Testing** • testing of topsoil • testing of compacted fill • other soils compaction testing • concrete testing • structural steel inspection/testing • mortar testing • asphalt testing • building envelope - air barrier • waterproofing • sprayed fireproofing • Civil inspections and testing as per Municipal requirements beyond general review	
2.	**Gas Service Connection** • local utility charges related to gas service & meter	
3.	**Unit Masonry** • supply of Date Stone	
4.	**Roof Inspection**	
5.	**Miscellaneous Millwork and Shelving** • additional units not shown on drawing	
6.	**Hardware** • door hardware (excluding cabinet hardware which is included in Section 06400 • Locksets at tall cabinets to be included in this cash allowance is for supply of hardware only. Installation is included in Contract.	
7.	**Exterior Signs** • Supply and install signage indicated on the drawings is included I bid amount.	

	• Supply and install of power and data conduit to pylon sign location is included in bid amount. • This allowance is for the concrete base and sign box.	
8.	**Interior Signage** (supply and install) • major and minor signage • door signage • bulkhead signage • translucent vision strips	
9.	**Communications** • Supply and installation of voice/data network for the school, excluding the Day Care area. • Supply and installation of public address system for the School and Day Care. • Testing, certification, and documentation of voice/data and public address systems.	
10	**Public Address System** • Supply and installation of public address system for the school, including the Day Care area. • Supply and installation of a gymnasium sound and Audio/Visual System	
11.	**Security System** • Supply and installation of entry door intercom system for the school, including the Day Care area. • Supply and installation of an intrusion detection system. • Supply and installation of a access control system. • Supply and installation of a ULC Monitoring System for fire alarm control panel. • Supply and installation of a Closed Circuit Television system.	
SUMMARY OF CASH ALLOWANCES		**$714,000 + HST**

This total amount is to be included in the Base Bid Amount along with the Contingency Allowance noted above.

11. Progress payments on accounts of work authorized under cash allowances shall be included in the Consultant's monthly certificate for payment. Copies of invoices are to be submitted to substantiate claims.

END OF SECTION

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

1. Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

1. General Requirements - Section 01010
2. General Work - Section 01015
3. Individual Sections - Cutting and patching incidental work of the section. Advance notification to other sections required.

1.3 SUBMITTALS

1. Submit written request in advance of cutting or alteration which affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather-exposed or moisture-resistant elements.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight-exposed elements.
    5. Work of the Owner or separate contractor.
2. Include in request:
    1. Identification of Project.
    2. Location and description of affected work.
    3. Statement on necessity for cutting or alteration.
    4. Description of proposed work, and products to be used.
    5. Alternatives to cutting and patching.
    6. Effect on work of the Owner or separate contractor.
    7. Written permission of affected separate contractor.
    8. Date and time work will be executed.

1.4 GENERAL

1. Execute cutting, fitting, and patching including excavation and fill, to complete the Work.
2. Fit the several parts together, to integrate with other work.
3. Uncover work to install ill-timed work.

4. Remove and replace defective and non-conforming work.

5. Remove samples of installed work for testing if requested by Consultant.

6. Provide openings in non-structural elements of Work for penetrations of mechanical and electrical work.

1.5 INSPECTION

1. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

2. After uncovering, inspect conditions affecting performance of work.

3. Beginning of cutting or patching means acceptance of existing conditions.

1.6 PREPARATION

1. Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of project from damage.

2. Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.7 PERFORMANCE

1. Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

2. Use material to match existing.

3. For a change in material submit request for substitution under provisions of Section 01500 – Substitutions.

4. Employ qualified trade contractor to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight exposed surfaces.

5. Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed without prior approval.

6. Restore work with new products in accordance with requirements of Contract Documents.

7. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

8. Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

1. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

2. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

    1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

    2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

1.2 SUBMITTAL PROCEDURE

1. Provide submittals electronically in Portable Document Format (PDF) as per Architect's Contract Administration System Software 01805, in accordance with GC's of CCDC Document 2, 2020 and as revised in the Supplementary General Conditions, as required in various sections of these specifications and on the drawings.

2. Submissions must be clear, to scale, complete, specific and correctly transmitted.

3. Submittals are to be numbered in the sequence which they are submitted. Submittal numbering to be as follows 001, 002, 003 etc.

4. Processing: To avoid the need to delay installation as a result of the time required to process submittals such as samples and shop drawings , allow enough time for submittal review, including time for resubmittals.

    1. Allow Consultant five (5) working days to respond to Request for Information (RFI).

    2. Allow ten (10) days for initial review of shop drawings and samples. Allow additional time if the Consultant must delay processing to permit coordination with subsequent submittals.

    3. The Consultant will return to the Contractor indicating that, the items been:

        1. Reviewed (no re-submittal required).

        2. Reviewed as indicated (no submittal required).

        3. Revise and resubmit (re-submittal required).

4. Review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Subcontractor, and such review shall not relieve the Subcontractor of his responsibility for errors / omissions in the shop drawings or of his Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the processes or techniques of construction and installation and for co-ordination of all sub-trades.

5. The Contractor will advise all Trades, Subcontractors and suppliers of the limits of the Consultant's responsibility with respect to Shop Drawings and other submittals.

6. If an intermediate submittal is necessary, process the same as the initial submittal.

7. No extension of contract time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing

1.3 SHOP DRAWINGS

2. Review submittals prior to submission. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated by the General Contractor and identified as to specific project will be returned without being examined and considered rejected.

3. Notify, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

4. Verify field measurements and affected adjacent work are coordinated.

5. Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

6. Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

7. Keep one reviewed copy of each submission on site.

8. Submit Shop Drawings as per following list:

LIST SHOP DRAWINGS

Section	Title
02711	Chain Link Fence
03200	Concrete Reinforcement
03400	Precast Hollow Core Floor Slabs
03481	Precast Concrete Stairs
04200	Unit Masonry
05120	Structural Steel
05300	Steel Deck
05500	Miscellaneous Metals
06200	Finish Carpentry
06400	Architectural Woodwork
06650	Solid Surface Fabrications
07214	Sprayed Foam Insulation & Air Barrier
07250	Fireproofing
07270	Firestopping
07461	Aluminum Architectural Composite Panel System
07465	Preformed Metal Cladding
08110	Hollow Metal Doors, Frames and Screens
08200	Wood Doors
08400	Aluminum Entrances & Doors
08800	Glass and Glazing
08900	Aluminum Curtain Wall
09250	Gypsum Wallboard
09300	Porcelain & Ceramic Tile
09624	Sports Flooring
10100	Whiteboards and Tackboards
10160	Metal Toilet Compartments
10500	Lockers
10650	Folding Partitions
10800	Washroom Accessories
10955	Classroom Control Panels
11170	Coat Racks
11500	Athletic Equipment

11510	Gym Curtain
12522	Manual & Electrical Rolling Shades
14201	Barrier Free Lift

Mechanical Items: Refer to Mechanical Specifications

Electrical Items: Refer to Electrical Specifications

1.4 SAMPLES

1. Submit samples as listed in List of Samples below.

2. Samples of materials, both manufactured and otherwise, proposed for the use on the work shall be submitted to the Architect for approval as required by the Contract Document and/or reasonably required by the Architect. The work shall be in accordance with approved samples. All samples shall be supplied and delivered to the Architect free of charge. The approval of samples shall not be construed as an acceptance of work subsequently carried out.

3. Samples shall be labelled indicating date of submission, name of project, names of contractor and manufacturer, and complete identification of locations at which materials are to be installed.

LIST OF SAMPLES

Section	Title
31 00 00.01 & 31 23 33.01	Granular "A" and "B"
31 05 13	Topsoil Testing
32 12 16.01	Paving
02710	Fences and Gates
32 92 23	Sodding
32 93 10	Plant Material
03300	Vapour Barriers
04100	Mortar
04200	Unit Masonry
06100	Rough Carpentry
06200	Finish Carpentry
06400	Architectural Woodwork
07190	Vapour Barrier
07195	Air/Vapour Barrier System
07211	Rigid Insulation

07214	Sprayed Foam Insulation & Air Barrier
07215	Sprayed-On Insulation
07250	Fireproofing
07270	Firestopping and Smoke Seals
07461	Aluminum Architectural Panel System
07465	Prefinished Metal Siding
07520	Modified Bitumen Membrane Roofing
07550	Flashing and Sheet Metal, Roof Components
07900	Caulking and Sealants
08400	Aluminum Entrances
08800	Glass & Glazing
09300	Porcelain & Ceramic Tile
09500	Acoustical Treatment
09624	Resilient Athletic Flooring
09800	Special Coatings
09900	Painting and Finishing
10100	Whiteboards and Tackboards
10800	Washroom Accessories

1.5 EXTENDED WARRANTIES

1. In addition to the warranty requirements of GC 12.3 of CCDC Document 2, 2020, and as revised in the Supplementary General Conditions, the Contractor shall note that the following extended warranty periods are required by the Contract Documents for the individual items under respective Sections.

LIST OT WARRANTIES

Section	Title
32 16 15	Concrete Walks and Curbs - 2 years
32 12 16.01	Asphalt Paving - 2 years
02731	Artificial Turf Grass – 10 years
06200	Finish Carpentry - 2 years
06400	Architectural Woodwork - 5 years
07195	Air/Vapour Barrier - 5 years
07214	Sprayed-On Insulation Air Barrier - 10 years
07461	Aluminum Arch Composite Panel Systems – 5 years
07465	Preformed Metal Siding – 5 years

07513	Built-Up Asphalt Roofing
	Installation and Sheet Metal – 2 years 25 years from Roofing Manufacturer
07900	Caulking and Sealants - 5 years
08400	Aluminum Windows Entrance Framing & Doors - 5 years; Glass - 10 years
08800	Glass & Glazing - 5 years
08900	Aluminum Curtain Wall – 5 years, Glass – 10 Years
09624	Sports Flooring – 5 years
09800	Special Wall Coatings - 3 years
10100	Whiteboard and Tackboards - 2 years
Division 21,22,23,25	Refer to Mechanical Sections
Division 26,27,28	Refer to Electrical Sections

1.6 MAINTENANCE MANUALS

LIST OF MAINTENANCE MANUALS

Section	Title
04100	Mortar (colour formulae)
06400	Architectural Woodwork
08700	Finishing Hardware
09300	Porcelain & Ceramic Tile
09624	Sports Athletic Flooring
09800	Special Coatings
09900	Painting
10100	Tackboards and Whiteboards
10950	Manufactured Specialties
14202	LULA Lift
Division 21,22,23,25	Refer to Mechanical Sections
Division 26,27,28	Refer to Electrical Sections

1.7 EXTRA MATERIAL

1. Submit extra material as specified in the following Sections:

Section	Title
04200	Unit Masonry - See Section 04200
09300	Porcelain & Ceramic Tile - 2% of total area of each
	colour and type
09500	Acoustical Tile - 1% of each type
09650	Resilient Flooring - 2% of total of each colours
09900	Painting - See Section
Division 21,22,23,25	All items indicated in these sections
Division 26,27,28	All items indicated in these sections

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

CERTIFICATE OF PAYMENT APPLICATION FORM

NOTE: HST TO BE INCLUDED IN EACH OF THE FOLLOWING VALUES:

Contractor: _____ Application No. _____

Work: _____ Date: _____

Period Covered: _____

Description	Contract Amount	% To Date	Value Performed To Date	Value Previously Performed	Value Current Period	Balance to Complete
This Section to show breakdown of Contract such details as:						
General Conditions	$	$	$		$	$
Excavation						
Concrete Footings						
Concrete Walls, Cash Allowances, Hardware, etc.						
SUB-TOTAL						
Change Orders No. 1 No. 2 No. 3						
TOTAL CONTRACT						

SUMMARY (HST to be included in all items)

Value of Work Completed to date $ _____

Less Holdback of 10% $ _____

Holdback Released $ _____

Current Holdback (Net Retained) $ _____

Sub-Total $ _____

Less Previous Certificates $ _____

Amount of this Claim $ _____

Total of H.S.T. included above ($ _____)

GENERAL CONTRACTOR'S H.S.T. NO. _____

End of Section

PART 1 GENERAL

1.1 DESCRIPTION

1. See Individual Specifications Sections for full listing of inspections and approvals.

2. Architect, consultant or testing inspector's approvals required:

    1. Consultant's approval before interfering with existing services and apparatus. One week notice to be given. Section 01010.

    2. Architect's approval before installing flooring - 01010.

    3. Architect's approval of work schedule (Progress Schedule) - 01310.

    4. Architect's approval of construction signs and locations - 01015.

    5. Architect's approval of temporary fence and layout - 01015.

    6. Architect's and Consultant's approval of substitutions - 01500.

    7. Architect's approval of topsoil stockpile locations - 02215.

    8. Consultant's approval of footing bearing soil compaction - 02200.

    9. Consultant's approval of compaction - 02200.

    10. Consultant's approval of weeping drains and subdrains - 02550.

    11. Architect's and Consultant's approval of cast-in-place concrete materials, sandblasting, tint, admixtures and tests - 03300.

    12. Architect's approval of Masonry Sample Wall - 04200.

    13. Architect's approval of waterproofing - 07110 and 07120

    14. Architect's approval of caulking joint samples - 07900.

    15. Architect's approval of sealant samples - 07900.

3. Notify Architect:

    1. Notify Architect and Roof Consultant 7 days in advance before commencing roofing - 07510.

    2. Notify Architect for Deficiency Inspection upon agreed Substantial Completion.

    3. Notify Architect for One-Year Holdback Inspection.

4. Notify Client for Two-Year Roofing Inspection for Extended Warranties

5. Notify Client for Two Year Inspection of Extended Warranties

6. Notify Client for Three Year Inspection of Extended Warranties.

7. Notify Client for Five Year Inspection for Extended Warranties.

8. Notify Client for Ten Year Inspection for Extended Warranties.

4. Submit samples for approval.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 PROGRESS PHOTOGRAPHS

1. Take total of eight (8) colour photographs once a week where directed. Provide two (2) 200mm x 250mm (8" x 10") prints of each photograph. On reverse side of each photograph, state date on which photograph was taken, and view which photograph shows, together with Project and Contractor's name. Submit photographs with each monthly draw request to the Architect.

2. Record progress photographs digitally and submit one recordable CD containing all digital images recorded every month in JPEG file format compatible for playback on PC.

1.2 PROFESSIONAL PHOTOGRAPHS

1. Prior to the Release of Deficiency Holdback, the General Contractor shall arrange for a professional photographer to provide 20 photographs in both raw format as well as in digital high resolution TIFF and JPEG format (min. 10MP) to the Client and the Architect.

2. Photographs must be taken by one of the Professional Photographers listed below:

   - Stan Switalski (519-740-9828)
   - Mario Madau (416-262-1200)
   - Studio Shai Gil Inc. (416-916-1840)

3. For substitution to use an alternate accredited photographer, submit a written request for approval to be received by the Architect at least ten (10) days prior to tender closing. The request shall include the proposed alternate accredited photographer's sample photographs of similar buildings and a list of similar buildings and clients.

4. Professional exterior photographs are to be taken from May 15 to October 15 when the ground is not snow covered and leaves are on the deciduous trees.

PART 2 – PRODUCTS Not Used

PART 3 – EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 CONSTRUCTION SIGNAGE AND ADVERTISEMENTS

1. Construction sign to be supplied and installed by Contractor as detailed on the drawings. Locate as directed by Architect. All costs for the installation of the sign to be included in Base Tender Sum (not part of Signage Allowance). The Owner and Architect to approve sign layout prior to sign production.

2. Erect no other signs, except those signs which are necessary to give direction or for safety, or warning signs, without the Architect's permission. Where other signs are required or wanted, obtain Architect's approval.

1.2 EXTERIOR SIGNAGE

1. Pin mounted painted aluminium letters to be as indicated on the Exterior Elevation drawings. Font & Colour to be selected by Architect.

2. Illuminated Ground sign to be by cash allowance. Concrete base to be included in contract unless noted other wise on the drawings

1.3 INTERIOR SIGNAGE

1. Refer to the A12.1 drawings for description and locations of interior signage

PART 2 – PRODUCTS Not Used

PART 3 – EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

1. Before commencing any work, the Construction Manager, along with their trade contractors, are to prepare working / interference drawings, to ensure that all components are to be properly accommodated within the spaces provided, ensuring all clearances required by jurisdictional authorities and for proper maintenance are indicated and maintained.

2. Schedule meetings on site with all associated trades to review all interference areas until all issues have been coordinated and required interference drawings issued.

3. Prepare drawings to indicate coordination and method of installation of a mechanical system with sprinkler, electrical, structural and other systems where their relationship is critical. Ensure all details of equipment, apparatus and connections are coordinated.

4. The Construction Manager shall provide interference drawings prepared by their Mechanical, Sprinkler and Electrical subtrades. Drawings are to be red-line markups scanned to PDF Format and shall indicate any perceived interference between mechanical, sprinkler, structural, and electrical work and the work of all other Divisions along with proposed solution to such interference.

5. Failure to coordinate with all other trades could result in reworking of installed equipment, piping or ducting at the discretion of the Consultant. Any reworking to accommodate the installation of other trades is to be performed at no extra cost.

6. All interference drawings shall be submitted and approved prior to the second Certificate of Payment being released.

1.2 COOPERATION AND COORDINATION

1. Cooperate and coordinate with other trades as required, for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to, or inserted in work, and set in place or instruct related trades as to their location. Pay cost of extra work caused by and make up time lost, as a result of failure to provide inadequate time, the necessary cooperative information of items to be fixed to, or built in.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

1. This section details Construction Manager's responsibilities in preparation, submission and maintenance of construction schedules with form and requirements for periodic revisions. The Sub-Contractors shall provide the Construction Manager with their schedule of work and co-ordinate the work with Construction Manager and the Work Progress of other trades on site.

1.2 REQUIREMENTS INCLUDE

1. Schedule, form, content.

    1. Stages/Phased Construction.

    2. Schedule Revisions.

    3. Weekly schedule updating.

1.3 SCHEDULES REQUIRED

1. Submit the following schedules:

    1. Construction Progress Schedule.

    2. Weekly Schedule and Manpower Loading.

    3. Submittal Schedule for Shop Drawings and Product Data and Shades.

    4. Product Delivery Schedule. Include required decision dates for finishes and colours.

    5. Sub-schedule showing submittals, review times, procurement schedules, and delivery dates.

    6. Sub-schedules to define critical portions of overall schedule.

1.4 FORMS OF SCHEDULES

1. Prepare schedules in form of horizontal bar chart (GANTT, or C.P.M. network). Provide separate horizontal bar column for each trade or operation, or separate activity for each operation that can be completed independently of other operations or trades. Provide as follows:

    1. Order: Chronological order of beginning of each item of work.

        1. Identification: Identify each column by distinct graphic delineation.
        2. Horizontal Time Scale: Identify first workday of each week.

        3. Scale and Spacing: To allow space for updating.

        4. Minimum Sheet Size: 11" x 17" for electronic submission.

1.5 SUBMITTALS SCHEDULE

1. Include schedule for submitting shop drawings, product data, and samples. Co-ordinate with section 01300 requirements. Incorporate into Preliminary Progress Schedule and Weekly Schedule updates.

2. Indicate dates for submitting, review time, resubmission time, float time, and last date for meeting fabrication schedule.

3. Include dates when SUBMITTALS and delivery will be required for the Owner-furnished products if applicable.

4. Include dates when reviewed submittals will be required from the Consultant.

1.6 PRODUCT DELIVERY SCHEDULE

1. Include dates for delivery of products specified in Section 01020 - Allowances, if applicable.

2. Include dates for products furnished by Owner, if applicable.

3. Submit a schedule of required equipment order dates and delivery dates for products and/or assemblies which involve insignificant production time or fabrication time and/or will significantly affect the project schedule if not available when needed.

1.7 CONSTRUCTION PROGRESS SCHEDULE

1. Submit a preliminary construction schedule and phasing plan within ten working days of notification of bid acceptance, for approval.

2. Incorporate approved preliminary schedule in construction schedule specified in

3. Submit a bar-chart progress schedule a minimum of seven (7) days before first progress application for payment. Prepare schedule in sufficient detail to indicate timing of major activities during phased progress of the Work and which will ensure completion of the Work on or before schedule.

4. On schedule indicate a time bar for each major construction activity to be performed at the site, properly sequenced and co-ordinate with other activities of work. Itemize activities in sufficient detail that no one bar exceeds two months in duration (separate long running trades such as Masonry into Logical Sub-Sections). Allow sufficient space below planned time bar for another time bar to record actual progress.

5. Show dates for commencement and completion of all activities. Estimate duration period and float (contingency) time for each activity.

6. Show projected percentage of completion for each activity as of the date of submission of monthly progress payment applications and/or to the date of submission of schedule when requested.

7. Indicate actual progress of each activity to date of submission of schedule.

Indicate current status of all activities to date of submissions of schedule by showing where behind, on or ahead of planned schedule.

8. Show changes occurring since previous submission of schedules:

    1. Major changes to scope

    2. Activities modified since previous submission

    3. Revised projections of progress and completion

    4. Other identifiable changes.

    5. Confirm commencement, duration and completion dates of all activities with subcontractors, subtrades and suppliers.

    6. Deliver to Consultant, at the end of each calendar month with progress application a project status report derived from evaluation of Schedule.

    7. Include in this report updated schedule together with such supporting narrative and such graphical presentations necessary to clearly outline the progress of Work, areas of current and anticipated problems, effect of changes on schedules of major trade subcontractors and proposed corrective action.

    8. Be aware that the nature and day-to-day functioning of the Owner will have precedence over any phasing and arranged schedule, and stoppage of the work with good reason, and changes to the schedule may be made by the Owner on an as needed basis without prior notice and at no extra cost to the contract. The Contractor shall take this into account and shall co-ordinate and co-operate with the Owner and reschedule the work to accommodate the Owner's requirements.

    9. Lengthy shutdowns and disruptions of services will not be tolerated, and strict attention shall be paid to minimizing any disruption.

    10. Schedule required work in occupied areas in co-ordination with the Owner and such schedule be approved by the Owner prior to start of the work. Provide two weeks minimum notice when work in existing area is required

1.8 STAGED/PHASE CONSTRUCTION

1. Prepare and submit sub-schedules for each separate stage of Work when pertinent to the project.

2. Provide sub-schedules to define critical portions of prime concern to master schedule.

3. Describe start and stop, float time and affected other work.

1.9 WEEKLY SCHEDULE UPDATE AND MANPOWER LOADING

1. Use the Construction Progress Schedule as a basis for reporting on a weekly basis

the complete status of construction progress, scheduled activities and manpower loading on the project.

2. There will be an Owner/A/Consultant/ Construction Manager /Trade Contractor meeting every second week to review the project status. Provide a detailed 2-week work schedule (based upon the Construction Progress Schedule) outlining work activities and manpower requirements planned for that period.

3. Identify current and anticipated problems and delays with respect to the past work period the effects of said problems on the overall schedule and proposed corrective measures.

4. Submit to Consultant two days prior to site meetings (every second week) the following:

    1. Updated Construction Progress Schedule.

    2. Outline of anticipated work activities for the forthcoming period.

    3. Outline of required and/or anticipated manpower levels (by trade) for the forthcoming period.

    4. Problems or delays experienced and/or anticipated.

    5. Proposed corrective measures to react to problems or delays.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements is a part of this Section and shall apply as if repeated here.

1.2 APPOINTMENT AND PAYMENT OF INSPECTION COMPANIES

1. Inspection and Testing Companies for various trades will be appointed by the Consultant where specifically stated or required. Refer to the cash allowance Section 01020 for the inspection and testing disciplines required.

2. The cost of inspection and testing will be paid out of an allowance provided under Section 01020, except where tests or inspections reveal work not in accordance with the Contract, the General Contractor shall bear the cost of such tests and additional tests as the Consultant requires to verify the acceptability of corrected work.

1.3 RESPONSIBILITIES

1. The Consultant will supply drawings and specifications as required for the use of the respective inspection and testing authorities and advise the Construction Manager of the Company appointed for the respective work.

2. The Construction Manager shall advise the Consultant and the respective Inspection and Testing authority not less than five (5) working days prior to the commencement of any work to be inspected or tested and ensure that proper facilities and co-operation is provided and that no work is carried out without the required inspection and testing.

3. Proper storage shall be provided for storing concrete specimens at the job site at the required temperature and free from vibration or injury.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 ACCEPTABLE PRODUCTS

1. First item named or specified by catalogue number meets specifications in all respects regarding performance, quality of material and workmanship, and is acceptable to the Consultant if it complies with the Provincial Procurement Restriction Policy. Refer to General Requirements for more information regarding this policy.

2. Items, other than first named, meeting specifications regarding quality of materials and workmanship only, are acceptable to the Consultant, if they also meet the Provincial Procurement Policy, performance, match the first named product in colour and texture, etc. and/or capacities specified and can be accommodated within the space allotted.

3. General approval indicated by inclusion of other manufacturers named is subject to final review of submitted samples of shop drawings, performance data and test reports.

4. Where the General Contractor uses equivalent products other than that first named, on which design is based, the General Contractor shall be responsible for all details of installation including product size, arrangement, fit, colour, etc. and maintenance of all required clearances. The General Contractor shall prepare and submit revised layouts to indicate arrangement of all affected piping, ductwork, conduit, lighting, equipment, etc. Failure by the General Contractor to provide such drawings may be considered indication that additional costs associated with equivalent products such as revisions to surrounding architectural finishes, structural components, or the need for larger motor starters, larger power feeders, space revisions to associated product equipment, controls, etc. shall be included in Bid price.

1.2 APPROVAL REQUIRED

1. The Contract is based on the materials, equipment, and methods described in the Contract Documents.

2. The Consultant will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Consultant to evaluate the proposed substitution.

5. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Consultant, in writing.

1.3 "OR EQUAL"

1. Where the phrase "or equal", "approved equal", or "equal as approved by the Consultant" occurs in the Contract Documents, do not assume that materials, equipment, or methods will be approved by the Consultant.

2. The decision of the Consultant shall be final.

1.4 AVAILABILITY OF SPECIFIED ITEMS

1. Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the work.

2. In the event specified items will not be so available, notify the Consultant prior to receipt of bids.

3. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the General Contractor, will be back-charged as necessary and shall not be borne by the Owner.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

1. Safety measures
2. Fire protection
3. Overloading precautions
4. Falsework
5. Scaffolding

1.2 CONSTRUCTION SAFETY MEASURES

1. Observe and enforce construction safety measures required by National Building Code (Part 8) and Ontario Building Code (latest edition as currently amended), Provincial Government, Workplace Safety & Insurance Board and municipal statues and authorities.
    1. In particular, the Ontario Construction Safety Act, the regulations of the Ontario Department of Labour and Ontario Hydro Safety Requirements shall be strictly enforced.
    2. In the event of conflict between any provisions of above authorities the most stringent provisions will apply.

1.3 MATERIAL SAFETY DATA SHEETS

1. Submit Material Safety Data Sheets (MSDS) for any product to be used, installed or applied inside of the building if said product may emit toxic fumes and/or noxious odours.
2. Submit Material Safety Data Sheets for any product which is known to or suspected of creating a health hazard or discomfort when used in confined spaces, including but not limited to the following:
    1. Adhesives
    2. Solvents
    3. Sealants (Caulking, etc.)
    4. Other products which may give off air borne particles after installation
        1. Any other product as direct by Consultant/Consultants.
    5. The required Material Safety Data Sheets to be submitted prior to ordering material or product for use as a part of the Work

3. The Owner may withhold payment for work of a subtrade or section until MSD Sheets for products supplied by that subtrade or section have been submitted, reviewed by Consultant and found to be acceptable.

4. Refer to Section 01700 - Project Close-Out for requirements regarding Certificates of Compliance.

1.4 MATERIALS SPECIFICALLY EXCLUDED

1. Asbestos and/or asbestos - containing products are not permitted. Submit Material Safety Data Sheets for any product suspected of containing asbestos if so requested by Consultant. Examples of some materials requiring close scrutiny and/or confirmation include:

2. Transite drainage pipe - whether buried or above grade - not permitted.

    1. Insulation and/or jacketting for pipes, ducts, motors, pumps, etc. - not permitted if any asbestos is present.

3. Solder for all piping is to be lead-free. "Lead Free" shall mean solder which contains less than 0.030% of lead when dissolved in fluoroboric and nitric acids and tested by inductively coupled argon plasma atomic emission spectroscopy. Steelbond 281 and Silverbrite are acceptable solder products.

4. The mechanical Construction Manager shall provide an affidavit signed by the principal of the company, on company letterhead, that all of the solder used on the project was either one of the two acceptable products or that the solder used (identified by brand name) meets or exceeds the testing criteria.

5. The Owner shall undertake random testing of the soldered joints. Should testing provide that the solder used was not as specified, the Owner shall take legal action against the Construction Manager as appropriate.

6. All paint and finish coatings are to be lead and mercury-free. Submit Material Safety Data Sheets confirming that these products are free of all lead and/or mercury compounds.

1.5 FIRE SAFETY REQUIREMENTS

1. Comply with requirements of the local municipal fire department with respect to continuous fire safety on the job site.

2. Comply with fire safety requirements of other construction related authorities (Workplace Safety & Insurance Board, Ministry of Labour, construction trade unions, etc.). If more than one authority issues similar requirements, the more stringent shall govern.

3. The appropriate clauses of the Ontario Building Code relating to fire protection shall be strictly followed.

4. Provide and maintain free access to temporary or permanent fire hydrants and

other fire protection equipment during performance of work required by insurance companies having jurisdiction and governing codes, regulations and by-laws.

1.6 OVERLOADING

1. Ensure no part of Work is subjected to a load which will endanger its safety or cause permanent deformation.

1.7 FALSEWORK

1. Design and construct falsework in accordance with latest issue of CSA S269.1-.

1.8 SCAFFOLDING

1. Design and construct scaffolding in accordance with latest issue of CSA-S269.2.

1.9 LIST OF MINIMUM SAFETY

1. Include all provisions for construction safety such as fences, hoarding along streets, storage provisions facilities, sanitation facilities, fire protection, electrical supply, temporary heat, ventilation, construction equipment with its supports and guards, stairs, platforms, ladders, scaffolds, guardrails, walkway lighting and morality lighting, work around asbestos lead, silica and fumes, all as required by the Construction Safety Act and Regulation, latest edition of the Province of Ontario, as well as all other applicable regulations of Jurisdictional Authorities.

1.10 OWNER SAFETY REQUIREMENTS

1. The Construction Manager will take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.

2. All work procedures will be in accordance with Owner legislated standards.

3. All equipment shall be in safe operating condition and appropriate to the task.

4. The Construction Manager shall ensure that only competent personnel are permitted work on site. The owner will throughout the term of the contract also remove from the site any persons not observing or complying with safety requirements.

5. The Construction Manager shall provide competent personnel to implement their safety programs and ensure that the owner's standards and those of the Ontario Health and Safety Act are being complied with.

6. Plant Services or the Consultant will monitor every week to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Construction Manager or subcontractors removed from site.

7. The Construction Manager will report to the Owner, Consultant and jurisdictional authorities any accident or incident involving Construction Manager, owner or public personnel and/or property arising from the Construction Manager's execution of the work.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 FIRES

1. Open fires and burning of rubbish are not permitted on the site.

1.2 DISPOSAL OF WASTES

1. Do not bury rubbish and waste materials on site.

2. Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

3. All removal of waste products and debris resulting from the work must be audited and source-separated to comply with the most current version O.Reg 102 103 Industrial, Commercial and Institutional Source Separation Programs under the Environmental Protection Act and the 3 R's Regulation.

1.3 DRAINAGE

1. Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

2. Do not pump water containing suspended materials into waterways, sewer or drainage systems.

3. Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

1. Refer to Division 2.

1.5 POLLUTION CONTROL

1. Provide and maintain temporary erosion and pollution control features including mud mats and siltation fences as per the Bruce County- Town of Mildmay and Ontario provincial standard details and requirements installed under this contract or previously installed.

2. Control emissions from equipment and plant to local authorities' emission requirements.

3. Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

4. Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.6 NOISE CONTROL

1. Adhere to local noise bylaws.

2. Equip vehicles and equipment with efficient noise attenuation devices (mufflers) to minimize noise levels in vicinity of Site

3. Where necessary place noise attenuation devices (barriers) around stationery pumps and compressors.

1.7 WASTE MANAGEMENT CONTROL

1. Prepare Waste Audit and Waste Reduction Plans in accordance with O.Reg. 102/94 made under the environmental Protection Act for Waste Audits and Waste Reduction Work Plans. Ensure these plans are prepared prior to construction or demolition work proceeds on Site.

2. Prepare and implement a Source Separation Program in accordance with Ont. Reg. 103/94 made under the environmental Protection Act for Industrial Commercial source Separation Programs. Ensure program is implemented prior to construction or demolition work proceeds on Site.

3. Post plans on Site where most workers will see them and allow any worker to view plans who makes such a request.

4. The following set of definitions are intended to augment terms provided within this Article:

1.8 3 R: REDUCE (REDUCTION), REUSE, RECYCLE

1. REDUCE (REDUCTION) - Reduction involves actions to minimize quantity of waste at source and consequently, assumes highest priority in hierarchy of 3R activities.

2. REUSE - Direct reuse of products which otherwise would become waste, provides another means of diverting quantity of waste destined for landfill.

3. RECYCLE - Recycling involves collection of materials for use as feedstock in manufacturing of new products. Recycling can be most effectively accomplished if recyclable materials have been source separated at point of generation.

4. SOURCE SEPARATION - Purposeful segregation of materials from designated solid waste stream into specific material types at point of generation to facilitate recycling.

5. SOURCE SEPARATED MATERIALS - Specific types of materials that have been purposefully segregated from municipal waste into specific material types at point of generation.

6. CONSTRUCTION BUSINESS - Business enterprise employing more than 50 persons out of 1 office involved in building, renovation and repair of immobile structures, including soil excavation and landscaping.

7. DEMOLITION BUSINESS - Business enterprise employing more than 50 persons out of 1 office involved in dismantling any immobile structure, facility or dwelling.

8. Apply waste management activities of reduction, reuse and recycling of waste materials during construction and/or renovation of this Contract.

9. Construction/Demolition Businesses shall be required to source separate in accordance with Ont. Reg. 103/94, for purposes of recycling, following materials:

    1. corrugated cardboard

    2. wood waste (i.e., non-treated dimensional lumber, manufactured wood) non-painted gypsum board

    3. ferrous metals

    4. Brick and Portland cement concrete

10. Submit agreement as requested to include source separation of above identified materials and other waste diversion activities during construction phase.

11. Requirements: During construction phase, Construction Manager shall be required to comply with following program requirements:

    1. Identify sorting, storage and disposal requirements anticipated during construction to maximize waste diversion.

    2. Establish reduction, reuse and on-site source separation activities during construction.

12. Identify haulers and recycling companies that have entered into agreement with or have expressed willingness to enter into such agreement with Construction Manager.

13. Identify person responsible for source separation program.

14. Establish effective education and information program for on-site employees, including training sessions, use of signs, and designated waste diversion program.

15. Establish cooperative agreements with Sub-Construction Managers/trades to abide by waste diversion program.

16. Construction Manager shall be willing to allow monthly on-site visits by Consultant to review waste management/recycling program.

17. Immediately upon notification of award of Contract, and before starting work on Site, submit fully completed "Subcontractor Participation Form" appended to this Section to the Consultant.

18. Construction Managers shall provide evidence that they can and shall implement required waste diversion program. Provision of evidence includes, but is not limited to following:

    1. Written agreements with Sub-Construction Managers that they will participate in waste diversion program.

    2. Letters from reuse/recycling markets that they are in position to accept

designed materials.

3. Action plan prepared by Construction Manager for meeting objectives of waste diversion program; and

4. Contract Sum shall include costs for implementing waste diversion program.

1.9 HAZARDOUS MATERIALS

1. See Section 00840 Hazardous Materials.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SUBCONTRACTOR PARTICIPATION FORM

For source separation program to be effective, it is important for Subcontractor Managers/trades to work cooperatively with your company. To ensure this cooperative arrangement will be carried out, you may wish to ask Subcontractor Managers/trades companies to sign this agreement.

I hereby agree to participate in the source separation program to the best of my abilities.

1. Company Name _____

   Address _____

   _____

   Signature _____

2. Company Name _____

   Address _____

   _____

   Signature _____

3. Company Name _____

   Address _____

   _____

   Signature _____

4. Company Name _____

   Address _____

   _____

   Signature _____

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

1. Systems demonstration
2. Document submission
3. Project commissioning
4. Inspection and takeover procedures

1.2 SYSTEM DEMONSTRATION

1. Prior to final inspection, demonstrate operation of each system to the Owner and Consultant.

1.3 DOCUMENTS

1. Collect reviewed submittals in Section 01010 and 01300 and assemble documents executed by subcontractors, suppliers, and manufacturers. Submit as per requirements in Section 01010 - General Requirements.
    1. Provide bonds fully executed and notarized.
    2. Submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and monies remaining due.
    3. Architect will issue a final change order reflecting approved adjustments to Contract Sum not previously made.

1.4 PROJECT COMMISSIONING

1. Expedite and complete deficiencies and defects identified by the Consultant.
2. Review record "as-built" drawings for completeness and then have "as-built" AutoCad 2010 or later drawings completed by a professional drafting service and provide "as-builts" on computer disks.
3. Review Cash and Contingency Allowances in relation to Contract Price, change orders, hold-backs and other Contract Price adjustments.
4. Submit required documentation such as statutory declarations, Workplace Safety & Insurance Board Certificates, certificates of approval or acceptance from regulating bodies.
5. Attend "end-of-work" testing and break-in or start-up demonstrations.
6. Review inspection and testing reports to verify conformance to the intent of the documents and that changes, repairs or replacements have been completed.
7. Meet with structural consultant and inspection and testing consultant to co-

ordinate completion, testing approvals.

1.5 INSPECTION/TAKEOVER PROCEDURES

1. The requirements of OAA/OGCA Document No. 100 "Take-Over Procedures" also govern applicable take-over procedures for this Contract.

2. Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete and/or corrected and the building is clean and in condition for occupancy. Notify the Architect, in writing, of satisfactory completion of the Work and request an inspection.

3. During the Consultant inspections, lists of deficiencies and defects will be tabulated. Correct same.

4. When the Consultants consider deficiencies and defects have been corrected and it appears requirements of the Contract have been performed, make application for certificate of Substantial Performance. Refer to CCDC 5B, General Conditions GC 5.6 for specifics to application.

5. All utility meters to be read and transferred into the Owner's name.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

1. Environmental Protection – Section 01560

1.2 DUST AND CLEANING REQUIREMENTS

1. Standards:

1. Maintain project in accordance with the latest edition of the Occupational Health and Safety Act.

2. Hazards and Dust Control:

.1 Provide adequate ventilation during use of volatile or noxious substances.

.2 Prevent spread of dust beyond the construction site by wetting, or by other means suitable for conditions, as it accumulates.

.3 Provide Tack Mats at entrances to prevent dust and dirt from being traced through the project as required. Dispose of mats and replace on regular basis with new mat.

3. Floors:

.1 Keep troweled concrete floors free from oils, grease or other materials likely to damage them, discolour them or affect bond of applied finishes. Once building is enclosed, keep floors as dry as possible after curing.

.2 To prevent soiling or damage to finish flooring where pedestrian traffic occurs after the flooring has been installed, install and maintain reinforced kraft paper temporary protection, secured in place and with joints sealed by reinforced pressure sensitive tape.

.3 Install plywood panels of minimum ¼" thickness over completed finish flooring materials on which further construction work is performed or delivery of products is made, or both. Seal joints between panels with reinforced pressure sensitive tape.

1.3 MATERIALS

1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

2. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.1 DURING CONSTRUCTION

1. Execute cleaning to ensure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish. Keep site clear of snow, mud and pooling of water due to severe rain. Ensure that work is not stopped because of failure to provide access to site.

2. Wet down dry materials and rubbish to prevent blowing dust.

3. At reasonable intervals during progress of Work, clean site and public properties and dispose of waste materials, debris and rubbish.

4. Unless otherwise specified, salvaged material resulting from construction, and surplus materials and construction debris shall become property of Contractor, who shall dispose of it away from site.

5. Vacuum clean interior building areas when ready to receive finish paining and continue vacuum cleaning on an as-needed basis until building is ready for Substantial Performance or occupancy.

6. Obtain from each Subcontractor, instructions which designate proper methods and materials to be used in final cleaning and submit such instructions to the Consultant. Include Instructions in Manufacturer's Data Book specified in Section 01300.

7. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.2 FINAL CLEANING

1. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all surfaces exposed to view; leave project clean and ready for occupancy.

2. Employ experienced workers, or professional cleaners, for final cleaning.

3. In preparation for Substantial Performance or occupancy, conduct final inspection of interior and exterior surfaces exposed to view, and of concealed spaces.

4. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from all sight-exposed interior and exterior finished surfaces; polish resilient and ceramic surfaces so designated to shine finish. Vacuum carpet.

5. Clean and polish glass and mirrors.

6. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

7. Broom-clean paved surfaces; rake clean other surfaces of grounds.

8. Clean filters, exposed ductwork, and structure.

9. Clean bulbs and lamps and replace those burned out.

10. Clean diffusers and grilles.

11. Clean sinks, faucets, and water closets and controls.

12. Remove snow and ice from access to building.

13. Maintain cleaning until project, or portion thereof, is occupied by Owner.

3.3 REMOVAL OF TEMPORARY FACILITIES

1. Completely remove temporary facilities from site, making good any damage when no longer required.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

1. The printed forms outlined below shall form the basis of communication between the Consultant and the Construction Manager. Copies of forms unrelated to the issuance of monies, shall be kept on the site; neatly filed and readily accessible to the parties concerned.

1.2 TRANSMITTAL RECORD

1. A record of material issued by the Consultant, General Contractor or Project Manager.

1.3 GENERAL REVIEW REPORT

1. A progress report completed by the Architect or Consultant on a regular basis.

1.4 PROPOSED CHANGE

1. A description of contemplated changes to the Contract. This puts on hold all related work that would be affected by the proposed change.

1.5 CASH ALLOWANCE CHANGE ORDER

1. Assignment of money for work executed under the Cash Allowance Section.

1.6 CHANGE ORDER

1. Assignment of money for work executed beyond the financial limits of the Contract.

1.7 CHANGE DIRECTIVE

1. A description of a change in the work when the Owner requires the Contractor to proceed with a change in the work prior to the Owner and the Contractor agreeing upon the adjustment in Contract Price and Contract Time.

1.8 CERTIFICATE FOR PAYMENT

1. For release of contract money based on monthly progress draws.

1.9 SUPPLEMENTAL INSTRUCTIONS

1. A description and/or clarification for the purpose of recording a clarification or interpretation of the contract documents or giving directions on problems resulting from field conditions.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 NEWFORMA SOFTWARE SYSTEM

1. This project will be administered through the Consultant using the NEWFORMA software system.

2. The Construction Manager is required to use this internet-based software for ALL project communications, RFIs, quotations, project schedule, shop drawing log, change log, RFI log, etc., including all administrative forms as outlined in Section 01800 and construction schedules as outlined in Section 01310. All shop drawings, interference drawings and as-built drawings shall be submitted electronically through the Newforma Info Exchange in PDF format and shall be numbered in the order which they are submitted. Numbering shall be in the following format; 001, 002, 003, etc. Submittals will not be deemed as received unless delivered through Newforma Info Exchange.

3. Utilization of this system does not require the purchase or download of the Newforma software. The Consultant will send an email notification which will automatically provide online access to the Newforma Info Exchange specific to this project.

1.2 NEWFORMA INSTRUCTIONS

1. You will receive an email instructing you how to get into the system (click on link). The system is self-explanatory as to the "use" for Submittals (Shop Drawings) and RFIs. Refer to attached screen shots.

2. Shop Drawings are to be issued as "Submittals". There is a place on the Submittal section to put in the Construction Manager's "expected response date" – please ensure that is filled in. Submittals are to be numbered in the sequence which they are submitted. Numbering to be as follows; 001, 002, 003, etc. (NOTE: as per the contract, the Consultant has 10 working days to respond).

3. RFIs: There is a place on the RFI section to put in the Construction Manager's "expected response date" – please ensure that is filled in. RFI's are to be numbered in the sequence which they are submitted. Numbering to be as follows; 001, 002, 003, etc. (NOTE: as per the contract, the Consultant has 5 working days to respond)

4. RFCs: (all Construction Manager quotations to be submitted as an RFC) RFC's are to be numbered in the sequence which they are submitted. Numbering to be as follows; 001, 002, 003, etc.

5. Submittals and RFI's requiring consultant review other than the Consultant shall be sent via Newforma directly to the respective consultant. The +VG Project Manager as well as the persons noted above shall be copied on all submittals and RFI's.

6. All shop drawings, interference drawings and as-built drawings shall be submitted electronically through the Newforma Info Exchange in PDF format. Submittals will not be deemed as received unless delivered through Newforma Info Exchange.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

1. Refer to the attached report prepared for the Bluewater District School Board. The report is titled **Geotechnical Investigation & Preliminary Hydrogeological Assessment: Proposed New School - Waterloo St & Concession 10 Road, Port Elgin Ontario**. Prepared by Chung & Vanderdolen Engineering Ltd., file number 1704 dated May 14, 2024.

2. This information given in this report was obtained for the use of the Owner in the execution of the design. It is presented in good faith to assist the Contractors and their subcontractors.

3. Any information pertaining to soils, and borehole logs are furnished by the Architect and Geotechnical Engineer as a matter of general information only and borehole descriptions of logs are not to be interpreted as descriptive of conditions at locations other than those described by the boreholes themselves.

4. It is incumbent upon the Contractors to make whatever additional soils investigation they feel may be required for the proper execution of the Contract at no additional cost to the Owner.

5. Where the work included in the Excavating, Backfilling and Rough Grading (below the building) - Section 02200 and Earthwork - Below Paving, Sidewalks and Landscaping - Section 02215 specification sections exceeds the recommendations of the soil report these specification sections shall govern. All work called for in Sections 02200 and 02215 shall be performed whether or not it is included in the soil report.

6. Examine the conditions on the site, confirm the present site conditions prior to starting work.

END OF SECTION

CHUNG & VANDER DOELEN
ENGINEERING LTD.

GEOTECHNICAL INVESTIGATION & PRELIMINARY HYDROGEOLOGICAL ASSESSMENT PROPOSED NEW SCHOOL

Waterloo Street & Concession Road 10

Port Elgin, Ontario

SUBMITTED TO:
Bluewater District School Board
351 1st Avenue North
Chesley, Ontario
N0G 1L0

ATTENTION:
Mr. John Bumstead

FILE NO / 1704 / May 14, 2024

CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1
519-742-8979

May 14, 2024
File No.: 1704

Bluewater District School Board
351 1st Avenue North
Chesley, Ontario
N0G 1L0

Attention: Mr. John Bumstead

RE: Geotechnical Investigation & Preliminary Hydrogeological Assessment
Proposed New School
Waterloo Street & Concession Road 10, Port Elgin, Ontario

We take pleasure in enclosing one (1) copy of our Geotechnical Investigation Report carried out at the above-referenced Site. Soil samples will be retained for a period of three (3) months and will thereafter be disposed of unless we are otherwise instructed.

If you have any questions or clarifications are required, please contact the undersigned at your convenience.

We thank you for giving us this opportunity to be of service to you.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Eric Y. Chung, M. Eng., P.Eng.
Principal Engineer

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1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by Bluewater District School Board to carry out a geotechnical investigation and preliminary hydrogeological assessment for the proposed new school to be located at Waterloo Street and Concession Road 10, Port Elgin, Ontario.

It is understood the proposed K-8 school will be a single-storey structure without a basement. A bus drop-off loop will be located fronting Waterloo Street, and paved parking located to the south of the school building. Paved play area will be located to the east (behind) the school and a future addition is planned to the north of the school building. A sports field will be located north of the school building. Finished floor elevations have not been established, however is it assumed that the finished floor would be just above the existing grade.

The purpose of this investigation was to determine the subsurface conditions at the site and based on the findings, to make geotechnical recommendations for:

- Foundation design recommendations
- Excavation condition
- Groundwater control during construction and after building is completed
- Slab on grade design
- Backfilling recommendations
- Site servicing
- Foundation soil classification for seismic design per OBC 2012
- Foundation walls and retaining wall design
- Pavement design and construction
- Estimates of infiltration rates of encountered soil deposits

2.0 FIELD WORK

To investigate the subsurface conditions at the site, fourteen (14) boreholes, designated as Boreholes 1 to 14, were advanced to depths between 3.35 and 6.40 m below ground surface between February 12 and 13, 2024. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The field work was carried out under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling, and monitored the groundwater conditions. The boreholes were advanced using a track-mounted drilling rig, supplied, and operated by a specialized contractor. The drill rig was equipped with continuous flight augers and standard soil sampling equipment.

Standard Penetration Tests (SPTs) in accordance with ASTM Specification D1586, were carried out at frequent intervals of depth, and the results are shown on the Borehole Logs as Penetration Resistance or “N”-values. Dynamic Cone Penetration Testing (DCPT) was carried out in Boreholes 3, 4, 6, 8, 9, and 14 below the conventionally drilled and sampled depths. The undrained shear strength of the cohesive

soil deposits was determined on the slightly disturbed SPT samples using a field pocket penetrometer. The compactness condition or consistency of the soil strata has been inferred from these test results.

Monitoring wells were installed in Boreholes 9, 11, and 13 to enable measurement of the stabilized groundwater table.

The boreholes were surveyed by CVD with reference to a local temporary benchmark (TBM). The boreholes and temporary benchmark elevation were surveyed by CVD for the purpose of this report using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using the UTM Zone 17N Projection, NAD83(CSRS)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28)

TBM: Top of catch basin on the east side of Waterloo Street, approximately 100 m south of the site, as shown on Drawing No. 1

Elevation: 199.02 m (Geodetic Datum)

3.0 LABORATORY TESTING

Soil samples obtained from the in-situ tests were examined in the field and subsequently brought to our laboratory for visual and tactile examination to confirm field classification. Moisture content determination of all retrieved samples occurred.

In addition, three (3) grain size distribution analyses were performed on the major soil deposits to confirm field identification and to provide information on the soil engineering characteristics.

4.0 EXISTING SITE CONDITIONS

The site is located on the south side of Concession Road 10 and at the north end of Waterloo Street in Port Elgin, Ontario. The site is a vacant lot that consists of an agricultural field. A storm water management pond is located just east of the site.

The ground surface at the site is gently sloping, with grades slightly higher in the east side of the site and lowest at the west side. Ground surface elevations at the borehole locations ranged between 198.92 and 199.60 m.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface conditions encountered in the fourteen (14) boreholes advanced as part of this investigation are shown on the Borehole Log Sheets, Enclosures 1 to 14. The following sections provide descriptions of the major soil deposits encountered in the boreholes.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions between soil types rather than exact planes of geologic change. The subsurface conditions will vary between and beyond the borehole locations.

In general, the surficial topsoil was underlain by a loose to compact silty sand and a firm to very stiff clayey silt. The silty sand and clayey silt were in turn underlain by a loose to compact sand deposit.

5.1 Topsoil

Topsoil was encountered at ground surface in Boreholes 1 to 14 with measured thicknesses ranging between 150 and 250 mm.

5.2 Silty Sand

A layer of silty sand was encountered below the topsoil in Boreholes 1 and 3 to 14 and extended to depths between 0.60 and 2.90 m. Borehole 14 was terminated within the silty sand at a depth of 1.98 m. The silty sand contained occasional to frequent clay seams and occasional silt seams.

The SPT “N”-values measured within the silty sand ranged from 5 to 27 blows per 300 mm of penetration, indicating a loose to compact compactness condition. Natural moisture contents were measured between 11 and 23%, indicating a moist to saturated moisture condition.

5.3 Clayey Silt

A layer of clayey silt was encountered below the topsoil in Borehole 2 and the silty sand in Boreholes 1, 3, 4, and 9. Boreholes 3 and 4 were terminated within the clayey silt at a depth of 1.98 m. In Boreholes 1, 2, and 9, the deposit extended to depths between 2.15 and 3.45 m.

The clayey silt contained trace to some sand and occasional to frequent sand and silt seams. In Borehole 1, a sand interlayer was encountered at depths between 2.2 and 2.9 m. Results of one (1) grain size distribution analysis from Borehole 1 are shown graphically on Enclosure 15.

The SPT “N”-values measured within the clayey silt ranged from 7 to 22 blows per 300 mm of penetration, indicating a firm to very stiff consistency. Based on the shear strength measured by field pocket penetrometer, the deposit had a firm to hard consistency. Natural moisture contents were measured between 18 and 26%, indicating that the clayey silt was drier than the plastic limit (DTPL) to at

about plastic limit (APL).

5.4 Sand

A deposit of sand was encountered below the sandy silt in Boreholes 5 to 8 and 10 to 13 and below the clayey silt in Boreholes 1, 2, and 9. Boreholes 1, 2, and 5 to 13 were terminated within the deposit at depths between 3.51 and 5.18 m.

The sand contained trace to some silt and occasional to frequent clay seams. In Borehole 7 a sandy silt interlayer was encountered at depths between 3.4 and 4.1 m. Results of two (2) grain size distribution analyses from Boreholes 9 and 11 are shown graphically on Enclosure 16 and 17.

The SPT "N"-values measured within the sand ranged from 5 to 25 blows per 300 mm of penetration, indicating a loose to compact compactness condition. Natural moisture contents were measured between 16 and 22%, indicating a saturated moisture condition.

5.5 Groundwater

Groundwater conditions were monitored during and following completion of borehole sampling. Groundwater levels were measure at depths ranging from 1.2 to 1.5 m in Boreholes 1 to 8, 10, 12, and 14 upon completion of drilling.

Three (3) groundwater monitoring wells where installed thought the site. The table below summarizes the water level readings in the monitoring wells:

Borehole No.	Existing Ground Elevation (m)	Date	Water Level Below Existing Ground Surface (m)	Water Level Elevation (m)
9	199.28	March 15, 2024	1.03	198.25
11	198.92	March 15, 2024	0.96	197.96
13	198.98	March 15, 2024	1.44	197.54

Groundwater levels measured in the monitoring wells were at depths between approximately 1.0 and 1.4 m below existing grades, corresponding to elevations between 197.5 and 198.3 m.

It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

5.6 Hydraulic Testing and Hydraulic Conductivity Estimates

Appendix D provides well response recovery test (slug test) data collected on March 15, 2024 from the monitoring wells in Borehole 9, 11, and 13. The monitoring wells were purged by hand using polyethylene tubing and check valves. The water in the test well was lowered by pumping and the subsequent water level recovery was measured over time. The response was analyzed using AquiferTest software and the results are presented in Appendix D. The hydraulic conductivity of the material was analyzed using the Bouwer and Rice Method.

The following table summarizes the depth/elevation of the well screen and the materials screened/tested:

Borehole No.	Existing Ground Elevation (m)	Screened depth/elevation (m)	Primary Material Screened	Estimated Hydraulic Conductivity (m/s)
9	199.28	1.5± to 3.0± (197.8± to 196.3±)	Clayey Silt over Sand	5.9×10^{-6}
11	198.92	1.5± to 3.0± (197.4± to 195.9±)	Silty Sand over Sand	2.7×10^{-5}
13	198.98	1.5± to 3.0± (197.5± to 196.0±)	Silty Sand over Sand	3.6×10^{-5}

Based upon these results, the hydraulic conductivity (permeability) of the silty sand to sand is therefore estimated to be in the range of 4×10^{-5} to 6×10^{-6} m/s.

5.7 Soil Chemistry

Five (5) soil samples were submitted to AGAT Laboratories for analysis of metals, inorganics, Petroleum Hydrocarbons (PHCs F1-F4) and Benzene-Toluene-Ethylbenzene-Xylene (BTEX). The chemical testing was conducted to initially assess the environmental quality of potential excess soil which may be generated and removed off-site during construction activities.

The following table presents the location, depth, description, and parameters analysed for each soil sample collected and submitted.

Sample I.D.	Sample Depth (mbgs)	Sample Description	Parameters Analysed
BH 1 – SA 1	0.2 to 0.6	Silty sand	metals and inorganics, PHCs (F1-F4), BTEX
BH 2 – SA 2	0.8 to 1.2	Clayey silt	metals and inorganics, PHCs (F1-F4), BTEX
BH 5 – SA 2	0.8 to 1.2	Silty sand	metals and inorganics, PHCs (F1-F4), BTEX
BH 7 – SA 1	0.2 to 0.6	Silty sand	metals and inorganics, PHCs (F1-F4), BTEX
BH 13 – SA 1	0.2 to 0.6	Silty Sand	metals and inorganics, PHCs (F1-F4), BTEX

mbgs– denotes metres below ground surface

The laboratory certificates of chemical analysis and results provided by AGAT Laboratories are enclosed in Appendix B.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

It is understood the proposed K-8 school will be a single-storey structure without a basement. A bus drop-off loop will be located fronting Waterloo Street, and paved parking located to the south of the school building. Paved play area will be located to the east (behind) the school and a future addition is planned to the north of the school building. A sports field will be located north of the school building. Finished floor elevations have not been established, however is it assumed that the finished floor would be just above the existing grade.

In general, the surficial topsoil was underlain by a loose to compact silty sand and a firm to very stiff clayey silt. The silty sand and clayey silt were in turn underlain by a loose to compact sand deposit.

Groundwater levels measured in the monitoring wells were at depths between approximately 1.0 and 1.4 m below existing grades, corresponding to elevations between 197.5 and 198.3 m.

6.2 Footing Foundations

Conventional strip and spread footing foundations can be used to support the proposed new school building. Footings cast on competent native undisturbed compact silty sand or stiff clayey silt can be designed using a Geotechnical Reaction at SLS of 100 kPa. The SLS value given above is based on a maximum settlement of 25 mm under the footing foundations. The Factored Geotechnical Resistance at ULS is 175 kPa.

The following table summarizes the highest founding level and elevation for the footing at each borehole location:

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
1	199.18	0.78	198.40
2	199.04	0.84	198.20
3	199.08	0.78	198.30
4	199.15	0.75	198.40
5	199.05	1.05	198.00
6	199.14	1.44	197.70

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
7	199.23	0.73	198.50
8	199.28	0.78	198.50
9	199.28	0.78	198.50
10	199.32	0.72	198.60

These soil bearing pressures can be achieved provided that the founding subgrade is undisturbed during construction. The majority of the settlements will take place during construction and the first loading cycle of the building.

The maximum total and differential settlements of footings designed to the above recommended soil bearing pressure are expected to be less than 25 and 20 mm, respectively, and these are considered tolerable for the structure being contemplated.

Exterior footings and footings in unheated portions of the building should be provided with a soil cover of not less than 1.20 m or equivalent synthetic thermal insulation for adequate frost protection. The founding subgrade soils must be protected from frost penetration during winter construction.

It is recommended that a lean concrete mat be placed over approved footing subgrade in wet to saturated areas to prevent further disturbance to the bearing soils resulting from construction activities.

It is recommended that the footing excavations be inspected by the geotechnical engineer to ensure adequate soil bearing and proper subgrade preparation.

6.3 Earthquake Considerations

In accordance with The Ontario Building Code 2012 (OBC), the proposed structure should be designed to resist earthquake load and effects as per OBC Subsection 4.1.8.

Based on the underlying soil conditions encountered at the boreholes, the site can be classified as a Site Class D as per OBC Table 4.1.8.4.A (Page B4-24).

6.4 Open Cut Excavation and Groundwater Control

Excavations are expected to be in the order of 1 to 2 m deep for footing foundations and site servicing. The excavations will penetrate loose to compact silty sand, sand, and firm to very stiff clayey silt. Provided the groundwater is controlled/lowered below the excavation depths, these materials are considered to be Type 3 Soils in accordance with the latest Occupational Health and Safety Act.

Above the groundwater table, excavations in the Type 3 Soils are expected to remain stable during the construction period provided that side slopes are cut to 1H : 1V from the bottom of the excavation. Where seepage or perched groundwater is encountered, side slopes should be cut to more stable angles of 3H : 1V. The side slopes should be suitably protected from erosion processes.

Above the groundwater table, rainwater or local perched groundwater can be controlled by pumping from filtered sump pits as and where required. It is recommended that excavation for the future development be done during the typically drier summer months when groundwater conditions would be expected to lie at lower elevations.

In light of the relatively high groundwater table at the site and that saturated silty sand and sand will be encountered below the groundwater table, all excavations for site services and building foundations and elevator pits should be keep above the groundwater table to circumvent dewatering requirements.

Dewatering will be required for any excavations carried out below the groundwater table, as the silty sand and sand soil will become “quick” and lose its integrity to support loads. The groundwater table must be lowered and controlled to at least 600 mm below the excavation level to facilitate the excavation and construction of footings, and foundation walls to be carried out in the dry condition.

Sump pumping will be able to control the groundwater ingress into the excavation if the excavation is no deeper than 0.6 m into the groundwater table. Otherwise, more sophisticated dewatering system, such as vacuum well points will be required.

In wet to saturated subgrade condition, it will be necessary to excavate below founding level and pour a 75 mm thick mud slab of lean concrete to protect the founding soil from disturbance during the installation of reinforcing steel bars and form work.

6.5 Floor Slab Construction

The floor slabs for the proposed buildings can be constructed as conventional slab-on-grade on the approved compacted native silty sand or clayey silt. At the time of floor slab construction, the exposed subgrade should be proof-rolled with a heavy roller in conjunction with an inspection by the geotechnical engineer. Any soft and/or unstable areas detected should be replaced with imported granular fill which should be compacted to at least 95% SPMDD.

Following the proof-rolling of the subgrade, it is recommended that a minimum 150 mm thick layer of OPSS Granular “A” be placed and compacted to at least 100% SPMDD beneath the concrete floor slabs to provide uniform support.

A modulus of subgrade reaction (k_s) of 50 MN/m^3 may be used for the design of the floor slabs, considering the floor subgrade will consist of sand soils.

The floor slabs should be separated structurally from the columns and foundation walls. Sawcut control joints should be provided at regular spacing (less than 30 times the concrete slab thickness) and to depths between one-third and one-quarter of the slab thickness.

Care should be taken to ensure that the backfill against foundation walls, interior piers/columns and concrete pits are placed in thin layers and each layer compacted to at least 95% SPMDD. These types of confined areas should be backfilled with excavated granular materials or imported granular soils such as OPSS Granular B Type I.

Moisture migration from the underlying soils through the concrete slab-on-grade will take place via "capillary action" and "diffusion" (due to vapour pressure differential). Although the Granular "A" layer will provide a capillary break, the low permeance of the concrete slab and floor coverings will result in 100% humidity under the concrete slab and, consequently, the moisture in the concrete will increase over time. The potential effect of the soil moisture should be considered in selecting the floor coverings. A vapour retarder material (such as a 15-mil poly, ASTM E-1745) can be placed to reduce soil moisture migration. Reference is made to ACI 302.

6.6 Lateral Earth Pressure

The unbalanced foundation walls and any other soil retaining structures should be designed to resist the lateral earth pressure acting against these walls. The following formula may be used to calculate the unfactored earth pressure distribution. The factored resistance can be calculated by using a factor of 0.8.

$$P = K (\gamma H + q)$$

Where:

P =	lateral earth pressure	kPa
K =	earth pressure coefficient, 0.5 for non-yielding foundation wall earth pressure coefficient, 0.3 for yielding retaining wall	
γ =	unit weight of granular backfill, compacted to 95% SPMDD	21 kN/m^3
H =	unbalanced height of wall	m
q =	surcharge load at ground surface	kPa

The backfill for the foundation walls and retaining walls should be free-draining granular materials which should have less than 8% silt particles (OPSS Granular "B" Type I). The backfill should be placed in thin layers and compacted to 95% SPMDD. Over-compaction adjacent to the foundation/retaining walls

should be avoided. Compaction should be carried out with hand operated equipment within 1 m of the foundation wall or retaining wall. Weeping tiles leading to a frost-free outlet or weep holes should be installed to effect drainage behind the retaining wall.

The sliding resistance of the retaining wall footings should be checked. The unfactored horizontal resistance against sliding between cast-in-place concrete and the various soils can be calculated using the following unit weight and friction coefficient:

Soil	Unit Weight (kN/m$^{3)}$	Friction Coefficient
Well-compacted granular backfill	21	0.45
Loose to Compact Silty Sand to Sand	19	0.30
Firm to Stiff Clayey Silt	19	0.40

6.7 Asphalt Pavement Design

The earth subgrade in the pavement areas is expected to consist of predominantly silty sand, sand, and clayey silt. The following flexible pavement structures are recommended for the proposed parking lots and driveway/drop-off loop areas proposed to be reconstructed based on an assumed CBR value, the observed groundwater conditions, and the frost susceptibility of the subgrade soils:

Component	**Light Duty Pavement (mm)**	**Heavy Duty Pavement (mm)**
Asphaltic Concrete HL3 Asphaltic Concrete HL8	40 40	40 60
Granular “A” Base Course	150	150
Granular “B” Sub-base Course (OPSS Granular “B” Type I)	350	450
Granular Base Equivalency (GBE)[1]	**545**	**651**

Notes:

1. GBE denotes Granular Base Equivalency which is calculated using factors of 2 for asphaltic concrete, 1 for Granular “A” base and 0.67 for Granular “B” sub-base

The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff away from buildings, sidewalks, and other similar pertinent structures. Additional catch-basins and positive drainage outlets should be provided at all low points of the prepared earth subgrade, such as stub drains extended from the catch-basins.

Performance Grade Asphalt Cement (PGAC) 64-28 should be utilized in the hot mix asphalt as per OPSS 1101.

6.8 Pavement Construction

It is recommended that the pavement construction be carried out during the drier time of the year and that the subgrade is stable, not heaving under construction equipment traffic. If the subgrade is wet or unstable, additional granular sub-base and/or woven geotextile may be required.

Preparation of the subgrade will involve removal of the existing pavement structure, topsoil, and deleterious materials to the proposed subgrade elevation.

The subgrade should be recompacted from the surface with a minimum 10 tonne vibratory compactor to a density of no less than 95% Standard Proctor Maximum Dry Density (SPMDD) prior to placement of the specified Granular “B” sub-base materials. Any soft or otherwise incompactable areas detected should be removed and replaced with approved granular materials and should also be compacted to no less than 95% SPMDD.

The Granular “A” and Granular “B” Type materials should meet the gradational requirements of OPSS 1010 and should be compacted to no less than 100% SPMDD.

The placing and rolling of the asphalt mixture should conform to OPSS.MUNI 310 Table 10 and should be compacted to no less than 92% of the Marshall density (BRD).

During asphalt placement, construction joints must be offset a minimum of 300 mm from the construction joints in the binder asphalt so that longitudinal joints do not coincide in order to reduce the risk of surface asphalt failure.

Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction is being achieved and maintained.

6.9 Drainage System

Based on the results of the boreholes, wet to saturated soil conditions exist at shallow depths across the site. It is recommended to implement a drainage system across the site within the asphalt paved areas to promote the longevity.

The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff away from buildings, sidewalks, and other similar pertinent structures. Positive drainage outlets should be provided for at all low points of the earth subgrade to drain the granular bases by installing a subdrain system connected to the catch-basins. The subdrains should be at least 3 m long and radiating from the catch-basins. In addition, “frost tapers” consisting of backfilling catch-basins and manholes with free-draining Granular 'B' (similar to OPSD 802.010) are recommended at such underground structures.

Due to the frost-susceptible nature of the subgrade soil, it is recommended that a longitudinal subdrain system be installed along the edges of the new pavement areas. The subdrain system should incorporate a 150 mm diameter perforated tile equipped with a factory installed filter sock. The subdrain will enable water removal, in turn reducing the risk and effects of frost heaving and load transfer in saturated conditions. The subdrains should be installed in a 300 by 300 mm trench in the subgrade, surrounded by approximately 50 to 75 mm concrete sand. Subdrains must be installed with positive drainage into a catch basin or other suitable outlet and the subgrade must be prepared with positive drainage to the subdrains.

The surface drainage design should be reviewed the site Civil Engineer to ensure that ponding does not occur and that it is adequate for the scope of the proposed pavement construction.

6.10 On-site Infiltration

It is understood that the potential for an at-source storm water management feature is to be considered at the site. The top of the infiltration feature should be located below the footing drain/weeper and at least 5 m away from the proposed building footprints. It is noted that infiltration features should have the base located at least 1.0 m above the groundwater table and that a minimum infiltration rate of 15 mm/hr is required.

Based on the results of grain size analyses and our experience, the hydraulic conductivity and estimated infiltration rate of the native inorganic soil types encountered at the boreholes (nearest the potential infiltration gallery) are estimated and provided in the following table and may be used for storm water management purposes:

MATERIAL	PERMEABILITY (K) (cm/sec)	INFILTRATION RATE (mm/hr)
Clayey Silt (Enclosure 15)	1×10^{-6} to 1×10^{-7}	1 to 3
Silty Sand	1×10^{-4} to 1×10^{-5}	3 to 10
Sand, trace to some silt (Enclosure 16 and 17)	1×10^{-3} to 3×10^{-4}	15 to 50

7.0 GEO-ENVIRONMENTAL CONSIDERATIONS

Excess soil may be generated and removed off-site during the construction activities associated with the proposed site works. The management of excess soil is now governed by Ontario Regulation 406/19 (O. Reg. 406/19), MECP document titled “On-Site and Excess Soil Management Regulation”. In accordance with the regulation, the Project Leader is responsible for the handling, storage, reuse, transportation,

and removal of all soil. Furthermore, the analytical results must be disclosed with and approved by the owner(s) of the receiving site before exporting the soil.

If the anticipated volume of excess soil generated during construction activities is greater than 2,000 m^3, the following is required for on-site and excess soil management:

- Planning Documentation
  - Assessment of Past Use
  - Sampling and Analysis Plan
  - Excess Soil Characterization Report
  - Excess Soil Destination Report
- Tracking
- Registry
- Record Keeping

Five (5) soil samples were collected and submitted as part of this geotechnical investigation to provide preliminary environmental quality of potential excess soils, which can be used to assist with the preparation and implementation of the above-noted Planning Documentation. It is noted that the soil conditions may differ between and beyond the sample locations. If any impacted soils are discovered during construction, CVD should be contacted for further sampling and testing to determine the limit of the impacted soils.

Any soils identified during construction to have been environmentally impacted are to be separately stockpiled and analysed to determine the appropriate measures for handling and disposal. Waste characterization testing (TCLP) to classify the material for disposal as prescribed in O.Reg. 347/558 is required. Leachate analysis (mSPLP) is to be carried out if the excess soil is to be disposed to receiving sites under O.Reg. 406/19.

Similarly, groundwater encountered during construction works must also be suitably assessed and handled.

7.1 Applicable Regulatory Standards

The Soil, Ground Water and Sediment Standards for Use Under the New Soil Rules and Excess Soil Quality Standards established in accordance with the O. Reg. 406/19 as amended were consulted in the assessment of the soil at the project site.

The analytical results for soils were compared to the following O. Reg. 406/19 regulatory standards:

- Table 1 (Full Depth Background Site Condition Standards) for Residential/Parkland/Institutional/ Industrial/Commercial/Community Property Use (Table 1 RPIICC ESQS)
- Table 2.1 (Full Depth Generic Excess Soil Quality Standards in a Potable Ground Water Condition) for Residential/Parkland/Institutional Property Use (Table 2.1 RPI ESQS)

- Table 2.1 (Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition) for Industrial/Commercial/Community Property Use (Table 2.1 ICC ESQS)

7.2 Handling of Excess Soil

In support of on-site and excess soil management, an initial chemical testing program was conducted as part of this geotechnical investigation. Five (5) samples were collected and submitted to AGAT Laboratories for analysis of metals and inorganics, Petroleum Hydrocarbons (PHCs) F1 to F4, and Benzene, Toluene, Ethylbenzene and Xylene (BTEX).

The table below outlines a summary of the samples submitted for chemical analysis and all exceedances:

Sample	Table 1	Table 2.1 RPI	Table 2.1 ICC	Exceedance Parameter(s)
BH 1 – SA 1	✓	✓	✓	-
BH 2 – SA 2	✓	✓	✓	-
BH 5 – SA 2	✓	✓	✓	-
BH 7 – SA 1	✓	✓	✓	-
BH 13 – SA 1	✓	✓	✓	-

It is noted that the soil conditions may differ between and beyond the sample locations. If environmentally impacted soil is encountered during construction, the soil should be segregated, stockpiled and CVD should be contacted for further assessment of the impacted soils.

The results and laboratory certificates of chemical analysis provided by AGAT Laboratories of Mississauga are enclosed in Appendix “B”. A comparison of the soil chemistry results to the applicable regulatory standard is included in Appendix “C”.

CVD further recommends that a disposal plan for excess soils be established to manage the quantity, as well as where and how the excess soils can be disposed of off-site.

8.0 CLOSURE

The Limitations of Report, as quoted in Appendix A, is an integral part of this report.

We trust that the information presented in this report is complete within our terms of reference. If there are any further questions concerning this report, please do not hesitate to contact our office.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Chris Sternik, P.Eng.
Geotechnical Engineer

Eric Y. Chung, M. Eng., P.Eng.
Principal Engineer

APPENDIX A

Limitations of Report

APPENDIX "A"

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes and their respective depths may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. CHUNG & VANDER DOELEN ENGINEERING LIMITED accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

APPENDIX B

Soil Chemistry Results (AGAT Laboratories)

AGAT Laboratories

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CLIENT NAME: CHUNG AND VANDER DOELEN
311 VICTORIA STREET NORTH
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(519) 742-8979
ATTENTION TO: Yaroslav Chudin
PROJECT: 1704
AGAT WORK ORDER: 24T121177
SOIL ANALYSIS REVIEWED BY: Chuandi Zhang, Inorganic Supervisor
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
DATE REPORTED: Feb 27, 2024
PAGES (INCLUDING COVER): 10
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. Measurement Uncertainty is not taken into consideration when stating conformity with a specified requirement.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24T121177

PROJECT: 1704

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2024-02-15

DATE REPORTED: 2024-02-27

						SAMPLE DESCRIPTION:	BH1-SA1	BH2-SA2	BH5-SA2	BH7-SA1	BH13-SA1
						SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil
						DATE SAMPLED:	2024-02-12	2024-02-12	2024-02-12	2024-02-12	2024-02-12
Parameter	Unit	G / S: A	G / S: B	G / S: C	RDL		5653357	5653362	5653363	5653364	5653365
Antimony	µg/g	1.3	7.5	40	0.8		<0.8[<A]	<0.8[<A]	<0.8[<A]	<0.8[<A]	<0.8[<A]
Arsenic	µg/g	18	18	18	1		3[<A]	2[<A]	2[<A]	3[<A]	3[<A]
Barium	µg/g	220	390	670	2.0		13.3[<A]	5.3[<A]	5.9[<A]	9.0[<A]	16.9[<A]
Beryllium	µg/g	2.5	4	8	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Boron	µg/g	36	120	120	5		<5[<A]	<5[<A]	<5[<A]	5[<A]	<5[<A]
Boron (Hot Water Soluble)	µg/g	NA	1.5	2	0.10		<0.10[<B]	0.20[<B]	<0.10[<B]	<0.10[<B]	0.19[<B]
Cadmium	µg/g	1.2	1.2	1.9	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Chromium	µg/g	70	160	160	5		13[<A]	<5[<A]	6[<A]	8[<A]	18[<A]
Cobalt	µg/g	21	22	80	0.8		2.7[<A]	1.4[<A]	1.9[<A]	2.2[<A]	3.2[<A]
Copper	µg/g	92	140	230	1.0		3.6[<A]	2.8[<A]	2.1[<A]	5.7[<A]	5.0[<A]
Lead	µg/g	120	120	120	1		6[<A]	2[<A]	2[<A]	2[<A]	9[<A]
Molybdenum	µg/g	2	6.9	40	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Nickel	µg/g	82	100	270	1		6[<A]	4[<A]	5[<A]	6[<A]	7[<A]
Selenium	µg/g	1.5	2.4	5.5	0.8		<0.8[<A]	<0.8[<A]	<0.8[<A]	<0.8[<A]	<0.8[<A]
Silver	µg/g	0.5	20	40	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Thallium	µg/g	1	1	3.3	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Uranium	µg/g	2.5	23	33	0.50		0.56[<A]	<0.50[<A]	<0.50[<A]	<0.50[<A]	0.85[<A]
Vanadium	µg/g	86	86	86	2.0		20.8[<A]	7.5[<A]	10.0[<A]	14.4[<A]	30.2[<A]
Zinc	µg/g	290	340	340	5		17[<A]	6[<A]	7[<A]	10[<A]	28[<A]
Chromium, Hexavalent	µg/g	0.66	8	8	0.2		<0.2[<A]	<0.2[<A]	<0.2[<A]	<0.2[<A]	<0.2[<A]
Cyanide, WAD	µg/g	0.051	0.051	0.051	0.040		<0.040[<A]	<0.040[<A]	<0.040[<A]	<0.040[<A]	<0.040[<A]
Mercury	µg/g	0.27	0.27	0.27	0.10		<0.10[<A]	<0.10[<A]	<0.10[<A]	<0.10[<A]	<0.10[<A]
Electrical Conductivity (2:1)	mS/cm	0.57	0.7	1.4	0.005		0.179[<A]	0.099[<A]	0.118[<A]	0.117[<A]	0.214[<A]
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	2.4	5	12	N/A		0.461[<A]	0.217[<A]	0.209[<A]	0.118[<A]	0.149[<A]
pH, 2:1 CaCl2 Extraction	pH Units				NA		7.62	7.96	7.97	7.76	7.54

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24T121177

PROJECT: 1704

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2024-02-15 **DATE REPORTED: 2024-02-27**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use, B Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - RP, C Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - Com/Ind
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

5653357-5653365 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24T121177

PROJECT: 1704

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2024-02-15

DATE REPORTED: 2024-02-27

						SAMPLE DESCRIPTION:	BH1-SA1	BH2-SA2	BH5-SA2	BH7-SA1	BH13-SA1
						SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil
						DATE SAMPLED:	2024-02-12	2024-02-12	2024-02-12	2024-02-12	2024-02-12
Parameter	**Unit**	**G / S: A**	**G / S: B**	**G / S: C**	**RDL**		**5653357**	**5653362**	**5653363**	**5653364**	**5653365**
Benzene	µg/g	0.02	0.02	0.02	0.02		<0.02[<A]	<0.02[<A]	<0.02[<A]	<0.02[<A]	<0.02[<A]
Toluene	µg/g	0.2	0.2	0.2	0.05		<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
Ethylbenzene	µg/g	0.05		0.05	0.05		<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
m & p-Xylene	µg/g				0.05		<0.05	<0.05	<0.05	<0.05	<0.05
o-Xylene	µg/g				0.05		<0.05	<0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.05	0.091	0.091	0.05		<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
F1 (C6 to C10)	µg/g	25			5		<5[<A]	<5[<A]	<5[<A]	<5[<A]	<5[<A]
F1 (C6 to C10) minus BTEX	µg/g	25	25	25	5		<5[<A]	<5[<A]	<5[<A]	<5[<A]	<5[<A]
F2 (C10 to C16)	µg/g	10	10	26	10		<10[<A]	<10[<A]	<10[<A]	<10[<A]	<10[<A]
F3 (C16 to C34)	µg/g	240	240	240	50		<50[<A]	<50[<A]	<50[<A]	<50[<A]	<50[<A]
F4 (C34 to C50)	µg/g	120	2800	3300	50		<50[<A]	<50[<A]	<50[<A]	<50[<A]	<50[<A]
Gravimetric Heavy Hydrocarbons	µg/g	120			50		NA[B]	NA[B]	NA[B]	NA[B]	NA[B]
Moisture Content	%				0.1		17.0	15.3	18.6	11.9	13.8
Surrogate	**Unit**	**Acceptable Limits**									
Toluene-d8	% Recovery	60-140					100	92	99	98	100
Terphenyl	%	60-140					88	92	105	85	90

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 24T121177

PROJECT: 1704

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2024-02-15 **DATE REPORTED: 2024-02-27**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use, B Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - RP, C Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - Com/Ind
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

5653357-5653365 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

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Quality Assurance

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 24T121177

PROJECT: 1704

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

Soil Analysis

RPT Date: Feb 27, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	5650637		<0.8	<0.8	NA	< 0.8	118%	70%	130%	97%	80%	120%	100%	70%	130%
Arsenic	5650637		8	8	0.0%	< 1	126%	70%	130%	96%	80%	120%	99%	70%	130%
Barium	5650637		209	196	6.4%	< 2.0	104%	70%	130%	92%	80%	120%	92%	70%	130%
Beryllium	5650637		2.6	2.4	NA	< 0.5	81%	70%	130%	99%	80%	120%	89%	70%	130%
Boron	5650637		26	24	NA	< 5	74%	70%	130%	100%	80%	120%	79%	70%	130%
Boron (Hot Water Soluble)	5645152		<0.10	0.10	NA	< 0.10	88%	60%	140%	103%	70%	130%	93%	60%	140%
Cadmium	5650637		1.0	1.0	NA	< 0.5	108%	70%	130%	106%	80%	120%	98%	70%	130%
Chromium	5650637		16	15	NA	< 5	97%	70%	130%	104%	80%	120%	99%	70%	130%
Cobalt	5650637		5.5	5.3	3.7%	< 0.8	104%	70%	130%	95%	80%	120%	93%	70%	130%
Copper	5650637		15.2	16.5	8.2%	< 1.0	100%	70%	130%	103%	80%	120%	89%	70%	130%
Lead	5650637		74	72	2.7%	< 1	115%	70%	130%	102%	80%	120%	100%	70%	130%
Molybdenum	5650637		1.2	1.2	NA	< 0.5	118%	70%	130%	108%	80%	120%	120%	70%	130%
Nickel	5650637		13	13	0.0%	< 1	104%	70%	130%	94%	80%	120%	90%	70%	130%
Selenium	5650637		1.4	1.6	NA	< 0.8	125%	70%	130%	95%	80%	120%	97%	70%	130%
Silver	5650637		<0.5	<0.5	NA	< 0.5	111%	70%	130%	97%	80%	120%	94%	70%	130%
Thallium	5650637		<0.5	<0.5	NA	< 0.5	97%	70%	130%	95%	80%	120%	96%	70%	130%
Uranium	5650637		1.70	1.60	NA	< 0.50	122%	70%	130%	110%	80%	120%	116%	70%	130%
Vanadium	5650637		21.7	20.7	4.7%	< 2.0	109%	70%	130%	103%	80%	120%	101%	70%	130%
Zinc	5650637		322	366	12.8%	< 5	112%	70%	130%	98%	80%	120%	91%	70%	130%
Chromium, Hexavalent	5653357	5653357	<0.2	<0.2	NA	< 0.2	97%	70%	130%	91%	80%	120%	72%	70%	130%
Cyanide, WAD	5653465		<0.040	<0.040	NA	< 0.040	100%	70%	130%	100%	80%	120%	104%	70%	130%
Mercury	5650637		<0.10	<0.10	NA	< 0.10	128%	70%	130%	100%	80%	120%	107%	70%	130%
Electrical Conductivity (2:1)	5642722		0.353	0.334	5.5%	< 0.005	109%	80%	120%						
Sodium Adsorption Ratio (2:1) (Calc.)	5651370		0.273	0.235	15.0%										
pH, 2:1 CaCl2 Extraction	5667527		7.11	6.89	3.2%		100%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

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AGAT Laboratories

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Quality Assurance

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 24T121177

PROJECT: 1704

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

Trace Organics Analysis

RPT Date: Feb 27, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
Benzene	5656221		<0.02	<0.02	NA	< 0.02	90%	60%	140%	110%	60%	140%	107%	60%	140%
Toluene	5656221		<0.05	<0.05	NA	< 0.05	92%	60%	140%	101%	60%	140%	108%	60%	140%
Ethylbenzene	5656221		<0.05	<0.05	NA	< 0.05	109%	60%	140%	80%	60%	140%	103%	60%	140%
m & p-Xylene	5656221		<0.05	<0.05	NA	< 0.05	108%	60%	140%	81%	60%	140%	96%	60%	140%
o-Xylene	5656221		<0.05	<0.05	NA	< 0.05	105%	60%	140%	83%	60%	140%	91%	60%	140%
F1 (C6 to C10)	5656221		<5	<5	NA	< 5	103%	60%	140%	91%	60%	140%	91%	60%	140%
F2 (C10 to C16)	5653364	5653364	< 10	< 10	NA	< 10	119%	60%	140%	82%	60%	140%	104%	60%	140%
F3 (C16 to C34)	5653364	5653364	< 50	< 50	NA	< 50	120%	60%	140%	89%	60%	140%	116%	60%	140%
F4 (C34 to C50)	5653364	5653364	< 50	< 50	NA	< 50	96%	60%	140%	64%	60%	140%	92%	60%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

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http://www.agatlabs.com

Method Summary

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 24T121177

PROJECT: 1704

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	SEGMENTED FLOW ANALYSIS
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE

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Method Summary

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 24T121177

PROJECT: 1704

ATTENTION TO: Yaroslav Chudin

SAMPLING SITE:351 1st Avenue N, Chesley, Ontario

SAMPLED BY:YC

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Toluene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Ethylbenzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
m & p-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
o-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Xylenes (Total)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
F1 (C6 to C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	P&T GC/FID
Toluene-d8	VOL-91-5009	modified from EPA SW-846 5030C & 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

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GAT Laboratories

Have feedback? Scan here for a quick survey!

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Mississauga, Ontario L4Z 1Y2
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webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 24T121177

Cooler Quantity: 1 med

Arrival Temperatures: 4.3 | 4.1 | 4.0

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: loose ice

Report Information:

Company: Chung & Vander Doelen Engineering Ltd.
Contact:
Address: 1311 Victoria St. N, Kitchener, ON
Phone: Fax:
Reports to be sent to:
1. Email: joel.rudd@cvdengineering.com
2. Email: yaroslav.chudin@cvdengineering.com

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04 — Table: T1 PRIICC (Indicate One) — ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine

☑ Regulation 406 — Table: T2.1 PRI/IC (Indicate One)
☐ Regulation 558
☐ CCME

☐ Sewer Use ☐ Sanitary ☐ Storm — Region
☐ Prov. Water Quality Objectives (PWQO)
☐ Other — Indicate One

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 1704
Site Location: 351 1st Avenue N, Chesley, Ontario
Sampled By: YC
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: Chung & Vander Doelen Engineering Ltd.
Contact:
Address: 1311 Victoria St. N, Kitchener, ON
Email: ap@cvdengineering.com

Sample Matrix Legend

GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	VOC	PAHs	PCBs	PCBs: Aroclors ☐	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Regulation 406 SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Regulation 406 Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: ☐ Moisture ☐ Sulphide	Potentially Hazardous or High Concentration (Y/N)
1. BH1 - SA1	FEB 12, 202	AM PM	3	S			☑		☑									
2. BH2 - SA2	FEB 12, 202	AM PM	3	S			☑		☑									
3. BH5 - SA2	FEB 12, 202	AM PM	3	S			☑		☑									
4. BH7 - SA1	FEB 13, 202	AM PM	3	S			☑		☑									
5. BH13 - SA1	FEB 13, 202	AM PM	3	S			☑		☑									
6.		AM PM																
7.		AM PM																
8.		AM PM																
9.		AM PM																
10.		AM PM																
11.		AM PM																

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Joel Rudd	Feb 15, 2024	12:00 PM		Feb 15	4:15pm
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page _____ of _____

No:

APPENDIX C

Comparison of the Soil Chemistry Results to the Applicable Regulatory Criteria

ANALYTICAL RESULTS FOR SOIL

Ontario Regulation 406/19 (as amended) - Excess Soil Quality Standards

		T1 RPIICC[1]	T2.1 RPI[2]	T2.1 ICC[3]	BH 1 - SA 1	BH 2 - SA 2	BH 5 - SA 2	BH 7 - SA 1	BH 13 - SA 1
Metals & Inorganics	Antimony (Sb)	1.3	7.5	40	<0.8	<0.8	<0.8	<0.8	<0.8
	Arsenic (As)	18	18	18	3	2	2	3	3
	Barium (Ba)	220	390	670	13.3	5.3	5.9	9	16.9
	Beryllium (Be)	2.5	4	8	<0.5	<0.5	<0.5	<0.5	<0.5
	Boron (B)	36	120	120	<5	<5	<5	5	<5
	Boron, Hot Water Soluble	-	1.5	2	<0.10	0.2	<0.10	<0.10	0.19
	Cadmium (Cd)	1.2	1.2	1.9	<0.5	<0.5	<0.5	<0.5	<0.5
	Chromium (Cr)	70	160	160	13	<5	6	8	18
	Cobalt (Co)	21	22	80	2.7	1.4	1.9	2.2	3.2
	Copper (Cu)	92	140	230	3.6	2.8	2.1	5.7	5
	Lead (Pb)	120	120	120	6	2	2	2	9
	Molybdenum (Mo)	2	6.9	40	<0.5	<0.5	<0.5	<0.5	<0.5
	Nickel (Ni)	82	100	270	6	4	5	6	7
	Selenium (Se)	1.5	2.4	5.5	<0.8	<0.8	<0.8	<0.8	<0.8
	Silver (Ag)	0.5	20	40	<0.5	<0.5	<0.5	<0.5	<0.5
	Thallium (Tl)	1	1	3.3	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	2.5	23	33	0.56	<0.50	<0.50	<0.50	0.85
	Vanadium (V)	86	86	86	20.8	7.5	10	14.4	30.2
	Zinc (Zn)	290	340	340	17	6	7	10	28
	Chromium, Hexavalent - Cr(VI)	0.66	8	8	<0.2	<0.2	<0.2	<0.2	<0.2
	Cyanide	0.051	0.051	0.051	<0.040	<0.040	<0.040	<0.040	<0.040
	Mercury (Hg)	0.27	0.27	0.27	<0.10	<0.10	<0.10	<0.10	<0.10
	Electrical Conductivity (EC)	0.57	0.7	1.4	0.179	0.099	0.118	0.117	0.214
	Sodium Adsorption Ratio (SAR)	2.4	5	12	0.461	0.217	0.209	0.118	0.149
	pH	-	-	-	7.62	7.96	7.97	7.76	7.54
BTEX	Benzene	0.02	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Ethylbenzene	0.05	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Toluene	0.2	0.2	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
	Xylenes (Total)	0.05	0.091	0.091	<0.05	<0.05	<0.05	<0.05	<0.05
Petroleum Hydrocarbons (F1-F4)	F1 (C6-C10)	25	25	25	<5	<5	<5	<5	<5
	F2 (C10-C16)	10	10	26	<10	<10	<10	<10	<10
	F3 (C16-C34)	240	240	240	<50	<50	<50	<50	<50
	F4 (C34-C50)	120	2800	3300	<50	<50	<50	<50	<50

NOTES:

[1] Table 1: Full Depth Background Site Condition Standards for Residential / Parkland / Institutional / Industrial / Commercial / Community Uses

[2] Table 2.1: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition (Volume Independent) for Residential / Parkland / Institutional Uses

[3] Table 2.1: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition (Volume Independent) for Industrial / Commercial / Community Uses

1. Units = ug/g (exluding pH/EC/SAR)

2."-" = Parameter not included in chemical analysis

3. Test results exceed Table 1 RPIICC ESQS

4. Test results exceed Table 2.1 RPI ESQS

5. Test results exceed Table 2.1 ICC ESQS

APPENDIX D

Well Response Test Analysis Charts

CHUNG & VANDER DOELEN
ENGINEERING LTD.
311 Victoria Street North
Kitchener / Ontario / N2H 5E1
519-742-8979

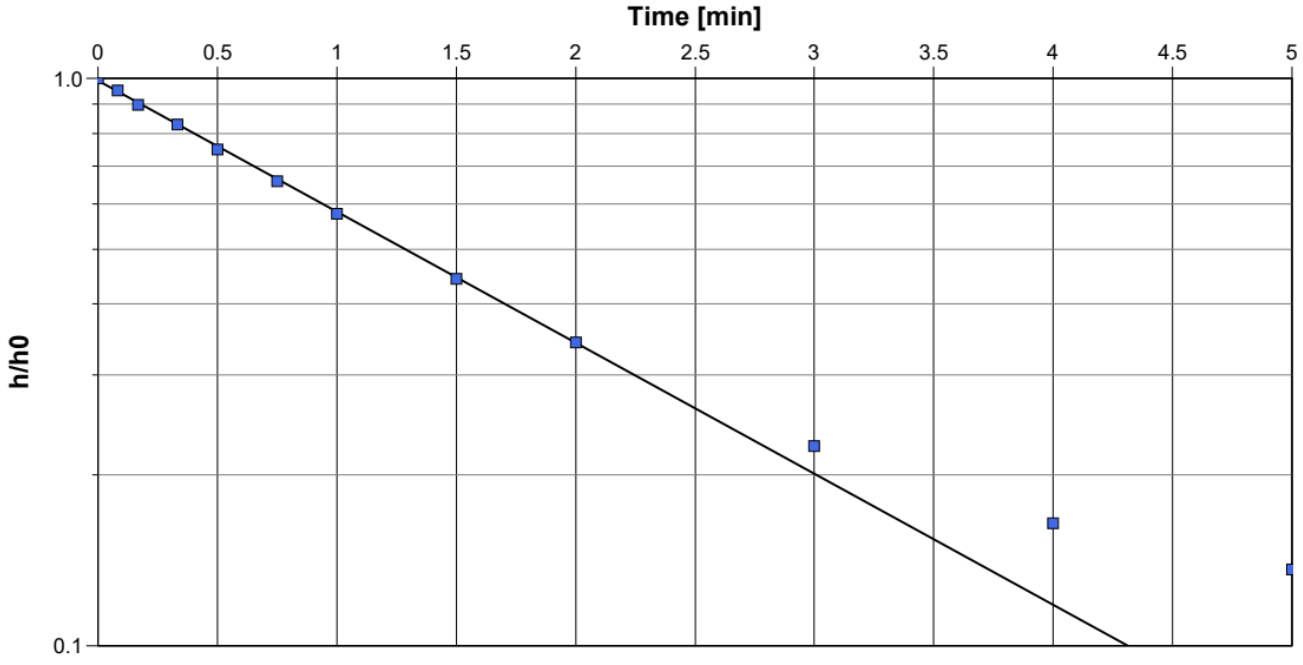
Project: Proposed New School

Number: 1704

Client: Bluewater District School Board

Location: Waterloo Street and Concession Road 10, Port Elgin, ON		Response Test: BH 9
Test Conducted by: Y.C.	Test Date: 2024-03-15	Aquifer Thickness: 2.0 m
Water level at t=0 [m]: 2.52	Static Water Level [m]: 1.03	Water level change at t=0 [m]: 1.49

	Time [min]	Water Level [m]	WL Change [m]
1	0	2.52	1.49
2	0.0833	2.45	1.42
3	0.1667	2.37	1.34
4	0.3333	2.265	1.235
5	0.5	2.145	1.115
6	0.75	2.01	0.98
7	1	1.89	0.86
8	1.5	1.69	0.66
9	2	1.54	0.51
10	3	1.365	0.335
11	4	1.275	0.245
12	5	1.233	0.203



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH 9	5.93×10^{-6}	

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Project: Proposed New School

Number: 1704

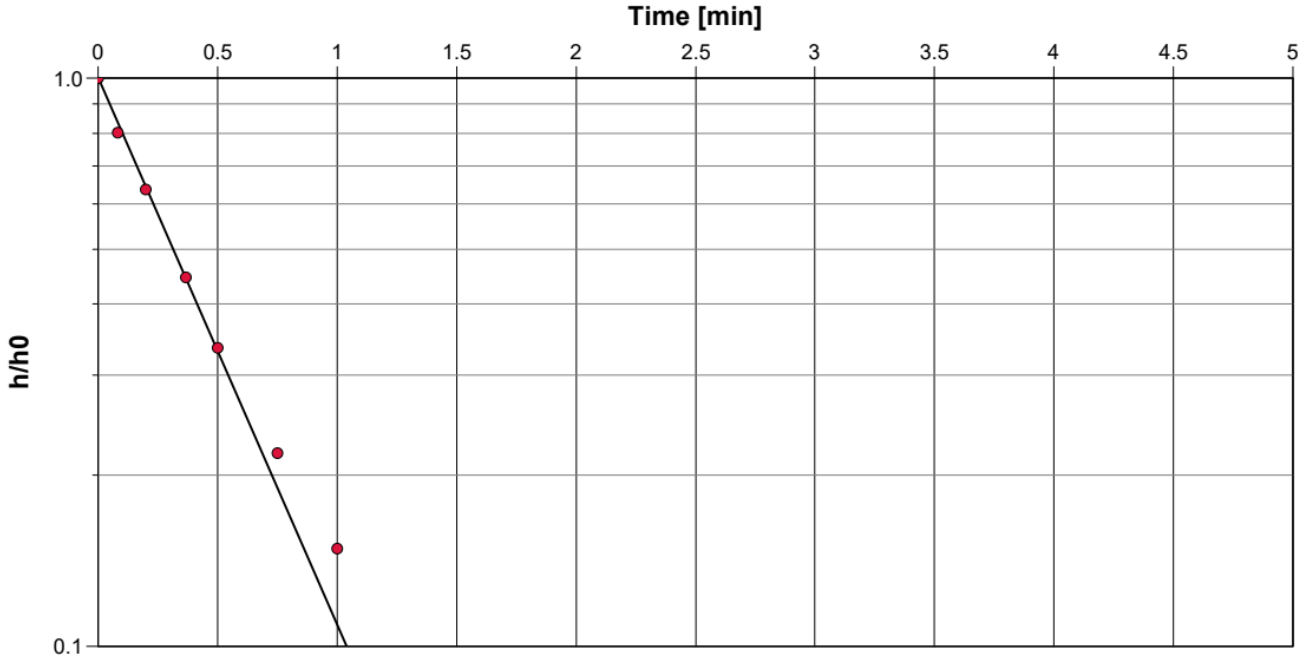
Client: Bluewater District School Board

Location: Waterloo Street and Concession Road 10, Port Elgin, ON | Response Test: BH 11

Test Conducted by: Y.C. | Test Date: 2024-03-15 | Aquifer Thickness: 2.20 m

Water level at t=0 [m]: 2.17 | Static Water Level [m]: 0.96 | Water level change at t=0 [m]: 1.21

	Time [min]	Water Level [m]	WL Change [m]
1	0	2.17	1.21
2	0.0833	1.93	0.97
3	0.2	1.73	0.77
4	0.3667	1.50	0.54
5	0.5	1.365	0.405
6	0.75	1.225	0.265
7	1	1.14	0.18
8	1.5	1.07	0.11
9	2	1.048	0.088
10	3	1.03	0.07



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH 11	2.66×10^{-5}	

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Project: Proposed New School

Number: 1704

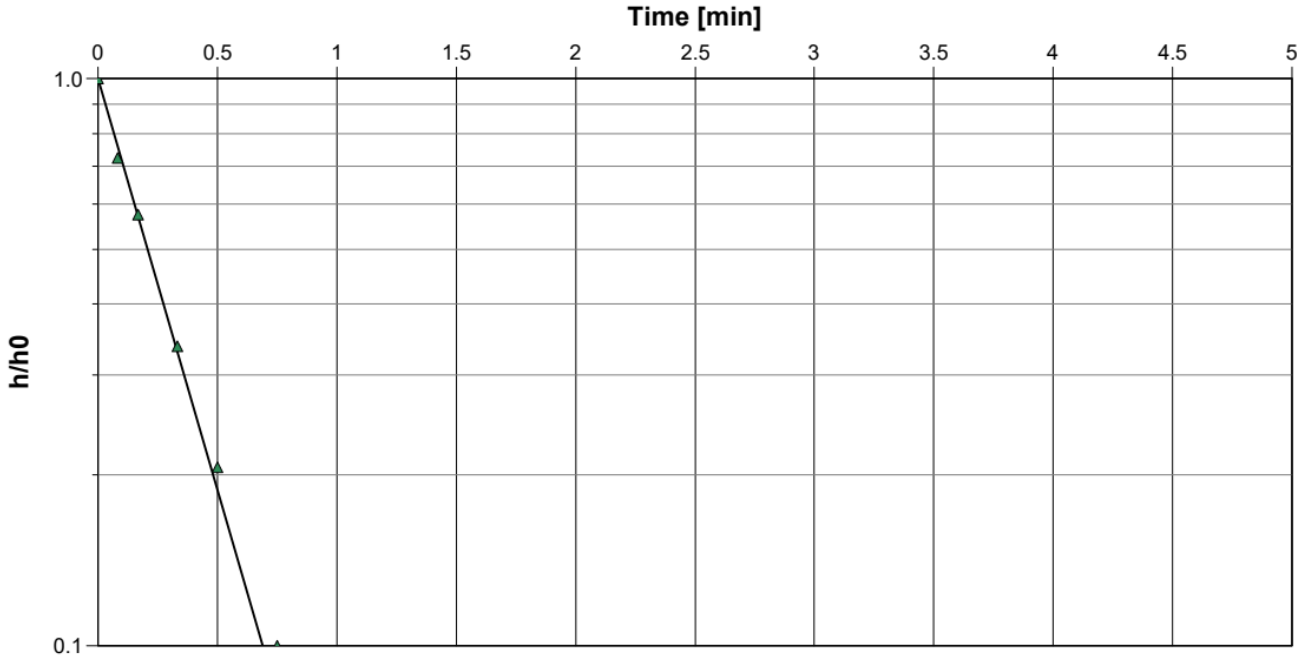
Client: Bluewater District School Board

Location: Waterloo Street and Concession Road 10, Port Elgin, ON | Response Test: BH 13

Test Conducted by: Y.C. | Test Date: 2024-03-15 | Aquifer Thickness: 1.80 m

Water level at t=0 [m]: 2.24 | Static Water Level [m]: 1.44 | Water level change at t=0 [m]: 0.80

	Time [min]	Water Level [m]	WL Change [m]
1	0	2.24	0.80
2	0.0833	2.02	0.58
3	0.1667	1.90	0.46
4	0.3333	1.71	0.27
5	0.5	1.605	0.165
6	0.75	1.52	0.08
7	1	1.49	0.05
8	1.5	1.458	0.018
9	2	1.449	0.009



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH 13	3.60×10^{-5}	

ENCLOSURES

Soil Abbreviations and Terms Used on Record of Borehole Sheets

TERMINOLOGY DESCRIBING COMMON SOIL TYPES:

Topsoil	-	mixture of soil and humus capable of supporting vegetation
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	soil materials identified as being placed anthropologically

CLASSIFICATION (UNIFIED SYSTEM)

Clay	<0.002mm		
Silt	0.002 to .075mm		
Sand	0.075 to 4.75mm		
		Fine	0.075 to 0.425 mm
		Medium	0.425 to 2.0 mm
		Coarse	2.0 to 4.75 mm
Gravel	4.75 to 75mm		
		Fine	4.75 to 19 mm
		Coarse	19 to 75 mm
Cobbles	75 to 300mm		
Boulders	>300mm		

TERMINOLOGY

Soil Composition	**% by Weight**
"traces"	<10%
"some"(eg. some silt)	10-20%
Adjective (eg. sandy)	20-35%
"and"(eg. sand and gravel)	35-50%

Standard Penetration Resistance (SPT): Standard Penetration Resistance ('N' Values) refers to the number of blows required to advance a standard (ASTM D1586) 51 mm Ø (2 inch) split-spoon sampler by the use of a free falling, 63.5 Kg (140lbs) hammer. The number of blows from the drop weight is recorded for every 15 cm (6 inches). The hammer is dropped from a distance of 0.76m (30 inches) providing 474.5 Joules per blow. When the sampler is driven a total of 45 cm (18 inches) into the soil, the standard penetration index ('N' Value) is the total number of blows for the last 30 cm (12 inches).

Dynamic Cone Penetration Resistance (DCPT): Dynamic Cone Penetration Resistance is similar to a SPT with the 474.5 Joule/blow impulse provided by the free falling hammer where the split-spoon sampler is replaced by a 51 mm Ø, 60˚ conical point and the number of blows is recorded continuously for every 30 cm (12 inches).

COHESIVE SOILS CONSISTENCY

	(kPa)	**(P.S.F.)**	**Nominal 'N' Value**
Very Soft	<12	<250	0-2
Soft	12-25	250-500	2-4
Firm	25-50	500-1000	4-8
Stiff	50-100	1000-2000	8-15
Very Stiff	100-200	2000-4000	15-30
Hard	>200	>4000	>30

RELATIVE DENSITY OF COHESIONLESS SOIL

	'N' Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

MOISTURE CONDITIONS:

Cohesive Soil
DTPL- Drier than plastic limit
APL- About plastic limit
WTPL- Wetter than plastic limit
MWTPL- Much wetter than plastic limit

Cohesionless Soil
Damp
Moist
Wet
Saturated

SAMPLE TYPES AND ADDITIONAL FIELD TESTS

SS	Split Spoon Sample (obtained from SPT)	**GS**	Grab Sample	**PP**	Pocket Penetrometer
		BS	Bulk Sample	**VANE**	Peak & Remolded shear
AS	Auger Sample	**TW**	Thin Wall Sample or Shelby Tube	**DMT**	Flat Plate Dilatometer

LABORATORY TESTS

SG	Specific Gravity	**S**	Sieve Analysis	**W**	Water Content
H	Hydrometer	**P**	Field Permeability	**K**	Lab Permeability
W_p	Plastic Limit	**W_l**	Liquid Limit	**I_p**	Plasticity Index
GSA	Grain Size Analysis	**C**	Consolidation	**UNC**	Unconfined compression

Enclosure No.: 1
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 1

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
	Ground Elevation: **199.18 m**					
199.03	150 mm TOPSOIL					
0.15	loose to compact brown SILTY SAND occ. clay seams moist to saturated	0.5		1	SS	6
		1.0		2	SS	12
197.53		1.5				
1.65	stiff, grey CLAYEY SILT, trace sand APL	2.0		3	SS	11
196.98						
2.20	loose, grey SAND some silt, occ. clay seams saturated	2.5		4	SS	6
196.28						
2.90	very stiff, grey CLAYEY SILT, some sand APL	3.0		5	SS	22
195.73						
3.45	loose, grey SAND trace to some silt saturated	3.5				
		4.0				
		4.5		6	SS	8
194.15						
5.03	End of Borehole	5.0				
		5.5				
		6.0				
		6.5				
		7.0				
		7.5				
		8.0				
		8.5				
		9.0				
		9.5				

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

Cave-in at 0.6 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **CS**

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FILE No: 1704

BOREHOLE No. 2

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**

SOIL LITHOLOGY

Ground Elevation: **199.04 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL
198.89 / 0.15	150 mm TOPSOIL		
	firm to very stiff brown to grey CLEYEY SILT trace to some sand occ. to freq. sand and silt seams APL to DTPL	0.5 – 2.5	
196.14 / 2.90	compact, grey SAND trace to some silt, trace gravel occ. clay seams saturated	3.0 – 4.0	
194.77 / 4.27	End of Borehole	4.5 – 9.5	

SAMPLE

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

SAMPLE ID	TYPE	N-VALUE
1	SS	8
2	SS	10
3	SS	15
4	SS	7
5	SS	18
6	SS	25

WELL DATA

DEPTH (m)

REMARKS

Water level at 1.2 m bgs upon withdrawal of drilling augers
Cave-in at 1.5 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **CS**

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Enclosure No.: 3
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 3

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

Ground Elevation: **199.08 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
198.93	150 mm TOPSOIL	0					
0.15	loose to compact brown SILTY SAND occ. clay seams moist to saturated	0.5	1	SS	7		
		1.0	2	SS	11		
197.68	very stiff, brown CLAYEY SILT, trace sand APL	1.5	3	SS	20	▽	Cave-in and water level measured at 1.5 m bgs upon withdrawal of drilling augers
197.10	End of Borehole Start of DCPT	2.0					
1.98		2.5					
		3.0					Dynamic cone penetration test (DCPT) conducted between 2.13 and 4.88 m bgs
		3.5					
		4.0					
194.20	End of DCPT	4.5					
4.88		5.0					
		5.5					
		6.0					
		6.5					
		7.0					
		7.5					
		8.0					
		8.5					
		9.0					
		9.5					

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

PROJECT MANAGER: **CS**

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FILE No: 1704

BOREHOLE No. 4

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
	Ground Elevation: **199.15 m**					
198.90	250 mm TOPSOIL					
0.25	loose to compact brown SILTY SAND occ. clay seams moist to saturated	0.5		1	SS	5
		1.0		2	SS	11
197.75						
1.40	stiff, brown CLAYEY SILT, trace sand APL	1.5		3	SS	11
197.17		2.0				
1.98	End of Borehole Start of DCPT	2.5				
		3.0				
		3.5				
		4.0				
		4.5				
194.27						
4.88	End of DCPT	5.0				
		5.5				
		6.0				
		6.5				
		7.0				
		7.5				
		8.0				
		8.5				
		9.0				
		9.5				

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

REMARKS

- Cave-in and water level measured at 1.5 m bgs upon withdrawal of drilling augers
- Dynamic cone penetration test (DCPT) conducted between 2.13 and 4.88 m bgs

PROJECT MANAGER: **CS**

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FILE No: 1704

BOREHOLE No. 5

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**

Ground Elevation: **199.05 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE
198.80	250 mm TOPSOIL				
0.25	loose brown SILTY SAND moist to wet	0.5	1	SS	6
		1.0	2	SS	8
197.65					
1.40	compact grey SAND trace to some silt occ. clay seams saturated	1.5	3	SS	12
		2.0			
		2.5	4	SS	13
		3.0			
		3.5	5	SS	25
		4.0			
		4.5			
194.02			7	SS	12
5.03	End of Borehole	5.0			
		5.5			
		6.0			
		6.5			
		7.0			
		7.5			
		8.0			
		8.5			
		9.0			
		9.5			

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

REMARKS

Water level at 1.5 m bgs upon withdrawal of drilling augers
Cave-in at 1.85 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **CS**

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CVD BOREHOLE (2017) 1704 -WATERLOO STREET PORT ELGIN.GPJ CVD_ENG.GDT 5-14-24

FILE No: 1704

BOREHOLE No. 6

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
	Ground Elevation: **199.14 m**					
198.99	150 mm TOPSOIL	0				
0.15	loose to compact brown SILTY SAND trace gravel occ. clay seams moist to saturated	0.5		1	SS	6
		1.0		2	SS	6
		1.5		3	SS	15
		2.0				
		2.5		4	SS	12
196.24		3.0				
2.90	compact, brown SAND, trace silt saturated	3.5		5	SS	16
195.48		4.0				
3.66	End of Borehole	4.5				
	Start of DCPT	5.0				
		5.5				
		6.0				
192.74		6.5				
6.40	End of DCPT	7.0				
		7.5				
		8.0				
		8.5				
		9.0				
		9.5				

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- Cave-in and water level measured at 1.5 m bgs upon withdrawal of drilling augers
- Dynamic cone penetration test (DCPT) conducted between 4.55 and 6.4 m bgs

PROJECT MANAGER: **CS**

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FILE No: 1704

BOREHOLE No. 7

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

ELEV./ DEPTH (m)	DESCRIPTION (Ground Elevation: **199.23 m**)	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
199.03	200 mm TOPSOIL					
0.20	loose, brown SILTY SAND moist	0.5		1	SS	6
198.53						
0.70	compact brown SAND trace to some silt occ. clay seams moist to saturated	1.0		2	SS	13
		1.5		3	SS	14
		2.0				
		2.5		4	SS	11
		3.0				
195.83				5	SS	15
3.40	compact, brown SANDY SILT occ. clay seams saturated	3.5				
195.13		4.0				
4.10	compact brown SAND trace silt saturated	4.5		6	SS	19
194.20		5.0				
5.03	End of Borehole					

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

1.5 — Cave-in and water level measured at 1.5 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **CS**

CHUNG & VANDER DOELEN ENGINEERING LTD.
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Kitchener, Ontario N2H 5E1
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Enclosure No.: 8
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 8

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

Ground Elevation: **199.28 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE
199.08	200 mm TOPSOIL				
0.20	loose, dark brown SILTY SAND, moist		1	SS	6
198.68		0.5			
0.60	loose to compact brown SILTY SAND occ. to freq. clay seams moist to saturated	1.0	2	SS	14
		1.5	3	SS	9
197.13		2.0			
2.15	compact grey SAND trace to some silt occ. to freq. clay seams saturated	2.5	4	SS	11
		3.0	5	SS	19
		3.5			
		4.0	6	SS	19
194.86					
4.42	End of Borehole Start of DCPT	4.5			
		5.0			
		5.5			
193.18		6.0			
6.10	End of DCPT	6.5			
		7.0			
		7.5			
		8.0			
		8.5			
		9.0			
		9.5			

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- Cave-in and water level measured at 1.5 m bgs upon withdrawal of drilling augers
- Dynamic cone penetration test (DCPT) conducted between 4.57 and 6.1 m bgs

PROJECT MANAGER: **CS**

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FILE No: 1704

BOREHOLE No. 9

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

SOIL LITHOLOGY

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL
	Ground Elevation: **199.28 m**		
199.08	200 mm TOPSOIL		
0.20	loose to compact brown SILTY SAND occ. clay seams moist to saturated	0.5	
		1.0	
197.93			
1.35	very stiff brown CLAYEY SILT trace sand, occ. silt seams ATPL	1.5	
197.13			
2.15	compact brown SAND trace to some silt occ. clay seams saturated	2.0	
		2.5	
		3.0	
		3.5	
195.62			
3.66	End of Borehole Start of DCPT	4.0	
		4.5	
194.40			
4.88	End of DCPT	5.0	
		5.5	
		6.0	
		6.5	
		7.0	
		7.5	
		8.0	
		8.5	
		9.0	
		9.5	

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	5
2	SS	13
3	SS	16
4	SS	10
5	SS	10

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- Steel monument casing set in concrete
- 50 mm I.D. PVC riser with bentonite seal
- Water level in well measured at 1.03 m bgs on March 15, 2024
- 1.5 m long, 50 mm I.D. slotted screen with sand pack
- Dynamic cone penetration test (DCPT) conducted between 3.66 and 4.88 m bgs

PROJECT MANAGER: **CS**

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CVD BOREHOLE (2017) 1704 -WATERLOO STREET PORT ELGIN.GPJ CVD_ENG.GDT 5-14-24

Enclosure No.: 10
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 10

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
	Ground Elevation: **199.32 m**					
199.12	200 mm TOPSOIL					
0.20	loose to compact brown SILTY SAND freq. clay seams moist to saturated	0.5		1	SS	6
		1.0		2	SS	10
		1.5		3	SS	14
197.17		2.0				
2.15	compact grey SAND trace to some silt occ. clay seams saturated	2.5		4	SS	12
		3.0		5	SS	16
		3.5				
		4.0				
		4.5		6	SS	11
194.14		5.0				
5.18	End of Borehole					

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

REMARKS

- Water level measured at 1.2 m bgs upon withdrawal of drilling augers
- Cave-in measured at 2.15 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **CS**

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Enclosure No.: 11
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 11

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
	Ground Elevation: **198.92 m**							
198.72 0.20	200 mm TOPSOIL							
	loose to compact SILTY SAND trace clay occ. to freq. clay seams occ. silt seams moist to saturated	0.5 1.0 1.5 2.0		1 2 3	SS SS SS	6 15 15		Steel monument casing set in concrete 50 mm I.D. PVC riser with bentonite seal Water level in well measured at 0.96 m bgs on March 15, 2024
196.72 2.20	comapct brown SAND trace to some silt occ. clay seams saturated	2.5 3.0		4 5	SS SS	13 13		1.5 m long, 50 mm I.D. screen with sand pack
195.41 3.51	End of Borehole	3.5						

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

PROJECT MANAGER: **CS**

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FILE No: 1704

BOREHOLE No. 12

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**

SOIL LITHOLOGY

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL
	Ground Elevation: **198.97 m**		
198.77 / 0.20	200 mm TOPSOIL		
	loose to compact SILTY SAND trace clay occ. clay seams moist to saturated	0.5 – 2.5	
196.07 / 2.90	loose, brown SAND, trace silt saturated	3.0	
195.46 / 3.51	End of Borehole	3.5	

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	11
2	SS	27
3	SS	9
4	SS	18
5	SS	5

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

Cave-in and water level measured at 1.2 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **CS**

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Enclosure No.: 13
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 13

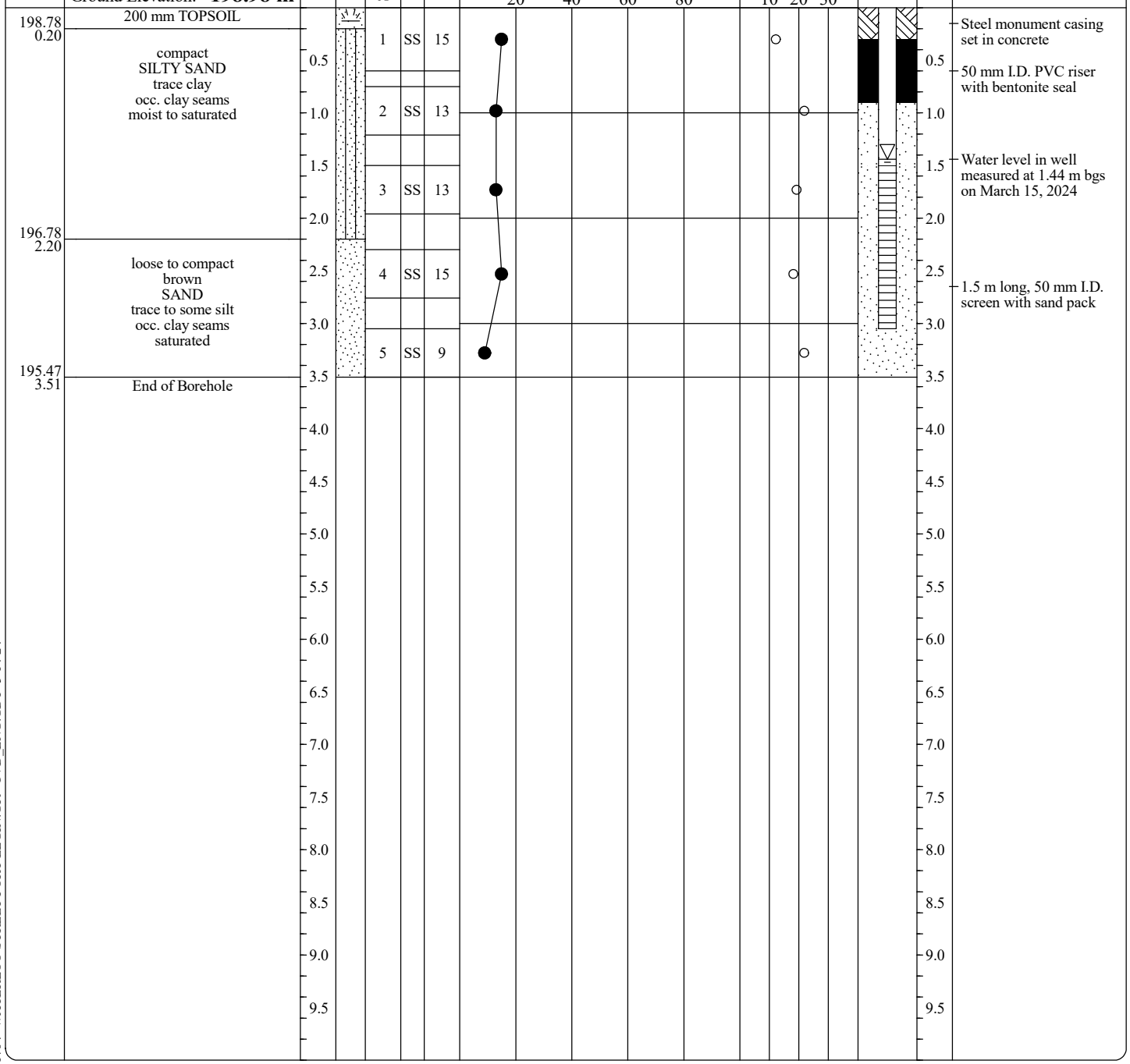
Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 12 - 24** TO **Feb 12 - 24**



PROJECT MANAGER: **CS**

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CVD BOREHOLE (2017) 1704 -WATERLOO STREET PORT ELGIN.GPJ CVD_ENG.GDT 5-14-24

Enclosure No.: 14
Sheet 1 of 1

FILE No: 1704

BOREHOLE No. 14

Client: **Bluewater District School Board**

Project: **Proposed New School**

Location: **Waterloo Street & Concession Road 10, Port Elgin, Ontario**

EQUIPMENT DATA

Machine: **D. D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Feb 13 - 24** TO **Feb 13 - 24**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	SHEAR STRENGTH (kPa) / PENETRATION RESISTANCE	WATER CONTENT (%)	WELL DATA	DEPTH (m)	REMARKS
	Ground Elevation: **199.60 m**						FIELD VANE: Peak ⊗ Rem. ×; LAB TEST: Unc. ■ P.P. □; 50 100 150 200; STANDARD ● DYN. CONE ○; 20 40 60 80	W_P W W_L; 10 20 30			
199.40	200 mm TOPSOIL										
0.20	loose to compact SILTY SAND moist to saturated	0.5								0.5	
		1.0		1	SS	7				1.0	
		1.5							▽	1.5	Cave-in and water level measured at 1.5 m bgs upon withdrawal of drilling augers
				2	SS	10					
197.62		2.0								2.0	
1.98	End of Borehole Start of DCPT										Dynamic cone penetration test (DCPT) conducted between 2.13 and 3.35 m bgs
		2.5								2.5	
		3.0								3.0	
196.25											
3.35	End of DCPT	3.5								3.5	
		4.0								4.0	
		4.5								4.5	
		5.0								5.0	
		5.5								5.5	
		6.0								6.0	
		6.5								6.5	
		7.0								7.0	
		7.5								7.5	
		8.0								8.0	
		8.5								8.5	
		9.0								9.0	
		9.5								9.5	

PROJECT MANAGER: **CS**

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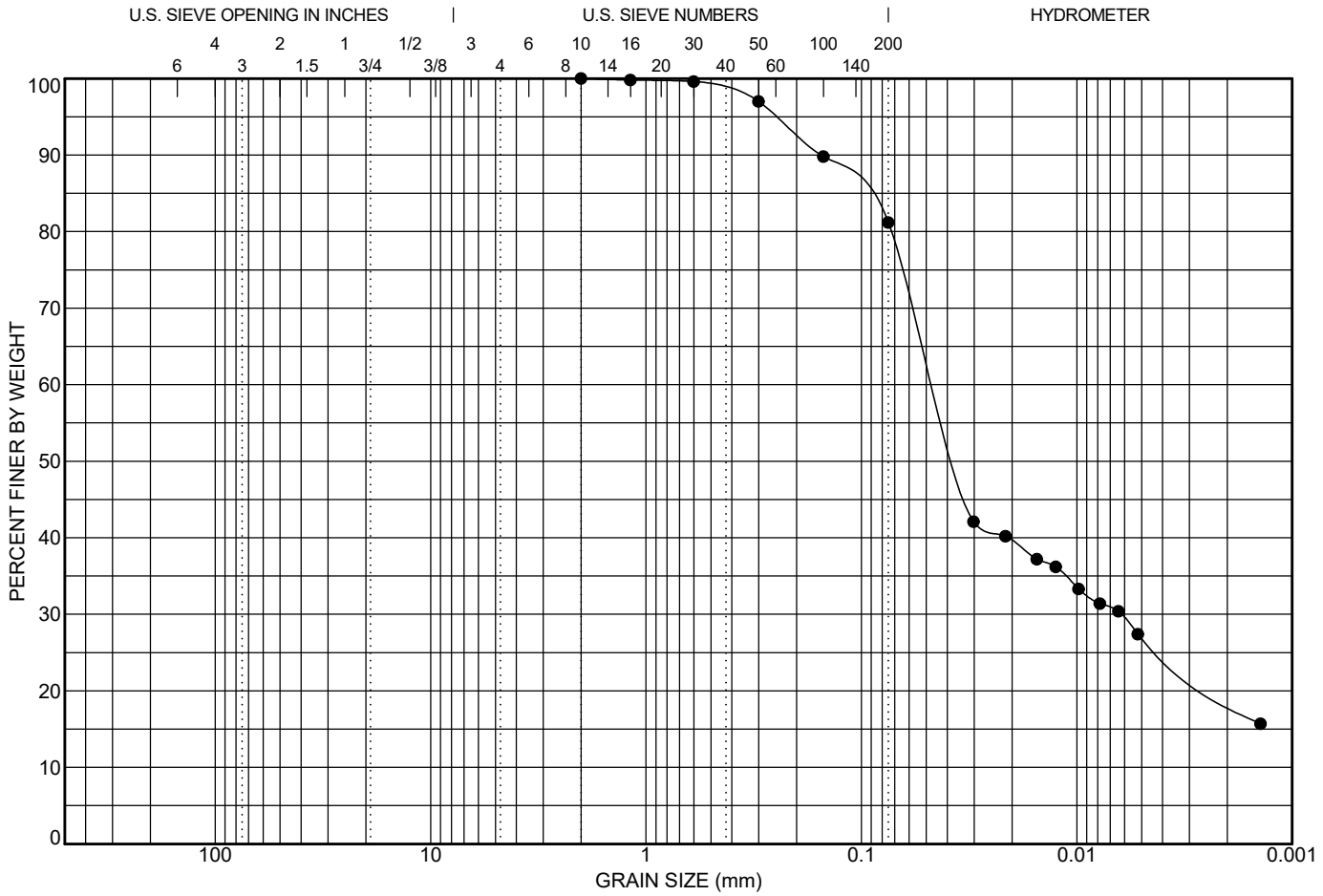
CVD BOREHOLE (2017) 1704 -WATERLOO STREET PORT ELGIN.GPJ CVD_ENG.GDT 5-14-24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
					2	0.046	0.006		0.0	18.8	81.2	

Date: May. 08 - 2024
Client: Bluewater District School Board
Contractor:
Source:
Sampled From: BH1 - SA5; 3.05 to 3.51 m depth
Sample No.: 1-5
Date Sampled: Feb. 12 - 2024
Sampled By: YC
Lab No.: 212
Date Tested: Mar. 25 - 2024
Type of Material: Clayey Silt, some sand

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

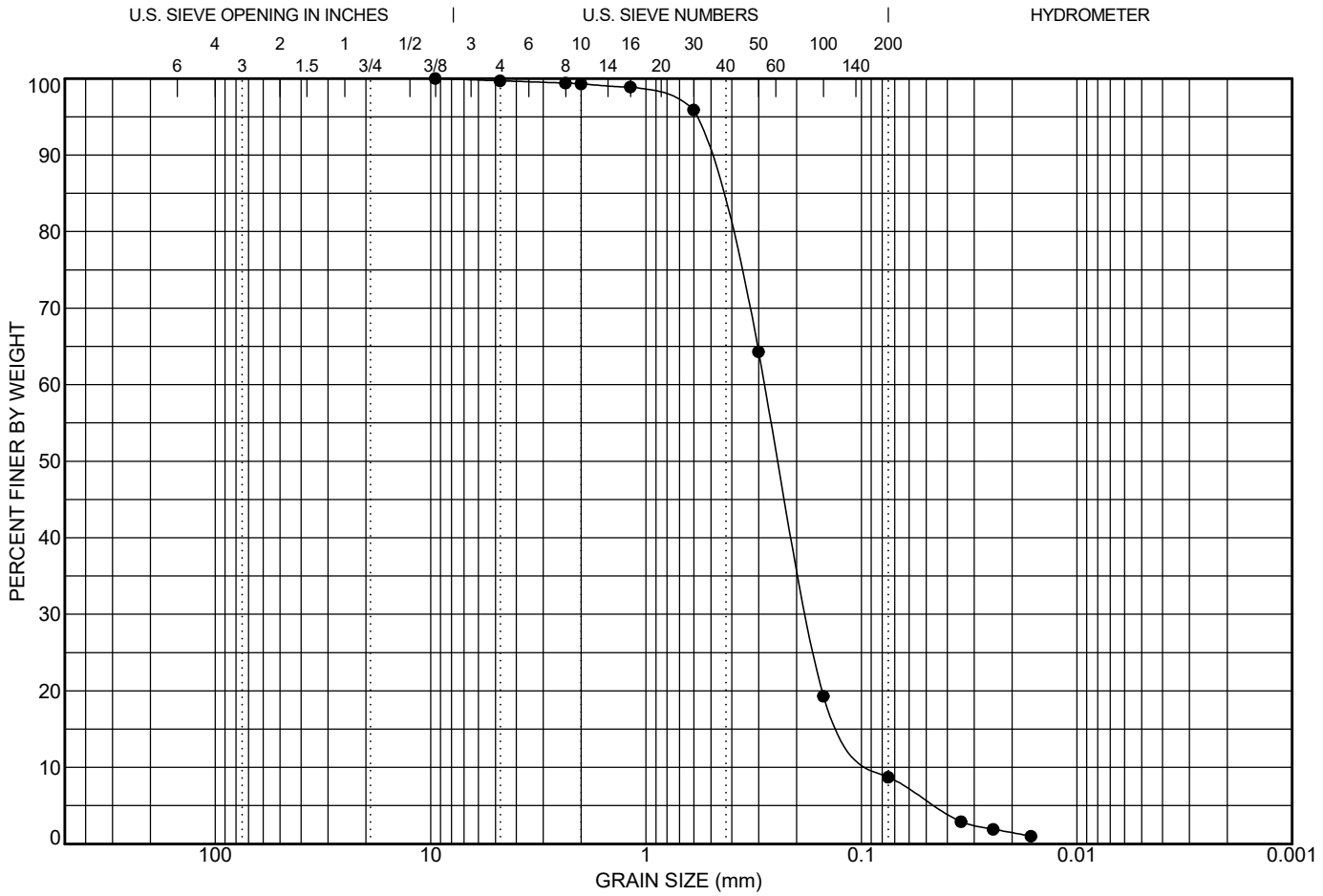
Project: Proposed New School

Location: Waterloo Street & Concession Road 10, Port Elgin, Ontario

File No.: 1704

Enclosure No.: 15

DM - NO SPECIFICATIONS 1704 -WATERLOO STREET PORT ELGIN.GPJ LAW LNDN.GDT 5-14-24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.36	3.44	9.5	0.281	0.177	0.082	0.3	91.0	8.7	

Date: May. 08 - 2024
Client: Bluewater District School Board
Contractor:
Source:
Sampled From: BH9 - SA5; 3.05 to 3.66 m depth
Sample No.: 9-5
Date Sampled: Feb. 13 - 2024
Sampled By: YC
Lab No.: 213
Date Tested: Mar. 25 - 2024
Type of Material: Sand, trace silt

Sieve Size (mm)	Percent Passing	No Specifications

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Fax: 519-742-7739
e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

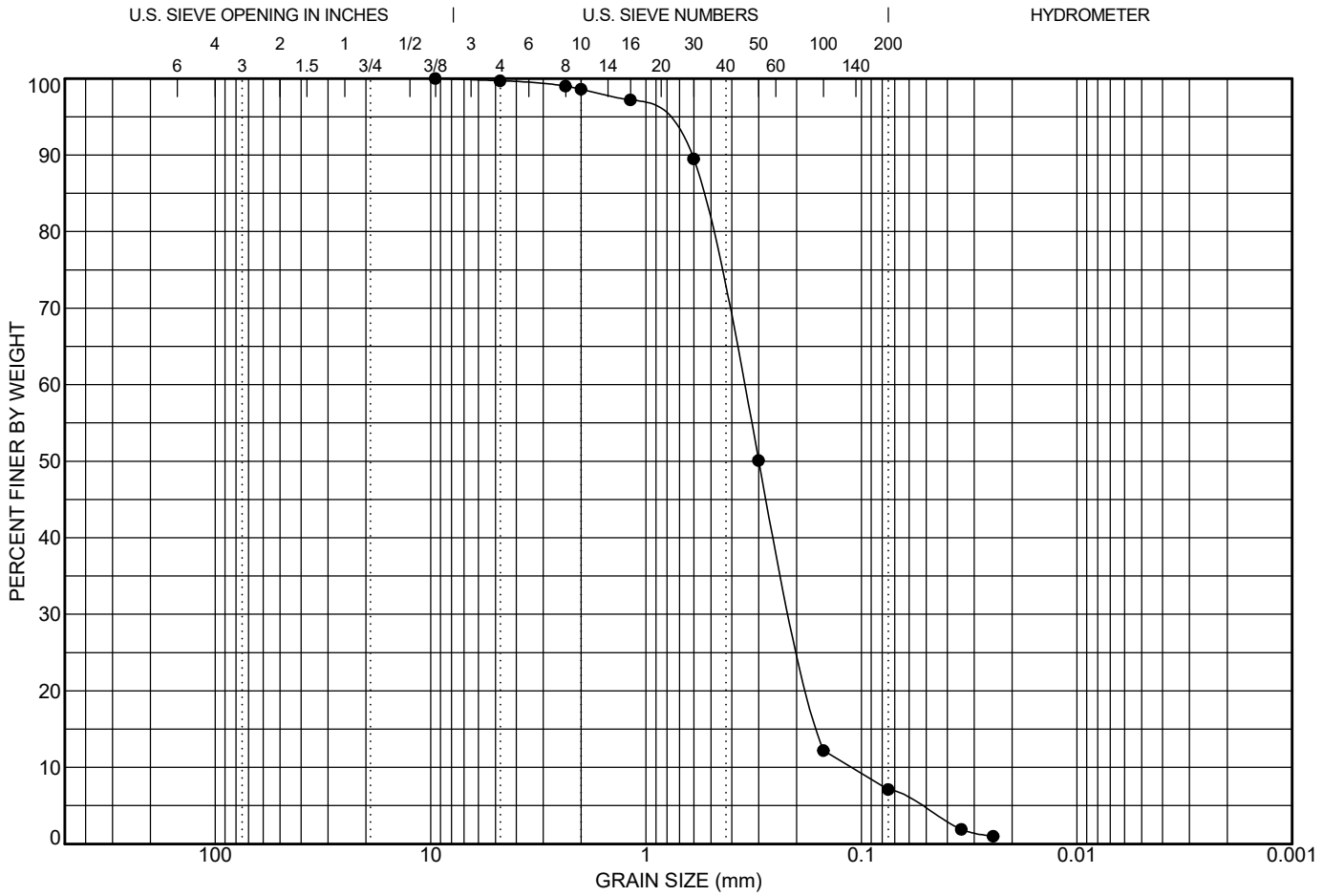
Project: Proposed New School

Location: Waterloo Street & Concession Road 10, Port Elgin, Ontario

File No.: 1704

Enclosure No.: 16

DM - NO SPECIFICATIONS 1704 -WATERLOO STREET PORT ELGIN.GPJ LAW LNDN.GDT 5-14-24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.09	3.21	9.5	0.357	0.208	0.111	0.3	92.6	7.1	

Date: May. 08 - 2024
Client: Bluewater District School Board
Contractor:
Source:
Sampled From: BH11 - SA5; 3.05 to 3.51 m depth
Sample No.: 11-5
Date Sampled: Feb. 12 - 2024
Sampled By: YC
Lab No.: 214
Date Tested: Mar. 25 - 2024
Type of Material: Sand, trace silt

Sieve Size (mm)	Percent Passing	No Specifications

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Kitchener, Ontario N2H 5E1
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Fax: 519-742-7739
e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

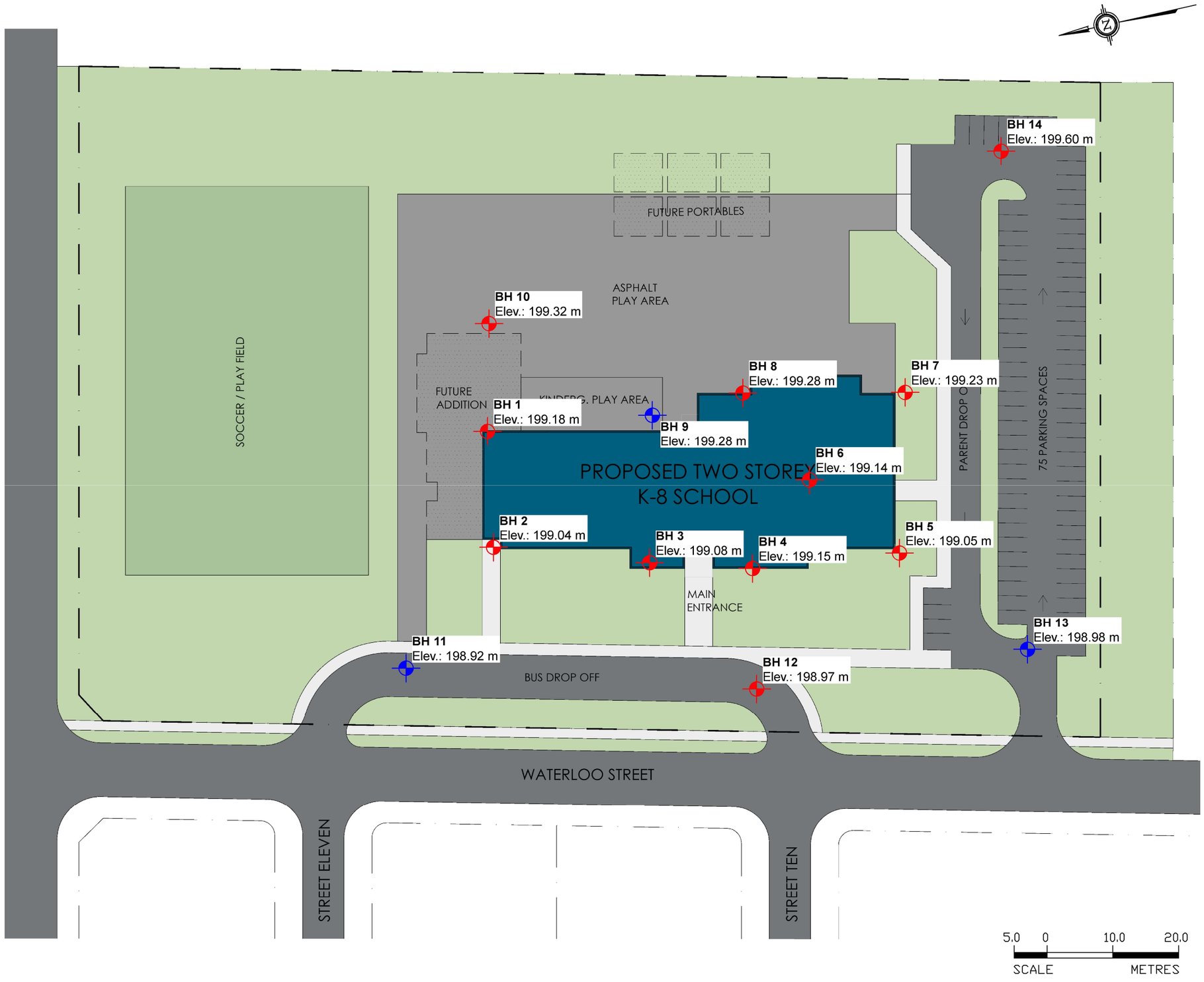
Project: Proposed New School

Location: Waterloo Street & Concession Road 10, Port Elgin, Ontario

File No.: 1704

Enclosure No.: 17

DM - NO SPECIFICATIONS 1704 -WATERLOO STREET PORT ELGIN.GPJ LAW LNDN.GDT 5-14-24



KEY PLAN **SOURCE:** Google Earth

LEGEND

TBM: Top of catch basin on east side of Waterloo Street, approximately 100 m south of site.
Elev.: 199.02 m (Geodetic)

Borehole Location

Borehole and Monitoring Well Location

DWG. Ref.: +VG Architects: The Ventin Group Ltd.; BWDSB New Port Elgin School (Two Storey); Site Plan; Rev. 2; October 10, 2023

Elev. Ref.: The borehole locations and associated ground surface elevations were surveyed using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using UTM Zone 17N Projection, NAD83(CSRS)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28).

BOREHOLE LOCATION PLAN

Proposed New School

Waterloo Street and Concession Road 10
Port Elgin, Ontario

CHUNG & VANDER DOELEN ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1 / 519-742-8979

Drawn By: YC	Date: April 2024	File No.: 1704
Checked By: CS	Scale: 1:600	Drawing No.: 1

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Conform to Sections of Division 1 as applicable.

1.2 REFERENCE STANDARDS

1. All reference standards to be latest issue, including amendments
2. ASTM D698-91
3. CAN3-A23.1-M90
4. OPSS 1010-93 "Materials Specifications for Aggregates".

1.3 REQUIREMENTS OF REGULATORY AGENCIES

1. All Standards to be latest issue with amendments.
2. Ontario Building Code.
3. The Construction Safety Act and all other regulations of the Ontario Ministry of Labour or local by-laws relating to the work of this Section.

1.4 PROJECT CONDITIONS

1. Protection

    1. Underground Services: Notify Public Utilities in advance of planned excavations adjacent to their services. Take care not to damage or displace encountered services. When such services are encountered notify Architect immediately and protect, brace and support them. Advise Architect which services require adjustment, relocation or abandonment. Where work on these services become necessary use following procedure:

        1. **Essential Services:** Make necessary repairs only to maintain essential services satisfactory to Architect and authorities having jurisdiction.
        2. **Known Services:** Repair promptly at no expense to Owner.
        3. **Unknown Services:** Repair promptly on Architect's instruction. Submit complete breakdown of cost of such work. Amount approved will be added to Contract Sum.

    2. Shoring and trench timbering, in addition to requirements of local authorities shall be carried out in accordance with requirements of The Occupational Health and Safety Act, 1991 and Regulations for Construction Projects, and all other applicable regulations of Ontario Ministry of Labour. In addition, follow the

recommendations of Construction Safety Association brochure "Shoring and Timbering in Trenches', 1981, wherever applicable.

3. Shoring and Bracing

1. Provide necessary shoring and bracing for excavations to existing premises including fences. Submit method of shoring and bracing for review before installing. Maintain shoring and bracing during work. Remove when no longer required and when notified.

2. Shoring and bracing shall properly retain the banks of excavations and prevent caving-in or displacement or damage to surrounding or adjacent buildings or other property.

3. Retain shoring and bracing until all other work affected thereby is carried out.

4. Erect shoring and bracing free of footings, foundations, walls or other such work so it may be removed entirely or in sections when it is no longer required and when directed, without causing damage or injury to the Work or adjacent property.

5. Submit drawings showing the methods of shoring and bracing to be used. Drawings shall be engineered and stamped by a Certified Engineer from the Province of Ontario. Submit calculations if requested by the consultant.

5. Sub-Surface Conditions

1. Sub-surface investigation was carried out by Cung & Vanderdolen Engineering. Refer to Geotechnical report included in the documents.

2. A copy of this Report is included in the Soil Report – following Section 02010 in this specification for your review.

3. The information given in this report was obtained for the use of the Owner in the execution of the design. It is presented in good faith to assist the Contractor. No guarantee is made or implied as to its detailed accuracy for every site location. It is incumbent upon the Sub-Contractor to make any additional tests to obtain any additional information deemed necessary for the proper execution of the work, at no additional cost to the Owner.

1.5 SCOPE

1. To perform all the work not done or included in Excavation, Trenching & Backfilling (Building Area) - Section 02300. All work called for in this section

is to be performed. If the work called for is in excess of work required in Geotechnical Report and/or on the Civil Drawings this section shall govern. At Landscape areas if the Landscape drawings or specs conflict with the work described in this section the Landscape drawings & specs shall govern. If Civil Engineering sections conflict with this section then the Civil sections shall govern.

1.6 2. In general, the work of this section shall include the clearing, grubbing, excavating, engineered fill, backfilling and rough grading for all the asphalt, sidewalk & landscaping areas which are indicated on the drawings (at all site areas beyond building walls).

1.7 UNIT PRICES

1. Provide in the Form of Tender, all requested unit prices.

2. Unit rates to include all labour, materials and applicable taxes for completion of the work.

3. Unit rates shall be used for both additions and deletions to the Contract subject to the mark-up or credit allowances specified in the Tender Form.

4. Additional payment in accordance with the agreed units prices shall be made only for additional work authorized by the Architect in writing.

5. Additional payment will not be made for accidental over-excavation by the Contractor.

1.8 DRAWINGS

1. Site Plans

1. Refer to Architectural Site Plan drawings A1.1, A1.2, Site Grading and Site Servicing Drawings which are included to show the finished, final grades.

2. Final contours are to be maintained as closely as possible with due allowance for "blending" of grades for drainage away from the building.

3. Refer to Landscape Drawings for all landscape areas.

1.9 ENVIRONMENTAL REQUIREMENTS

1. Comply with the requirements of the following Federal and Provincial Legislation related to the transportation use and disposal of ANY existing contaminated fill materials discovered and being excavated from site.

2. Federal Transportation of Dangerous Goods Act.

3. Ontario Regulation number 309: Liquid industrial and hazardous waste regulation.

4. All such waste shall be carried by an approved Ministry of the Environment Haulage carrier and disposed of at a Ministry of the Environment approved receiving facility.

1.10 CO-ORDINATION & CO-OPERATION

1. Co-ordinate the work of this Section with the work of all other Sections in accordance with the General Instructions.

2. Co-ordination and co-operation is particularly important with the following Sections: Landscaping, Site Servicing, Concrete Walks and Curbs, Asphalt Paving, Cast-In-Place Concrete, and Mechanical Excavation.

3. Particular care shall be taken in coordinating the work of this Section with the Trade Contractors performing related work.

1.11 EXAMINATION

1. Examine the site for the purpose of determining the current conditions prevailing there, which may affect the work of this Section, including available access to the site, site contours, etc.

2. Determine the nature and location of all existing services below and above ground, which may affect the work of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

1. Class "B" Granular: imported granular material in accordance with O.P.S.S. Specification Form 1010 for Granular 'B' specification form 1010

2. Class "A" Granular: imported in accordance with current O.P.S.S. Form 1010 for Granular 'A' Specification Form 1010.

3. Granular material shall be free draining and not susceptible to frost action as determined by current O.P.P.S. Methods.

4. Backfill and Fill at Landscaped, Seed and Sodded Areas: Clean excavated materials free from waste materials, debris, rubbish, frozen portions, muskeg, organic or cohesive matter and rocks larger than 100 mm (4") in diameter. If sufficient quantity of material is not available from excavation, use imported fill having same, or better characteristics.

5. Clear crushed aggregate: clear, clean, screened stone, in size between 10 mm and 25 mm.

6. Topsoil: Use from site topsoil stockpile and import additional topsoil as required to meet finish grades as indicated on drawings. Provide topsoil depth specified minimum 6" (150mm) at all seed and sodded areas and

24" (600mm) depth at all planting beds. Refer to specifications on seeding sodding and plantings. Coordinate depth of topsoil with landscape architect specs and drawings. Additional topsoil shall be fertile, friable natural loam containing 4% minimum organic matter for clay loams and 2% minimum organic matter for sandy loams with acidity range of 5.5 PH to 7.5 PH and capable of sustaining vigorous growth.

7. Submit representative samples of the proposed materials to the inspection company for testing and approval for use on this project two weeks prior to using.

    1. Supply only those materials approved for use on this project by the inspection company.

    2. NOTE: Slag content in any imported granular material is not acceptable

2.2 SOURCE QUALITY CONTROL

1. All materials shall be subject to test and inspection by a testing and inspection company appointed by the General Contractor.

2. Cost of testing will be paid for by the Owner in accordance with the General Conditions.

3. Provide access to pits in quarries for the personnel of the inspection company.

4. Provide representative samples of materials as may be required by the inspection company at no cost to the Owner.

PART 3 EXECUTION

3.1 EXAMINATION

1. Examine the site for the purpose of determining the conditions prevailing there which may affect the work of this Section, including available access to the site, and existing ground water conditions.

2. Determine the nature and location of all existing services above and below ground which may require protection during the construction operation, or otherwise affect the work of this Section.

3.2 PREPARATION

1. Clearing

    1. Clear and remove obstructions to excavating. Remove trees and stumps not required to be retained.

2. Clear site of all rubbish, rocks, boulders, tree stumps and other useless materials and debris, remove from site and dispose of unless instructed otherwise.

3. Cut all dead trees and remove stumps and roots to a minimum depth of 600 mm below proposed finished grade.

4. Burying of useless materials on the site is permitted only when approved in writing by the Architect.

5. Do burying only in areas designed by the Architect and do so in strict accordance with all applicable laws and regulations.

6. Be responsible for obtaining the necessary permits and assume all costs.

7. Bury to such depth and in such manner so as not to affect landscape work.

8. Backfill with approved fill and compact.

2. Topsoil and Stripping

1. Strip area of Site to be excavated or graded free of topsoil and stockpile good re-usable topsoil as approved by the consultant in the open play area where directed by Architect. Remove all unapproved topsoil and all other excavated materials from the site. Dispose of contaminated materials in conformance of Federal and Provincial Legislation requirements.

2. All areas designed for landscape, sod and seeding or paving or the construction of structures, shall be stripped of all topsoil and organic matter to its full depth taking care not to contaminate with any sub-soil. Refer to Site Plan drawings.

3. All stripped topsoil shall be stockpiled in areas so designated by the Landscape Architect.

4. Topsoil will be re-used for landscape work, unless specified otherwise.

5. Commence topsoil stripping only after designated areas have been cleared of scrub, weeds, brush stumps, rocks and other deleterious materials. Such materials shall be removed from the site and disposed of by the contractor.

3. Lines and Levels

1. Establish accurate lines and levels as required and supply batter boards, line stakes and templates and establish permanent reference lines and bench marks required.

3.3 PERFORMANCE

1. General

1. After stripping of topsoil, do all necessary rough grading, excavating, and filling, where required, to establish the sub-grade under all areas to the extent, elevations and depth required for completion of work.

2. Level of sub-grade shall be to the depths specified, after compaction of sub-grade and of materials placed thereon to allow for finished grades shown on drawings.

3. Remove all unsuitable material, soft and/or unstable areas in sub-grade to approved depth and backfill with clean, approved fill material.

4. Provide for uniform slopes between points for which finished grades are shown on drawings. Meet and blend with existing grades in a smooth manner.

5. Establish smoothly rounded grades at top and toe of slopes and banks.

6. Do not grade when soil is wet or frozen.

7. Compact sub-grade behind curbs, walls, and under paving and other hard surfaces to the specified density. Compact sub-grade below future portable classroom area.

8. Preparations of sub-grade:

    1. Scarify sub-grade on which topsoil is to be placed, to the minimum depths specified.

    2. Scarify sub-grades under areas which are to be raised by placing fill to minimum depth of 3" (75 mm) to provide a good bond and prevent slipping of fill.

9. Fill material shall be clean, free of topsoil and organic matter and debris, and shall be approved by the Architect before placing. On site excavating material may be used for filling when approved by the Architect.

10. Where required, supply and spread approved fill materials to raise existing grades to the specified sub-grade level, as shown on the drawings for new finish elevations.

11. Place fill in loose layers, not exceeding 200 mm in depth and compact each layer to a minimum dry density of ninety-five percent (95%) of the maximum Standard Proctor Density, before placing subsequent layers.

12. The surface shall be shaped at all times to ensure adequate surface run-off and prevent ponding and scouring.

13. Keep excavation free of water by bailing, pumping or a system of drainage as required and provide pumps, suction and discharge lines or well points of sufficient capacity and maintain until such time as the permanent drainage system is installed or until Architect agrees to its removal. Take all necessary measures to prevent flow of water into excavation.

14. Water discharged from de-watering systems shall be equal to or better in quality than the receiving stream or sewer storm water and shall be free of pollutants. Provide settling ponds and/or other treatment facilities as required to treat discharges at no cost to Owner.

15. Supply and install additional erosion controls and temporary sedimentation ponds, plastic tubing and temporary catch basins, as required to prevent erosion and contamination of sediment onto other properties or into waterways.

16. Maintain existing and any additional erosion controls until sod has been installed or seed areas have been growing for 6 months then remove all temporary erosion controls.

2. Below Building Excavation

1. Refer to Specification Section 02300 for all areas below building area.

3. Roadways, Parking Lots, Concrete Walks and Curbs Excavation

1. Excavate and rough grade at roadways, parking lots and hard surfaced areas to suit layouts shown on the drawings.

2. At roadways and paved parking areas (heavy duty asphalt areas), excavate to remove all topsoil, organic matter or deleterious material to a depth not less than 790 mm below the final asphalt grade but not less than sufficient depth to remove all topsoil, asphalt, soft and compressible materials to expose competent subgrade soil level.

3. At medium duty asphalt areas excavate to remove all topsoil, organic matter or deleterious material to a depth not less than 540 mm below finished grade but not less than sufficient depth to remove all topsoil, asphalt, soft and compressible materials to expose competent subgrade soil level.

4. At concrete walk areas and curbs, excavate to a minimum depth of 790 mm below finished grade **but not less** than sufficient depth to remove all top soil, soft and compressible materials to expose competent subgrade soil level.

5. Slope and shape subgrade towards catch basins and subgrade subdrains with 2% fall at roads and a minimum 1% at parking areas. (See drawing for further details.) Proof-roll existing sub-grade after excavation and shaping with a heavy vibratory roller.

6. Sub-excavate any soft or compressible materials and fill with modified Granular "B" compacted to 100% of SPMDD.

7. Provide rock removal and excavation where encountered at site service areas to obtain required depths.

4. General Backfilling

1. Prior to placing backfill, proof roll the exposed subgrade thoroughly with a smooth heavy roller to compact any loose zones. Sub-excavate any soft or compressible materials.

2. Proceed promptly with backfilling as work progresses after obtaining Architect's review.

3. Remove shoring material during backfilling.

4. Inspect moisture content of fill prior to placing. Limit addition of water only to extent required to provide optimum moisture content for compaction. Puddling or flooding with water to compact fill is not permitted.

5. Place all backfill and engineered fill in 200 mm (8") thick maximum layers. Compact each layer before placing next using approved mechanical equipment until compaction and level is reached.

6. Areas adjoining vulnerable building components which cannot be thoroughly compacted by drawn equipment, shall receive equivalent compaction with mechanical tampers.

7. Fill shall be free of frost, snow and ice and in no instance shall fill be placed on frozen snow, or ice covered ground.

5. Backfilling Below Building

1. Refer to Specification Section 02300- Excavation, Trenching & Backfilling (Building Area).

6. Roadways, Parking Lots and Hard Surfaced Areas, Fill

1. Refer to specification sections; 02600 Concrete Walks and Curbs, and 2610 Asphalt Paving for compacted fill work

7. Rough Grading

1. Rough grade all areas around the building in accordance with the

site plan and required and existing grades, and as directed by the Architect. Co-ordinate this work with work of other sections.

2. Areas to receive sod or seeding shall be rough graded to an elevation 12" (300 mm) below finished grade.

3. Slope ground so that water will drain at all times away from the building.

4. Rough graded areas shall be cleanly raked free of coarse material and left ready for final grading.

8. Installation of Topsoil

1. Spread a minimum of 12" (300 mm) topsoil over entire sodded and seeded areas and 24" (600mm) topsoil at all planting beds and tree locations. Existing topsoil on site to be spread over all sodded and seeded areas. Provide additional topsoil if required.

2. Depth indicated is compacted depth.

3. Spread topsoil on prepared subgrade of the work site.

4. Fine grade and loosen topsoil to produce a smooth even surface free from debris, sod, stones and roots over 1" (25 mm) in diameter. Eliminate rough spots and low areas. Prepare loose friable bed by means of cultivation and subsequent raking.

5. Compact (85% Standard Proctor Density) unless indicated otherwise elsewhere.

6. Meet and match all existing turf areas, curbs, manholes and catch basin frames in a smooth uniform line to the satisfaction of the Architect.

7. Landscape contractor to provide mixed topsoil where planting material will be installed.

8. Co-ordinate with Landscape contractor for installation of topsoil to be installed at all areas to be seeded, sodded and hydraulic seeded.

9. Coordinate with Landscape contractor for installation of topsoil to be installed at landscaped areas.

3.4 PROTECTION OF EXCAVATIONS

1. Protect adjacent construction and underground services from damage resulting from the excavation operations and from frost penetration.

3.5 PROTECTIVE MEASURES

1. Furnish all necessary barriers and other protection around open excavations. For other barriers and hoardings, consult General Works Section.

2. Maintain barricades in good condition at all times until they are no longer required.

3.6 FIELD QUALITY CONTROL

1. All materials and workmanship shall be subject to test and inspection by a testing and inspection company appointed by the General Contractor.

2. A representative (inspector) of the testing and inspection company will make random site inspections.

3. Sieve analysis, SPMDD tests for fill materials and field density tests of the compacted fill materials will be made by this inspector to ensure that the specified standard of work is achieved.

4. All excavation, placing and compaction procedures will be subject to the approval of the inspector.

5. Materials which fail to achieve the specified standard of compaction shall be re-compacted or replaced as directed by the Inspector.

6. The cost of testing will be paid for by the Cash Allowance Section 01020 in accordance with the General Conditions.

7. Provide access to the work for the personnel of the testing and inspection company.

8. The compaction tests are performed on behalf of the Owner to satisfy the Architect that the requirements of the Contract Documents have been met. They are not intended as a substitute for the contractor's quality control program.

3.7 ROAD DUST CONTROL

1. Where directed and after the final layer has been placed and compacted, calcium chloride shall then be applied at the rate directed by the Architect by means of a mechanical spreader.

3.8 CLEAN-UP

1. At the completion of the work of this Section, remove any excess materials, debris and equipment from the site.

2. Remove from work site all contaminated excavated material and dispose at an approved dump site in conformance with all Federal and Provincial Legislation for disposal of contaminated materials.

END OF SECTION

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Furnish all labour, materials, equipment and services specified, indicated, or required to provide excavating, trenching, backfill and compaction.

1.1.2 Related Work Described Elsewhere:
- .1 Soils Report – Section 02010.
- .2 Earthwork Below Paving and Sidewalks - Section 02215.
- .3 Site Servicing and Grading
- .4 Division 22 – Plumbing
- .5 Division 26 - Electrical

1.2 SAMPLES

1.2.1 Submit 20 kg (45 lbs.) samples of each type of fill specified including representative samples of excavated materials for analysis by testing laboratory.

1.2.2 Ship samples prepaid to testing laboratory in tightly closed containers to prevent contamination.

1.3 SUBMITTALS

1.3.1 Comply with pertinent provisions of Section 01300 regarding shoring, bracing and underpinning required in connection with excavation.

1.3.2 If drawings for structural elements are required, they shall bear the signature and stamp of a Professional Engineer Registered in Ontario.

1.4 SHORING AND BRACING

1.4.1 Take precautions to guard against movement or settlement of adjacent structures, earth, benchmarks, services, walks, paving, curbs and adjacent grades. Provide bracing and shoring if required.

1.4.2 Shore and brace excavations to prevent failure in accordance with *Construction Safety Act* and *Shoring and Timbering in Trenches* by the Construction Safety Association of Ontario.

1.4.3 Engage a registered structural engineer to design and assume responsibility for shoring, bracing, and caissons.

1.4.4 Make good any damage and be liable for any injury resulting from inadequate shoring or bracing.

1.5 DEWATERING

1.5.1 Take precautions necessary to sufficiently dewater excavation and fill areas to allow foundation construction and pipe installation.

1.6 UTILITY LINES

1.6.1 Where possible, known underground and surface utility lines are indicated. Locations of known existing services on plans are only approximate. Contractor shall be responsible for locating their exact position during the work. Notify Public Utility or Municipal Authorities well in advance of planned excavations and shoring adjacent to their services.

1.6.2 Record locations of maintained, re-routed and abandoned underground utility and sewer lines.

1.6.3 Make good any damage caused to existing utility and sewer lines resulting from work.

1.7 PROTECTION

1.7.1 Protect excavated earth from freezing by approved method.

1.7.2 Grade around excavations to prevent surface water runoff into excavated area.

PART TWO - PRODUCTS

2.1 MATERIALS

2.1.1 Reference to the abbreviation MTC indicates Ontario Ministry of Transport and Communications.

2.1.2 Grade Fill: Type 1 fill - Granular 'A' material conforming to OPSS Form #1010. Crushed rock composed of hard, uncoated cubical fragments produced from a naturally formed deposit and graded within the following limits:

Sieve Size (MTC)	Percent Passing
37.5 mm	100
16.0 mm	62-100
9.5 mm	48-73
4.75 mm	33-55
1.18 mm	15-45
300 um	5-22
75 um	0-8

2.1.3 Subgrade Fill: Type 2 fill - Granular 'B' material conforming to OPSS Form # 1010. Clean sand and gravel graded within the following limits:

Sieve Size (MTC)	Percent Passing
106.0 mm	100
22.4 mm	57-100
4.75 mm	26-100
10-85	1.18 mm
5-40	300 um
0-8	75 um

2.1.4 All fills shall be free of frost, ice or frozen particles, or stones greater than 106mm for granular 'B' or 37.5mm for granular 'A'.

2.2 STOCKPILING

2.2.1 Stockpile fill materials in areas designated by Consultant. Stockpile granular materials in a manner to prevent segregation. Protect from freezing.

PART THREE - EXECUTION

3.1. EXCAVATING

3.1.1 Excavate to elevations and dimensions indicated or required for construction of work plus space required to erect forms, shoring, permit inspection.

3.1.2 Make excavation to clean lines to minimize quantity of fill material required.

3.1.3 Earth bottoms of excavations to be dry undisturbed or previously compacted soil, level, free from loose or organic matter.

3.1.4 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

3.1.5 When complete, have Consultant inspect excavations before pouring any concrete.

3.1.6 Correct unauthorized excavation at no extra cost as follows:
.1 Fill under bearing surfaces and footings with concrete as specified for footings.
.2 Fill under other areas with Type 2 fill compacted to 100% Standard Proctor Density.

3.2 EXCESS WATER CONTROL

3.2.1 Unfavourable weather: Do not place, spread, or roll and fill material during unfavourable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the Consultant.

3.2.2 Softened subgrade: Where soil has been softened or eroded by flooding or placement during unfavourable weather, remove all damaged areas and recompact as specified for fill and compaction below.

3.2.3 Dewatering:
.1 Provide and maintain at all times during construction, ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the work.
.2 Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations.

3.3 BACKFILLING

3.3.1 Do not commence backfilling until work of other sections to be backfilled has been inspected by the Consultant.

3.3.2 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground.

3.3.3 Prior to placing fill under base courses and slabs on grade, compact existing sub-grade to obtain same compaction as specified for fill. Cut out "soft" areas and fill with suitable material until specified compaction can be obtained.

3.3.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Consultant.

3.3.5 Backfill simultaneously each side of walls and other structures to equalize soil pressures, when possible.

3.3.6 Place and compact fill materials in continuous horizontal layers not exceeding 150mm (6") loose depth. Avoid disturbing or damaging buried services. Make good any damage. Increased fill depths are not to be attempted without demonstration of compaction to Consultant.

3.3.7 Maintain optimum moisture content to enable compaction to attain specified density.

3.3.8 Where sheathing and shoring materials are used to support sides of excavation and are to be later removed, leave them in place as long as possible, compatible with the placing and compacting of backfill, in order to eliminate voids or pockets in the backfill and to minimize possible movement or loss of adjacent ground and damage to facilities.

3.3.9 Bring all filled areas to rough grade level. Leave surfaces clean and free of coarse materials.

3.3.10 Bedding of Mechanical and Electrical Services to be carried out by this Section under the direction of the trade concerned using cohesionless material.

3.4 FILL TYPES AND COMPACTION

3.4.1 Exterior sides of perimeter walls: use granular "B" to sub-grade levels. Compact to 95% Standard Proctor maximum dry density.

3.4.2 Within building area: Use granular "B" to underside of base course for concrete slabs. Compact to 100% Standard Proctor maximum dry density.

3.4.3 Under concrete slabs, including areas under thickened slabs: provide 150mm (6") base course of granular "A" fill to underside of slab. Compact to 100% Standard Proctor maximum dry density.

3.5 GRADING

3.5.1 Rough grading to levels, profile and contours required and made ready to receive surface treatment as indicated on site plan.

3.6 INSPECTION AND TESTING

3.6.1 Testing of materials and compaction will be carried out by testing laboratory designated by the Consultant.

3.6.2 Owner will pay for inspection and testing costs.

3.6.3 Sieve analysis: proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.

3.6.4 Density tests: tests will be conducted in place on compacted fill to ASTM D2922 for Standard Proctor Density.

3.6.5 If, during progress of work, tests indicate fills installed under this contract do not meet specified requirements, remove defective fills, replace and retest at Contractor's expense. All re-testing is to be at the Contractor's expense.

3.7 FREQUENCY OF TESTS

3.7.1 Consultant will determine frequency of testing as construction progresses. The following materials will be tested: excavated surfaces, fill under floor or other slabs on grade, backfill of structural walls.

3.8 SURPLUS

3.8.1 Remove surplus material not required for backfill, grading or landscaping, from the site.

3.9 INSULATION

3.9.1 Installation of perimeter foundation insulation specified under Section 07200 (Building Insulation) is to be installed by this Section as backfilling progresses.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

1 Division One, General Requirements, is part of this Section and shall apply as if repeated here.

2. System:

1. Supply and install 4" (100mm) perforated subdrains at interior granular matt base areas and to all catch basins and as shown on Civil, Landscape and architectural site plans.

1.2 REGULATORY AGENCIES REQUIREMENTS

1. Carry out all changes and alterations required by an authorized inspector of any authority having jurisdiction, without charge to the Owner.

PART 2 PRODUCTS

2.1 DRAINPIPE

1. 4" (100mm) perforated smooth wall HDPE pipe: Provide required elbows, connections, and end caps. Solid Non-Perforated Pipe: 4" (100mm) solid P.V.C. Pipe.

2. Solid Non-Perforated Pipe: 4" (100mm) solid HDPE smooth wall Pipe.

3. Pipe to meet requirements of ASTM D3350 and ASTM D2412.

2.2 AGGREGATE

1. Clear washed 3/4" (19mm) diameter crushed stone.

2. Bedding Sand (as required).

3. Clear pea gravel surrounding pipe 6" (150mm) on all sides.

2.3 FILTER CLOTH (FABRIC)

1. Geofab Soil Stabilization-Type 1127 by Mercantile Development, Inc., Westport, CT, **or**

2. "Terrafix 270R" geotextile membrane by Terrafix filter fabrics, Rexdale, Ontario, **or**

3. Trevira Spunbound" by Spunbound Business Group, Spatanburg, SC; 1-800-845-7597-thickness to match above.

PART3 EXECUTION

3.1 WORKMANSHIP

1. Excavating for Trenches:

1. The requirements of Sections 02200 and 02215 - shall apply to this Section.

2. Excavate to depths indicated on drawings for foundation weeping drains. Do not undermine foundations.

3. Excavate 6" (150mm) deep and 12" (300mm) on each side of all subdrains so that invert of subdrain is level with top of compacted subgrade at interior granular matt base areas and to all catch basins.

2. Catch Basin and Paved Areas Subdrain Installation

1. Subdrain pipe to be laid 20 feet (6m) in four directions at every catch basin shown on site plans at bottom granular 'B' into compacted subgrade base and at bottom of compacted Granular 'B' in compacted subgrade base at interior foundation granular matt area of building.

2. Sub-drain to be laid within granular sub-base at asphalt areas as outlined in the Geotechnical Report.

2. Slope drainpipe to catch basin or sump pit with a minimum 1% slope. Holes of drainpipe to be in down position.

3. Connect to all CBs at asphalt paved areas and as shown on Civil, Landscaping plan and site plan drawings.

4. Install clear pea gravel at least 6" (150mm) on all sides of drainpipe surrounded with geotextile fabric.

5. Connection of drainpipe up to catch basin to be done by Site Servicing Contractor.

6. Connection of drainpipe up to sump pipe to be done by Mechanical Contractor.

7. Provide and install all required connectors.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is part of this Section and shall apply as if repeated here.

1.2 STANDARDS

1. All aggregates, equipment, methods and materials shall conform strictly to the Specifications of the Ministry of Transportation and Communications.

2. Refer to ASTM C309-91, ASTM D698-91, CAN/CSA-A23.1-M90, CAN/CSA-A23.2-M90, OPSS 1010-93, OPSS 1308-83.

1.3 WARRANTY

1. The work under this section shall be under warranty in accordance with the Conditions of GC12.3 of the CCDC-2-2008 but for a period of two years after the date of issue of the Architect's Certificate of Substantial Completion.

1.4 SPECIAL PROTECTION

1. Barricade paved surfaces from traffic until surfaces are ready for normal traffic. Any damage or marked surfaces are to be removed and replaced by contractor.

1.5 UNIT PRICES

1. Provide unit prices as requested in tender form.

PART 2 PRODUCTS

2.1 MATERIALS

1. Granular Base Course: Conform to the Ontario Provincial Standard Specifications form 1010, for material designated as Class "A" and "B".

3. Concrete: Materials shall conform to Section 03300.

4. Joint Filler: For concrete walks 13 mm thick premoulded bituminous impregnated fibre conforming to ASTM D.1751-71a.

5. Joint Sealant: Conform to CGSB 19-GP-24M Tremco THC900 self levelling urethane, or Sternson's Duoflex or Rubber Caulk 6000 by PRC Canada Inc.

6. Air Entrainment: Admixture as manufactured by the Master Builders Co. or Sternson Ltd.

7. Concrete Curing: Conform to Section 03300

8. Concrete Sealer: Boiled Linseed oil conforming to ASTM D-260-58T cut back with kerosene to form a 50/50 mixture.

9. Reinforcing Materials shall conform to section 03300.

PART 3 EXECUTION

3.1 EXAMINATION

1. Before work commences ensure that subgrading and filling as specified in Section 02215 and this section, has been correctly completed and that the subgrade is satisfactory in all aspects for placing of pavement. Report to Architect any deficiencies before proceeding with work. Coordinate with Civil drawings and specifications. If any conflict between this section and Civil sections the Civil sections shall govern.

2. Verify that sub-grade densities, as may be specified in Section 02215 have been attained.

3. Provide additional compacted granular material where required.

3.2 INSTALLATION

1. Concrete Work

    1. Concrete work of this Section shall be executed generally as specified on Section 03300.

    2. The compressive strength of concrete after 28 days shall be 32 Mpa unless indicated or specified otherwise.

    3. Coordinate the work of this section with the drawings of the Civil consultant Crozier Associates Ltd. Which are included in the tender set.

2. Concrete Walks and Slabs

    1. Lay concrete for walks min. 125 mm (5") thick of 32 Mpa concrete on granular "A" compacted to 100% SPMDD and Granular "B" to 98% SPMDD. Entrained air mix shall be 6% ±1%.

        Note: Granular "A" to be a minimum 150 mm thick. Provide Granular "B" to be a minimum 500 mm thick as required to bring existing grade up to underside Granular "A" Layer.

    2. Finish wearing surface of walks with wood float or as directed by Architect. Round off edges of slab with an edging tool.

    3. Score surface of walks as indicated on drawings using proper tool or as directed by Architect.

4. Turn down perimeter edges of sidewalks a min. 125 mm (5") in addition to sidewalk thickness, complete with 300 mm (12") thick compacted stone base. See drawings for additional details.

5. Slope walks away from building a minimum 1% toward storm sewer systems.

6. Slope all concrete walks to one side at ¼" (6 mm) per foot for drainage or as directed by the Architect.

7. Widths of sidewalks as per site plan dimensions (not as per OPSD drawings).

3. Concrete Curbs (Barrier)

1. Curb design shall be in conformance with current OPSD details as indicated on drawings, using a minimum 500 mm thick base of compacted granular B to refusal.

2. Entrained air in the concrete shall be 6%±1%.

3. Curb Type: as per OPSD 600.11, Concrete Barrier Curb or as indicated on the Civil drawings.

4. Concrete Sidewalk Ramps/drop Curbs

1. Provide drop curbs and barrier-free ramped access to AODA standards including tactile warning strips where drop curbs shown on drawings.

2. Refer to OPSD 310.030 and Civil Drawings.

5. Expansion Joints

1. Provide isolation joints filled with ½" (13 mm) joint filler at the following locations:

1. Where shown and noted on drawings.

2. At maximum 6000 mm (20'-0") intervals in both directions in sidewalks and concrete paved areas.

3. Where two sidewalks intersect or meet.

4. Where a sidewalk or concrete pavement meets building or curb.

5. Refer also to OPSD 310.010 and OPSD 310.020.

6. Install joint sealant at all expansion joints including locations

where concrete abuts building (at entrances etc.).

6. Contraction Joints

1. Provide contraction and dummy joints in sidewalks at locations shown on drawings or at approximately 1500 mm (5'-0") intervals in both directions. Refer to OPSD-310.010 and OPSD-310.020.

2. Form joints be scoring concrete with "T" shaped tool providing a score 25 mm (1") deep.

7. Concrete Curing

1. Concrete curing shall be done in accordance with Section 03300.

8. Sealing of Concrete

1. Seal concrete surfaces using boiled linseed oil conforming to ASTM D-260-58T, cut back with kerosene to form a 50/50 mixture. Uniformly apply with spray, brush or roller in 2 coats not exceeding 9.2 sq.m./litre (50 sq. yds. per gallon) per coat. Surface shall be clean, dry and at least 2 weeks old. Air temperature above 7 degrees C. (45 degrees F.).

3.3 MAKING GOOD

1. Where new or existing concrete walks and curbs are disturbed or cracked, at the end of the project the Contractor shall remove concrete to the nearest joint in each direction and install new concrete to the satisfaction of the Architect.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division 1, General Requirements are a part of this Section and shall apply as if repeated here.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

1. O.P.S. Specification Form 310A "Specification for Hot Mix Patching".

2. O.P.S. Specification Form 310, "Construction Specification for Hot Mixed, Hot Laid Asphaltic Concrete".

3. O.P.S. Specification Form 1150, "Material specification for Hot Mixed, Hot Laid Asphaltic Concrete".

4. ASTM D698-91 "Test Methods

1.3 ENVIRONMENTAL CONDITIONS

1. Asphalt shall be laid only when base is dry and weather conditions are suitable.

2. H.L. 4 Binder course Asphaltic Concrete Base shall be laid at minimum temperature of (46 degrees F.), (8 degrees C.) and rising.

3. H.L.3 (fine aggregate) Surface Course Asphaltic Concrete shall be laid at minimum temperature of (46 degrees F.), (8 degrees C.) and rising.

1.4 WARRANTY

1. The work under this section shall be warranted in accordance with the General Conditions of CCDC-2-2020, but for a period of two years after the date of Architect's Certificate of Completion.

1.5 SPECIAL PROTECTION

1. Barricade paved surfaces from traffic until surfaces are ready for normal traffic.

1.6 SCOPE OF WORK

Pavement design to be as per the Recommendations of the Geotechnical report for the project included in the tender documents.

1. Supply and install specified 400mm thickness of Granular B Sub-base course at all heavy duty asphalt and parking areas and install 300mm thickness of Granular B sub-base course at all light duty asphalt areas. (This

sub-base is below the 150mm Granular A Base.). Refer to site plan for locations of heavy & light duty asphalt.

NOTE: Provide additional Granular B where required to raise grades to suit new finish grades. Coordinate with geotechnical recommendations for paving.

2. Supply and install specified minimum 150mm thickness of Granular A Base course at all light duty asphalt paved areas and 150mm thickness of Granular A Base course at all heavy duty asphalt paved areas.

3. Supply and install Asphaltic HL3 finish layer over specified 40mm compacted thickness at light duty area & 50mm of HL4 for heavy duty asphalt areas.

4. Paint all the markings indicated on the sit plan A1.1.

PART 2 PRODUCTS

2.1 MATERIALS

1. Granular "A" and "B": in accordance with O.P.S. Specification Form 1010 - 93.

    1. Note: Slag content in any imported granular material is not acceptable.

2. H.L.4 Binder: asphaltic concrete material shall conform to O.P.S. Specification Form 1150-93.

3. H.L.3 or H.L.3A Asphaltic Concrete: asphalt concrete material shall conform to O.P.S. Specification Form 1150-93.

4. Paving Paint: O.P.S. Specific approved "Traffic Paint" conforming to CGSB 1-GP-74M and AMDT May-81, white alkyd traffic paint.

5. Asphaltic Primer: to CAN/CGSB-16.1-M77 Grade Mc-70.

2.2 SOURCE QUALITY CONTROL

1. Cost of testing will be paid from the Testing and Inspection Allowance in accordance with Division 1.

2. Provide access to pits in quarries for the personnel of the Inspection Company.

PART 3 EXECUTION

3.1 GRANULAR SUB-BASE AND BASE UNDER ROADWAYS, DRIVEWAYS, PARKING AREAS AND WALKWAYS

1. Carefully lay out areas to be paved to required lines and levels. Proof roll subgrade and remove all soft spots.

   Note: Granular base course to extend a minimum 12" (300 mm) beyond the edge of the paving areas.

2. Install specified minimum 400mm thickness of Granular "B" sub-base at **heavy duty** paved areas and specified minimum 300mm thickness of Granular 'B' sub-base at **light duty** areas under 150mm Granular 'A' by this section. Compact to 100% SPMDD.

3. Install specified minimum 150mm thickness of compacted Granular "A" at **heavy duty** asphalt areas and specified minimum 150mm thickness of Granular 'A' at **light duty** areas above Granular "B" base, by this Section. Compact to 100% SPMDD.

3.2 INSTALLATION OF ASPHALT PAVING

1. At all **heavy duty** paved areas over the compacted Granular "A", apply one layer of 60mm H.L.4 compacted then install one layer of 50mm H.L.3 compacted. Compact as outlined in O.P.S. Specification Form 310 to at least 96.5% Marshall Density. Total thickness of compacted asphalt shall not be less than combined thickness of 110mm. Sweep and clean base layer and prime prior to installing top layer.

2. At all **light duty** paved areas install one layer of 40mm HL3 over 40 mm of HL4 over compacted granular base consisting of 300mm of Granular B and 150mm of Granular A material.

3. Temperature of asphalt shall not be less than 245 degrees F. (120 degrees C.) after spreading and prior to initial rolling.

4. Use mechanical spreaders and compact using rollers of sufficient size and weight as specified by O.P.S. Specification Standard.

5. Maintain specified slopes, elevations and "crowns" as shown on the site plan and in accordance with good construction practice to maintain positive drainage to storm sewers and eliminate ponding. If ponding occurs asphalt will be neatly cut out and reinstalled to eliminate ponding.

6. Refer to 3.1.1 above for "dressing" of shoulders.

3.3 PATCHING AND TYING IN

1. If and when patching is required, the area to be patched shall be cut out to its entire thickness and repaved making sure that the edges are primed, and compacting is equal to that outlined in O.P.S. Specification Form 310A.

2. Where "tying in" to existing asphalt pavement, neatly cut existing asphalt to full depth. Prime existing edges and "iron in" as required to provide neat, smooth and intersection to approved grades.

3.4 FIELD QUALITY CONTROL

1. All materials and workmanship shall be subject to test and inspection by a testing and inspection company appointed by the Architect.

2. Cost of testing and inspection will be paid from the Testing and Inspection Allowance in accordance with Division 1, except as noted hereafter.

3. Provide representative samples of the materials as requested by the testing and inspection company at no additional cost to the owner.

4. The cost of any additional testing and/or the cost of replacement of any part of the asphalt work resulting from failure of the asphalt to meet the test requirements, shall be borne by the contractor.

5. Where field tests have been cut as block samples from the in-place asphalt concrete, replace and make good to the satisfaction of the architect.

6. Notify the testing company of the paving schedule, sufficiently in advance so that tests may be made.

3.5 PROTECTION AND CLEAN-UP

1. Exercise care in paving operation adjacent to curbs, lighting standards, sidewalks, etc., so as not to damage these items. Make good any damaged items to the satisfaction of the Architect.

2. At the completion of the work of this Section, remove from the site all tools, equipment, surplus material, and debris.

3.6 PAVEMENT MARKINGS

1. Lay out lines and markings for all parking, road and play area lines on entire site as indicated on drawings and obtain Architect's approval prior to painting. Apply 4" (100 mm) wide lines for parking, use mechanical application equipment. End and edge limit of each line to have clean, sharp 90 degree corners with no over spray fogging. Thickness of paint application to be consistent throughout and obtain uniform density with

sharp edges. Under sprayed lines shall be repainted.

2. Install hatched line markings for handicapped markings, handicapped symbols, medians and crosswalk markings and game lines as indicated on drawings.

3. Paint shall be best grade per OPS standards and shall be installed at minimum rate of 3 sq. m./litre. Yellow lines to have 2 coats of paint.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 SCOPE

1. Provide fencing and gates to height and locations as indicated on drawings. Provide hot dipped galvanized fabric and components typ. where chain link fence. Provide complete with black vinyl coating where indicated on drawings. Provide black ornamental iron fencing complete with gates and hardware where shown on drawings.

1.3 SHOP DRAWINGS

1. Submit shop drawings in PDF format in accordance with General Conditions.

2. Submit shop drawings indicating proposed details, layout and post-to-rail connection details. Show dimensions from property lines to all end, corner and terminator posts.

1.4 REFERENCE STANDARDS

1. ASTM A120-72a, Standard Specifications Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Bars for Ordinary Uses.

2. ASTM A392-68, Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric.

3. CAN/CSA Standard G40.21, Structural Quality Steel.

4. CSA Standard G164, Hot Dip Galvanizing of Irregular Shaped Articles.

5. Install chain link fence in accordance with latest issue CAN/CGSB - 138.3 unless otherwise specified.

6. Fabricate gates in accordance with latest issue CAN/CGSB - 138.4 unless noted otherwise.

7. Fabricate gates in accordance with latest issue Ontario Provincial Standard Specifications and Drawings.

1.5 QUALIFICATIONS

1. The manufacturer for the work of this Section shall be of recognized standing with a proven record for at least 5 years of satisfactory installations of equal size and type to that specified.

PART 2 PRODUCTS

2.1 MATERIALS

1. Ornamental Iron Fence: 60" (1500mm) height - Constructed of Galvalume steel tubing – Equal to Prestige Iron Works Inc. Imperial collection, Majesty style with pickets at 4" (100mm) o.c. maximum. Protective E-coating with a black Powder coated finish. Provide lockable gates where indicated on the drawings. Install as per manufacturer's instructions and recommendations. Note at Kindergarten and Childcare Play Areas this is base bid and an alternate price is to be included to change to Black Vinyl finished CLF

2. Galvanized Chain Link Fence: Fabric to conform to CGSB/CAN 2-138.1, chain link fence fabric 50 mesh square woven 6-gauge steel wire, height as indicated on drawings, zinc coated after weaving, to meet specified requirements of ASTM A392, square mesh. Top and bottom selvedge to be knuckled. New chain link fence at property line to be galvanized finish. At Kindergarten and Childcare play areas base bid to be for 60" ornamental iron fence and alternate price to be black vinyl finished CLF.

3. Galvanized Tube for Posts: 1 11/16" (43 mm) o.d. top rails, bottom rails, gate frames and brace rails, 2 3/8" (60 mm) o.d. line posts, 3 ½" (89 mm) o.d. terminal posts and straining posts, standard, butt welded steel, galvanized, Schedule 40, to meet specified requirements of ASTM A120. Hollow structural steel tubing with minimum wall thickness of 1/8" (3 mm) and meeting specified requirements of CSA G40.21, Grade 50W. Vinyl coat where vinyl fence is required.

4. Tension Wire: No. 9 gauge single strand vinyl coated and hot dipped galvanized, finished to match fabric.

5. Fabric Bands: Galvanized steel and vinyl coated to fit tubing finished to match fabric.

6. Rail Fittings: Galvanized steel and vinyl coated. Post caps to provide waterproof fit. Turnbuckles to be dropforged. Use vinyl coated to match fabric where vinyl is indicated.

7. Galvanizing: Galvanize fittings, accessories and steel tube by hot dip method after fabrication to meet specified requirements of CSA Standard G164. Vinyl coat at vinyl areas.

8. Gate Hardware: Hinges latches malleable iron or cast iron galvanized after fabrication.

9. Tension Bar: 6-gauge (5 mm) x 5/8" (20 mm) minimum sized galvanized steel and vinyl coated, to match fabric.

10. Tension Bar Bands: 1/8" (3 mm) x 5/8" (20 mm) minimum sized galvanized steel or 6-gauge (5 mm) x 5/8" (20 mm) min. size aluminum and vinyl coated to match fabric.

11. Concrete: Conform to CAN 3 A 23.1 - M77 minimum 25 MPa at 28 days.

2.2 CHAIN LINK GATE FABRICATION

1. Gate: Construct gates with frames of 1 11/16" (43 mm) o.d. galvanized pipe electrically welded joints. Gate shall be complete with fabric galvanized malleable iron hinges, latch and lockable latch catch. Gate width to be minimum 42" (1000 mm) and full height of fence. Include diagonal brace pipes for gates wider than 8'-0" (2400 mm). Provide horizontal mid-rail pipe for all gates wider than 6'-0" (1800 mm). Provide centre ground stay and receptacle for pairs of fences. All gates to be industrial quality, vinyl dipped galvanized after fabrication, finish.

PART 3 EXECUTION

3.1 EXAMINATION

1. Take site measurements prior to fabrication of Work of this Section.

3.2 GRADING

1. Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface neither less than 1 1/4" (30 mm) nor more than 2" (50 mm).

3.3 ERECTION

1. Work includes chain link fencing, posts, miscellaneous hardware, gates, accessories and concrete footings as detailed or required for a complete installation of chain link fencing.

2. Install fencing in strict accordance with CGSB/CAN 138.3 and manufacturer's instructions and see drawings for fence heights and locations.

3. Space posts as indicated on drawings and to meet minimum requirements of the fencing manufacturer. Space at a maximum 10'-0" (3000 mm) centres. Space straining posts at equal intervals not exceeding 330 ft. (10000 mm) o.c. Install terminal posts at end of fence, at buildings and at gate posts on each side of opening.

4. Excavate post holes to dimensions indicated but a minimum dimension of 10" x 10" x 42" (250 mm x 250 mm x 1000 mm) deep for line posts and 12" x 12" x 48" (300 mm x 300 mm x 1200 mm) deep for terminal posts. Bulb bottom of holes 2" (50mm wider).

5. Install straining posts where change alignment exceeds 10%.

6. Place concrete in post holes then embed posts into concrete to depths indicated. Extend concrete 1½" (38 mm) above ground level and slope to drain

away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

7. Do not install fence fabric until concrete has cured a minimum of 5 days.

8. Install centre brace and bottom between terminal and gate posts and nearest line posts, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and line posts in similar matter.

9. Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner and straining posts with stretcher bar secured to post with stretcher bar bounds spaced at 12" (300 mm) o.c.

10. Stretch fabric taut and secure to line posts at 1'-0" (300 mm) intervals and top and intermediate rails at 1'-6" (450 mm) o.c. by means of 9 ga. wire ties.

11. Stretch tension wire along the bottom of fabric and securely attach to terminal and line posts, and to bottom of fabric at 1'-6" (450 mm) centres.

3.4 INSTALLATION OF GATES

1. Refer to drawings for gate types, sizes and locations. Layout proposed position of gates on site and obtain Consultant's and Owner's approval prior to installing gate support posts.

2. Install gates, complete with all hardware, to best industry practice. Ensure smooth, unobstructed full movement of all gates when finished grade is in place.

3. Lubricate all moving parts. Adjust tension on gate braces to ensure non-sag conditions.

4. Install top rails and caps. Install bottom tension wire, stretch tightly and secure to terminal posts and gate posts with turnbuckles and tension bar bands.

3.5 TOUCH-UP

1. Clean damages surfaces with wire brush removing loose and cracked coatings. Apply two coats of approved zinc pigmented paint to damaged areas to ensure uniform appearance for all surfaces or vinyl paint at vinyl fabric areas.

3.6 CLEANING

1. Clean and trim areas disturbed by operations. Dispose of surplus excavated material off site.

3.7 ORNAMENTAL IRON FENCE AND GATES

1. Fabricate and install all components per manufacturer's printed instructions using all posts set in concrete similar to chain link fencing posts.

END OF SECTION

PART 1 GENERAL

1. GENERAL REQUIREMENTS

    1. Division 1 General Requirements, General provisions of the contract and drawings apply to this section.

2. DESCRIPTION

    1. Unless otherwise indicated, work of this Section includes the procurement and installation of the following site furnishings:

        1. **Bike Racks**

    2. Contractor shall provide all labour, materials, equipment and services necessary to furnish, transport and install all site furnishing as indicated on the drawings, as specified herein and in accordance with local codes, and standards.

    3. This work includes but it is not limited to furnishing and installing bicycle racks, benches and refuse storage, grout, concrete, reinforcing anchors, attachment to other installations and miscellaneous items as required to provide a complete and secure installation.

    4. Related Sections: Cast-in-place concrete for installation of pipe sleeves and installation of anchor bolts in cast in concrete slabs.

    5. Products furnished but not installed under this Section include pipe sleeves and installation of anchor bolts to be cast in concrete footings.

    6. Coordinate delivery with other work to avoid delay. All work shall be coordinated with related Sections of these specifications.

3. SUBMITTALS

    1. Submittals shall be provided in accordance with Section 013000 and pertinent provisions of the contract.

        1. Product Data: For each type of product indicated, include construction details, materials description, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.

        2. Shop Drawings: Shall clearly show layout, designations, dimensions, locations, colours, style, quantities, accessories and materials. Include elevations, sections, plans, details, hardware (schedule, type, function, quantities and locations), fasteners, surface finish, anchors, installation details and attachments to other work. Include structural analysis data signed and sealed by the qualified professional engineer if applicable.

        3. Samples for Initial Selection: For units with factory-applied colour finishes.

4. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

5. Size: Not less than 6" long linear components and 4" square sheet components.

6. Substitutions: Substitution for any specified or designated material or equipment will only be made upon written approval of the Consultant in accordance with Section 01500 and pertinent provisions of the contract.

4. QUALITY ASSURANCE

1. Installation of all products in this specification shall conform to local codes requirements and standards.

2. Manufacturer's instructions for installation shall be delivered and stored with the materials.

3. Source Limitations: Obtain each type of site furnishing through one source from a single manufacturer.

4. Warranty: Manufacturer shall provide a warranty for materials for a period of two (2) years minimum commencing on date of Substantial Completion.

5. Repair: All warranties shall repair and/or replace any part of the premises or equipment required as a result of defects in materials or damage caused during construction. Repair/replacement shall be performed to the satisfaction of the Owner/Owner's Representative at the Contractor's expense.

5. DELIVERY, STORAGE AND HANDLING

1. Transport and handle all materials in such a manner as to prevent damage.

2. Locate storage piles, stacks, or bins to avoid or protect material from heavy and unnecessary traffic.

3. Deliver all packaged materials in original, unopened, undamaged containers, with identification labels intact and bearing the name of the manufacturer and brand.

4. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

5. Store and protect materials from exposure to harmful weather conditions, and at temperature and humidity conditions recommended by manufacturer. Some materials may need to be stored in protected enclosures and handled by

methods which avoid exposure to moisture. Store moisture-sensitive materials off the ground, under cover, and in a dry location. Additional requirements for product delivery, storage and handling are in Section 01600.

PART 2 PRODUCTS

2.1 BASIS-OF-DESIGN PRODUCTS

1. Provide the specified products and/or materials from indicated manufacturers. Other comparable products may be submitted as substitution requests.

2. Submit product information and test data showing that products are equal or better within ten (10) days prior to bid for Architect and/or Owner's review and approval.

3. Requests for substitutions will be considered in accordance with provisions of Sections 01016 - Products and Section 01500 - Substitutions

2.2 FURNISHINGS / ACCESSORIES

1. **Bike Rack:** Paris Site Furnishings

   1. Model: **LIS-BR-2HMP**
   2. Quantity: 6

   3. Final locations to be confirmed with owner prior to installation.

2.2 MATERIALS

1. Steel: Free from surface blemishes and complying with the following:

   1. Plates, Shapes, and Bars: ASTM A 36/A 36M.

   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.

   3. Tubing: Cold-formed steel tubing complying with ASTM A 500.

   4. Sheet: Commercial steel sheet complying with ASTM A 569/A 569M.

3. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or non-corrodible materials; commercial quality; tamperproof, vandal and theft resistant; concealed, recessed, and capped or plugged. Provide as required for site furnishings' assembly, mounting, and secure attachment.

4. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107.

Provide grout, recommended in writing by manufacturer, for exterior application

PART 3 EXECUTION

3.1 EXAMINATION

1. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finish grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

2. Notify Owner/ Owner's Representative within 48 hours of unsatisfactory conditions/defects which could be detrimental to other work.

3. Proceed with installation only after unsatisfactory conditions and/or work have been corrected.

3.2 INSTALLATION, GENERAL

1. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site and street furnishings, where required.

2. Unless otherwise indicated, install site and street furnishings after landscaping and paving have been completed.

3. Install site and street furnishings level, plumb, true, and securely anchored or positioned at locations indicated on Drawings, as specified herein, and per local codes and standards.

4. Vandal-proof bolts as approved by Owner's Representative.

5. Unless otherwise indicated, paint all hardware to match specified furnishings.

6. Pipe Sleeves: Unless otherwise indicated use, steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

3.3 CLEANING

1. After completing site and street furnishing installation, inspect components and premises. Remove spots, dirt and debris.

2. Remove spots, dirt and debris.

2. Repair damaged finishes to match original finish or replace component/premises at the discretion of the Owner/Owner's Representative.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 Section 02906 Planting of Trees, Shrubs, Ground Covers & Transplanting
.2 Section 02924 Seeding
.3 Section 02938 Sodding

1.2 Source Quality Control

.1 **Testing of Topsoil**

.1 All topsoil to be used on park sites, sports fields, planting beds, trees etc. must be tested by an approved testing in accordance with General Requirements: St out by Landscape Ontario.

.2 Test topsoil from source prior to stripping and stockpiling for :

.1 Particle size analysis (percentage of sand, silt and clay by Hydrometer Method).

.2 Organic matter, phosphorus (sodium bicarb), potassium, magnesium, calcium, soil pH, buffer pH, percent base saturation and calculated CEC. (Cation Exchange Capacity)

.3 Test for Sulphur, Zinc, Manganese, Iron, Copper, Boron and soluble salts content, and Atrazine.

.3 Use 25mm diameter sampling tube or spade and in the presence of the Consultant, take twenty-five (25) samples per hectare to full depth of topsoil at random across entire area to be stripped. Mix samples together thoroughly before submitting for testing.

.4 Submit 0.5 kg sample of topsoil to testing laboratory and indicate present use, intended use, type of subsoil and quality of drainage. Prepare and ship sample in accordance with provincial regulations and testing laboratory requirements.

.5 The Contractor shall arrange for and assume all costs for such testing of topsoil imported to the site and the amendment recommendation report. For onsite topsoil stockpiles, unless otherwise provided for in

this document, the tests and report shall be arranged and paid for by the Contractor. A Township of Mapleton Representative must be present for the sample selection. Submit two (2) copies of soil analysis and recommendations for corrections to sustain vigorous plant growth including recommended fertilizer applications to the Consultant prior to commencing of topsoil spreading and topsoil delivery.

.6 Stockpiled topsoil will be amended by shredder as per the recommendations for corrections in the presence of the Consultant.

.7 When the source of such topsoil is exhausted, topsoil from a new source shall not be used until tested and approved.

.8 The Contractor has one (1) growing season from the time of soil testing to implementation on site. Any test result that is older than one (1) growing season may be asked to be retested at the discretion of the Consultant.

1.3 Scheduling of Work

.1 Schedule placing of topsoil and finish grading to permit sodding or seeding operations under optimum conditions.

PART 2 PRODUCTS

2.1 Materials

.1 Topsoil: friable, neither heavy clay nor of very light sandy nature consisting of the following, within 5% +/-: 45% sand, 35% silt, 20% clay and pH of 6.2 to 7.2. Free from subsoil, roots, vegetation, debris, toxic materials, stones over 50 mm diameter, containing four percent (4%) **minimum** organic matter for clay loams and two percent (2%) **minimum** organic matter for sandy loams and must be capable of sustaining vigorous plant growth.

.2 All topsoil whether existing or imported topsoil for use under sodded areas shall be screened topsoil having passed through a 25mm size screen and ensure that it is free from:

.1 Debris and stones over 25 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.3 Planting Soil for planting of trees, shrubs and ground covers from the stockpile shall be mechanically shredded and amended as per the soil analysis recommendations for corrections. Rototilling or mixing by other means is not acceptable.

.4 Manure: Well-rotted, unleached cattle manure, free from harmful chemicals and other injurious substances and saw dust, shavings, or similar refuse, at least eight (8) months old, but not more than two (2) years old, and with no more than 25% straw, leaves or **other unacceptable materials** for planting use.

.5 Peat Moss: Shall be partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses with a texture varying from porous fibrous to spongy fibrous, fairly elastic and substantially homogeneous with a pH value of not less than 4.5 and not greater than 6.0. It shall be baled and free of decomposed colloidal residue, wood, sulphur and iron, be brown in colour and finely shredded, suitable for horticultural purposes. Shredded particles shall not exceed 5 mm in size.

.6 Fertilizer: All fertilizer and soil amendment materials and quality to meet recommendations and standards outlined in the soil testing report.

PART 3 EXECUTION

3.1 Soil Preparation of Existing Grade

.1 Grade soil, eliminating uneven areas and depressions, ensuring positive drainage. Remove soil contaminated with toxic materials. Dispose of removed materials as directed by Consultant.

.2 Cultivate entire area which is to receive topsoil to following depths:

.1	Sod:	150mm boulevard areas; 200mm building lots
.2	Seed:	150mm
.3	Flower beds:	300mm
.4	Shrub beds:	450mm
.5	Trees:	as specified or as directed by the Consultant.

.3 Repeat cultivation in those areas where equipment used for hauling and spreading has compacted soil.

.4 Remove surface debris, roots, vegetation branches and stones in excess of 50 mm diameter.

.5 Special Conditions:

1. Environmentally sensitive areas, wetlands, or natural heritage sites where existing soil conditions are sufficient to sustain additional plantings, the Consultant may request that plantings be installed in native, undisturbed soil.

3.2 Soil Amendment Preparation

.1 The Consultant will accept three (3) means of soil amendment preparation for areas seeded, sodded, or planted. These means are as follows:

.1 Mixed and prepared by a mechanical shredder on site.
.2 Mixed and amended on the site.
.3 Pre-mixed soils imported to the site.

.2 The Consultant will be responsible for reviewing soils during the preparation process and clarify in writing to the Owner that the final soil product(s) and installation conforms to the specification.

3.3 Spreading of Topsoil or Planting Soil

.1 Spread topsoil after the Consultant has inspected and certified rough grading.

.2 Spread topsoil with adequate moisture in uniform layers over approved, unfrozen subgrade, where, sodding or seeding is indicated. Irregularities in the surface resulting from topsoiling or other operations shall be corrected to avoid the formation of depressions causing standing water.

.3 Apply topsoil to following minimum depths: 150mm for seeded areas, 100mm for sodded areas.

.4 Apply planting soil to following **minimum** depths:
.1 Sod: 150mm boulevard areas; 200mm building lots.
.2 Seed: 150mm
.3 Flower beds: 300mm
.4 Shrub beds: 450mm
.5 Trees: as specified or as directed by the Consultant.

5. Manually spread topsoil or planting soil around existing trees, shrubs and obstacles.

6. Where any portion of the surface becomes gullied or similarly damaged, the Contractor will repair affected area adding topsoil as necessary to restore to the satisfaction of the Consultant.

7. Contractor is to install and maintain erosion control fencing to prevent soil erosion.

3.4 Soil Amendments

.1 Apply soil amendments at rate and number of applications as specified and as determined from soil test and report, including any maintenance recommendations.

.2 Mix soil amendments into full depth of topsoil prior to application of fertilizer.

3.5 Application for Fertilizer

.1 Spread fertilizer uniformly over entire area of topsoil at manufacturer's recommended timing and rate of application.

.2 Mix fertilizer thoroughly to full depth of topsoil.

3.6 Finish Grading

.1 Fine grade and loosen top soil. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Roll to consolidate topsoil for areas to be sodded leaving surface smooth, uniform, firm against deep foot printing, and with a fine loose, texture to approval of Consultant.

3.7 Restoration of Stockpile Sites

.1 Restore stockpile sites to a ‘rake clean' condition acceptable to the Consultant.

3.8 Surplus Material

.1 Dispose of materials not required off site or as directed by the Consultant.

END OF SECTION - 02911

PART 1 GENERAL

1.1 Description of Work

.1 This section describes the labour, materials, and installation requirements necessary to complete the seeded turf planting related items as indicated or specified.

1.2 Related Work

.4 Section 02911 Site Topsoil & Finish Grading

1.3 Product Data

.1 Submit product data in accordance **Submittals**.

.2 Provide product data for:

.1 Seed
.2 Mulch
.3 Fertilizer

1.4 Delivery, Storage and Acceptability

.1 All grass seed hydraulic mulch, fertilizers and other related materials, where required, shall be stored in a dry, weatherproof area and shall be protected from damage by heat, moisture, rodents, or other elements until the time of seeding or use. All material shall be labelled by grower or manufacturer as separate items and shall not be removed or defaced.

.2 Bulk deliveries of seed shall be accompanied with delivery tickets specifying percentage germination, purity, and noxious weed seed content.

1.5 Measurement for Payment

.1 Seeding will be measured as per square metre unless otherwise stipulated in the Bid Document – Price Schedule.

1.6 Job Conditions

.1 The turf areas will be free of waste or debris developed by other trades. Any discrepancy from such conditions shall be reported to

the Contractor before beginning construction.

1.7 Grading

.1 The Contractor shall grade all turf areas as noted on the Contract Document drawings;

.2 Fine grade all turf areas eliminating rough or low areas to ensure positive drain age.

PART 2 PRODUCTS

2.1 Grass Seed Mixture

.1 Consult the Consultant to determine specific requirements for seed mixture application. Fertilizer application rates are to be as recommended in the soils test report.

.2 Grass Seed shall be Certified Canada No. 1 Grade to Government of Canada, Seeds Regulations and having minimum germination of 85% and minimum purity of 97%.

.3 Seed mixtures shall be suited to the climate, soil conditions and type, orientation, sun exposure, terrain, establishment and maintenance conditions under which they are to be grown.

.4 The mixture shall be mixed and supplied by a recognized certified seed supplier.

2.2 Seed Labelling

.1 All seed and seed mixes shall be in the original sealed package with the original legible label securely attached.

.2 Labelling shall conform to the requirements of the Canadian Seeds Act and Regulations. Each package shall be labelled to show:

1. The name and address of the seed supplier.
2. The seed species, or the name of the seed mix and the various individual seed species that comprise the seed mix and the percentage by mass.
3. The grade of the seed or seed mix.
4. The supplier’s name and lot designation number.
5. Mass in kilograms
6. Date and location of bagging
7. Year of production

.3 Seeding mix specification for **Upland Naturalization Seed Mix**.

40% Elymus riparius (Riverbank Wild Rye)
25% Oenethera biennis (Evening Primrose)
10% Rudbeckia hirta (Black Eyed Susan)
5% Euthamnia graminifolia (Grass Leaf Goldenrod)
5% Carex granularis (Open Field Sedge)
2% Solidago Canadensis (Canada Goldenrod)
2% Asclepsis syriaca (Common Milkweed)
1% Aster cordifolius (Heart Leaved Aster)
1% Aster novae-angliae (New England Aster)
1% Anenome canadensis (Canada Anenome)
1% Clematis virginiana (Virgins Bower)
1% Monarda fistulosa (Wild Bergamot)

Seed rate to be 26 kg/Ha.

To be spread with Lolium multiflorum cover crop. Cover crop seed rate to be 22 kg/Ha. Ideally seed in Fall.

.4 Seeding mix specification for **Tableland parks**:

48% Creeping Red Fescue
15% Majestic Kentucky Bluegrass
13% Palmer Perennial Rye Grass
11% Gator Perennial Rye Grass
7% Fortress Creeping Red Fescue
6% Yorktown II Perennial Rye Grass

.5 Seed mix specification for **Valleylands**:

10% White Clover
15% Fiesta Perennial Rye Grass
10% Mustang Tall Fescue
10% Creeping Red Fescue
15% Timothy
10% 'Dormie' Kentucky Blue Grass
30% Bird’s Foot Trefoil

.6 Seed mix specification for **Road Buffers:**

25% RFT Tall Fescue (Festuca arundiancea ‘Rhizomatous’)
30% Perennial Rye Grass (Lolium perenne)
25% Creeping Red Fescue (Festuca rubra)
5% Kentucky Blue Grass (Poa pratensis)
5% White Clove (Tripofolium repens)
10% Bird’s Foot Trefoil (Lotus corniculatus)

.7 Seed rate as per manufacturer’s recommendation.

.8 Seed will be shipped in containers with original tags from recognized supplier

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2.3 Mechanical Seeding

.1 Use equipment suitable for specified area to approval of Consultant. Where area allows, the "Brillion" type equipment is recommended.

.2 Use manually operated broadcast seeder only for small specific locations and areas inaccessible to “Brillion” seeding.

.3 Sow at the rate of as per manufacturer’s recommendation during calm weather and when soil moisture content is adequate for germination.

.4 Sow seed in two directions, 50% of seed in one direction and remaining 50% of seed at right angles to first seeding pattern, using same method of seeding.

.5 Cover broadcasted seed by raking and chain harrowing.

.6 Hydro-Mulching:

.1 Mix fibre mulch with water according to manufacturer’s recommendations, and apply to seeded areas at a minimum rate of 1600 kg/ha (16kg/100m2). Apply 2250 kg/ha (22.5 kg/100m2) on areas subject to wind and water erosion.

.2 Add and mix tackifier into slurry of water and fibre mulch and apply as required according to manufacturer’s instructions and recommendations.

.3 Using hydro-mulching equipment, apply fibre mulch slurry mixture within twenty-four (24) hours of mechanical seeding. Achieve uniform coverage after application.

.7 Roll seeded grass with roller not exceeding 50 kg where uneven soil conditions warrant.

.8 Water entire area with fine spray after each area has been sown. Apply water only where application of water is practical and will not interfere with other Work.

.9 Apply enough water to ensure penetration of at least 50 mm, avoid washing out seeds.

2.4 Hydro-Seeding and Mulching

.1 Proceed with hydro-seeding only after final grade has been approved by Contractor.

.2 No Hydro-seeding shall be performed when wind speeds exceed 10 km/h, over frozen soil, or on ground covered in snow, ice or standing water. Hydro-seed only when conditions are favourable for successful seed germination.

.3 Do not spray onto structures, signs guardrails fences, plant material, utilities and other than surfaces intended. Clean-up immediately, any material sprayed where not intended to the satisfaction of the Consultant.

.4 One- Step Hydraulic Seeding and Mulching

.1 Thoroughly mix grass seed, fertilizer, fibre mulch and water to obtain following slurry mixture and application rates per hectare.

1. Grass Seed – 300 kg/ha.
2. Fertilizer – (12-51-0) at 300 kg/ha.
3. Fibre Mulch – minimum 1600 kg/ha or 2250 kg/ha on areas subject to wind and water erosion.
4. Water – minimum 32,000 litres and to fibre mulch manufacturer's recommendations.

.2 Add tackifier directly into slurry mixture and thoroughly mix at rate recommended by manufacturer. Apply tackifier as required according to manufacturer's instructions.

.3 Using appropriate hydraulic hydro-mulching equipment, apply slurry mixture uniformly at optimum angle of application.

.4 Use proper nozzles for application and provide hose extensions to propel mulch slurry to inaccessible areas.

.5 Agitate slurry mix consistently during spraying to keep it homogeneous and avoid blockage to pipes.

2.5 Terra Seeding

.1 Terra Seeding Installation contractor must have three (3) years proven experience in the application of Terra Seeding using a Blower Truck.

.2 A legible, valid Seed Analysis Certificate from a Seed Testing Laboratory approved by the Canadian Food Inspection Agency (CFIA) for all single seed species and all seed mixtures shall be provided to the Consultant twenty-four (24) hours prior to any seeding operations. The Seed Analysis Report shall stipulate the seed supplier's lot designation numbers.

.3 Test Results from the Seed Analysis Certificate shall specify germination and purity for each seed species of the mix as well as the seed mix composition expressed as a percentage of each see species by mass for each seed mix specified in the contract. Test results shall meet or exceed the value for the various seed mixes as specified by the consultant.

.4 Materials:

.1 Permanent Seed Mixes: Use permanent seed mixes as specified on drawings.

.2 Annual Nurse Crop Seed: Nurse crop seed shall be a cereal grain such as Annual Ryegrass, Fall Rye Grain or Winter Wheat Grain unless otherwise approved by the Consultant.

.3 Fertilizer: Shall comply with the provisions of the Canadian Fertilizers Act and Fertilizer Regulations. Fertilizer shall be supplied in original bags bearing the manufacturer's original label indicating mass and analysis. All fertilizer shall be in granular form, dry, free flowing and free from lumps, and applied at rates specified by the Consultant.

.4 Composted Topsoil: Shall be pre-mixed and shall consist of a minimum 60% compost material. The composted topsoil may be amended by the additional of concrete sand and peat loam. Concrete sand shall be added to improve aeration and soil structure. Peat loam shall be added to adjust the pH of the compost and to make the composted topsoil lighter and easier to blow. Both amendments shall be added at the discretion of the Contractor to ensure that the composted topsoil meets the material specification and is suited for distribution by a pneumatic blower. Once mixed, composted topsoil material shall consist of particles where 100% of the material is able to pass through a 25 mm sieve.

.5 Compost: Shall be derived from a well-composted green organic waste matter from an approved source. All compost material

shall meet the Ontario Ministry of the Environment's Interim Guidelines for the production and Use of Aerobic Compost in Ontario definition for Type A compost and shall be supplied from composting sites certified to meet the Ontario Ministry of the Environment's Compost Regulation 101.

.6 Concrete sand shall have a pH range from 7.7 to 8.0 with a mid-range of 7.8 and shall meet gradation requirements for concrete sand as described in OPSS.

.7 Peat loam shall consist of a minimum 50% organic matter and equal parts sand, silt and clay. Peat loam shall be suitable for horticultural purposes. Shredded particles shall not exceed 16 mm in size.

.5 Equipment:

.1 Pneumatic Blower Truck: Shall be a custom manufactured, fully integrated, truck mounted unit. The blower truck shall be equipped with a computer-calibrated seed injection system and shall be capable of uniformly applying composted topsoil and seed at a rate greater than 0.25 cubic meters of material per minute. The blower truck shall also be equipped with an application hose capable of extended 90 meters from the blower truck unit.

.6 Operational Constraints :

.1 The composted topsoil and seeding operation shall not commence until a legible, valid Seed Analysis Certificate and a legible, valid signed declaration from the compost supplier has been approved by the Consultant.

.2 The composted topsoil and seeding operation shall not commence until the Consultant has approved the surface preparation and the layout of permanent seed mixes.

.3 The composted topsoil and seeding application and or the reapplication shall not be carried out under adverse field conditions such as high wind, frozen soil or soil covered with snow, ice or in areas of standing water to a concentrated flow of water.

.4 The Contractor shall maintain the site and control erosion until conditions permit application or re-application of seed and compost topsoil.

.5 The surface shall be prepared not more than seven (7) calendar days before the seeding operation. No seeding or composted topsoil application shall come in contact with the foliage of any trees, shrubs, or other vegetation. No seed or composted soil application shall come in contact with water bodies.

.7 Application Rates for Composted Topsoil:

1. Depending of the slope gradation, depth and composted soil, seed shall be as follows:
   0- 5% slope: 10-15 mm. depth
   5- 10% slope: 15-20 mm. depth
   10-25% slope: (4:1) 20-25 mm. depth.
   25-35% slope: (3:1) 25-40 mm. depth
   35-45% slope (40-50 mm. depth
2. Composted Topsoil and Seed Application

   1- Prior to the application of the composted topsoil and seeding, the Contractor shall ensure that the pneumatic blower has been properly calibrated to provide the specified amounts of seed and that the blower can adequately uniformly apply composted topsoil and seed at a rate greater than .025 cubic meters of material per minute.

   2- Once the blower has been calibrated, the Contractor shall apply composted topsoil and seeding uniformly ay specified depths to all areas identified for cover in the contract drawings or as directed by the Consultant.

2.6 Water

.1 Water used should be potable and shall be free of impurities that would inhibit germination and growth or may be harmful to the environment.

2.7 Seed Protection on Slopes and Ditches

.1 Erosion Control Blanket: where applicable, refer to plans for extent.

.1 Bonterra S1 Erosion Control Blanket or approved alternate:

100% weed free wheat straw .50 lb./yd^2. Netting on top side made of photo-degradable polypropylene or alternate with mesh openings of approximately (13 mm x 13 mm). Blanket

sewn with biodegradable or photo-degradable thread on 50 mm centres or approved alternate.

.2 Cover all prepared and seeded slopes 3:1 or steeper with erosion control blanket.

.3 Unroll blanket either horizontally or vertically to the slope without stretching or pulling.

.4 Lay blanket smoothly on soil surface. Overlap adjacent sections of blanket minimum 100 mm and use metal staples.

.5 Secure blanket to ground with staples in accordance with the erosion control blanket manufacturer's instructions.

.6 Minimize damage to seedbed during installation of blanket. Re-grade by hand raking as required, to correct any damage.

.7 In ditches and swales, unroll blanket in the direction of flow. Overlap adjacent sections of blanket minimum of 100 mm with upstream section on top and stapled. Follow manufacturer's installation recommendations.

2.8 Protection of Seeded Areas - General

.1 Immediately after seeding provide adequate protection against erosion, pedestrian and vehicular traffic damages. Protect newly seeded areas along walkways using bright coloured ribbon or fencing when necessary. Remove protection after seeded areas become established or when directed by the Consultant.

.2 Keep site well drained and landscape excavations dry.

PART 3 EXECUTION

3.1 Workmanship

.1 Do not perform Work under adverse field conditions such as frozen ground or ground covered with snow, ice or standing water.

3.2 Preparation of Surfaces

.1 At the time of seeding, all top soiled areas designated for seeding shall be free from erosion and shall have a fine graded, uniform surface free of humps and hollows. The surface shall be uniformly cultivated with

agricultural implements to a minimum depth of 50mm and shall not have surface stones greater than 50mm in diameter, weeds or other unwanted vegetation. Ensure areas are free of deleterious and refuse materials.

.2 Soil to be loose, friable and suitable as a seedbed to germinate seed, free of humps and hollows and deleterious materials.

.3 Obtain approval of topsoil grade and depth from the Consultant before starting seeding.

3.3 Area and Layout

.1 The locations of the different, permanent seed mixtures and composted topsoil shall be staked out on the ground surface in accordance with the contract documents. Stakes shall be used to indicate the limits of each type of seed mix.

3.4 Seeding

.1 Schedule seeding to be carried out when seasonal conditions are likely to ensure successful germination and a continued growth of all species of seed in the grass mixture establishment. All seeding shall be done during calm weather and on soil that is free of frost, snow and standing water.

.2 Seed shall be applied by Mechanical Dry Seeding, Terra Seeding, or Hydraulic Seeding unless otherwise specified.

.3 Sow seed uniformly at the rate as per manufacturer's recommendations.

.4 Seed between August 15th and September 15th, and between April 15th and May 1st unless otherwise directed by the Consultant.

.5 Blend applications into adjacent grass areas or sodded areas previous applications to form uniform surfaces.

.6 Embed seed into soil to depth of 5 mm within one hour of sowing.

.7 Roll area immediately with water ballast type idler prior to watering.

.8 Install Erosion Control Material as per manufactured instructions in areas as shown on plans and details.

.9 Protect seeded areas against damage by using temporary protective hoarding and signage to protect newly seeded areas from damage including erosion, pedestrian and vehicular traffic or wild life. Remove this protection after lawn areas have been accepted by the Consultant.

3.5 Establishment

.1 Perform following operations from time of seed application until Preliminary Acceptance:

.1 Repair and reseed dead or bare spots to allow establishment of seed prior to Preliminary Acceptance.

.2 Cut grass to 40 mm whenever it reaches height of 60 mm. Remove clippings which will smother grass.

.3 Fertilize seeded areas after first cutting at the recommended rate per hectare as per testing agency. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well. Postpone fertilizing until following spring if application falls within four week period prior to expected end of local growing season.

.4 Eliminate weeds by mechanical means.

3.6 Maintenance

Perform the following operations from time of installation to acceptance and until the end of warranty period:

.1 Apply water in sufficient quantities to maintain optimum soil moisture level for germination and continued healthy growth of grass. Promptly repair and reseed any damage that occurs through washout of soil.

.2 Areas with no irrigation system: supply labour, hoses and attachments necessary to provide adequate watering to prevent grass and underlying soil from drying out.

.3 Provide clean water and water hauling vehicle with proper attachments to provide efficient and adequate watering of seeded areas when necessary.

.4 Provide weed control in newly seeded areas by mowing when required or directed by the Consultant. Cut and maintain weed growth to height of 100 mm. Remove all weed and grass clippings.

.5 Control and eliminate turf damaging pests that appear in newly seeded areas.

.6 Cut lawn grass at regular intervals and maintain minimum height of 60 mm. Cut forage or native type grass at 80 to 100 mm or as directed by the Consultant. Do not cut more than 30% of blade at any one mowing. Remove clippings that will smother grass.

.7 Re-seed areas which show root growth failure, deterioration, bare or thin spots, or which have been damaged by any means or cause, including replacement operations. Overseed areas that show inadequate or improper sowing of seed from Brillion or other methods.

.8 Fertilize seeded areas during establishment period, minimum six (6) weeks after seeding, with 27-14-0 fertilizer or as directed by the Consultant. Spread evenly at rate of 3 kg/100 m2, water in well.

.9 Maintain daily maintenance log throughout Contract. Submit copy of log data to the Consultant each week for verification. Record all maintenance activities performed on site.

.10 The Consultant may extend maintenance period at no additional cost when Contractor fails to: maintain an accurate log; submit log when required; or when unsatisfactory and inadequate maintenance occurs.

3.7 Preliminary Acceptance

.1 Seeded areas will be accepted by the Consultant provided that:

.1 Areas are uniformly established to minimum of 95% and turf is free of rutted, eroded, bare or dead spots and free of weeds.

.2 Areas have been cut at least twice.

.3 Areas have been fertilized.

.2 Areas seeded in fall which have not received two (2) cuts will be reviewed for Preliminary Acceptance the following spring, one (1) month after start of growing season provided Preliminary
Acceptance conditions are fulfilled.

3.8 Restoration

.1 Upon completion of Work, remove all or any surplus materials and

debris off site.

.2 Reinstate pavement and sidewalks, all amenities, etc., at elevation which existed before excavation.

.3 Clean and reinstate areas affected by Work as directed by the Consultant.

.4 Correct any or all deficiencies previously recorded.

3.9 Warranty

.1 Guarantee seeded areas due to faulty material and workmanship for a period of two (2) years from the issue date of the Substantial Performance of the work. Refer to **Contract Closeout, Takeover & Warranties** for submittal requirements.

END OF SECTION - 02924

PART 1 – GENERAL

1.1 General Requirements

1. The General Requirements, Bid Form, Instructions to Bidders, Bid Policies, Special Provisions, The Agreement and the Contract Drawings shall form part of this specification in the same manner as if they were recited in full herewith.

2. Refer to other Specifications in these Documents to determine their effect upon the work of this section.

1.2 Scope of Work

1. This Specification covers the requirements for the supplying and planting of trees and shrubs, including supply of topsoil and all other materials required. Also included are pruning, staking and mulching of plant material as required by the Plans and Details and maintenance of all plants for the twelve (12) month guarantee period.

1.3 Related Work Specified Elsewhere

1. Section 2 01 91 Tree and Shrub Preservation

1.4 References

1. Install trees, shrubs and ground covers work in accordance with the Canadian Standards for Nursery Stock (latest edition), published by the Canadian Nursery Trades Association, except where specified otherwise.

1.5 Delivery Storage and Protection

1. Supply and deliver all materials such as fertilizers, bonemeal, mulches, etc., in standard containers clearly indicating contents, weight, analysis and name of manufacturer.

2. Where such materials are supplied in bulk, written statements shall be submitted to the City indicating the same information as if supplied in standard containers.

3. Store materials which are subject to deterioration resulting from weather or any other causes thereby impairing their effectiveness, in a dry waterproof place, follow regulations regarding Health and Safety.

4. Protect plants from damage and drying out from the time of digging until planting. Plant material left covered in excess of three hours will not be accepted. All bare root stock must be adequately protected and remain in moist condition until installed.

5. Plants shall be transported with every care taken to prevent damage to trunks and branches. The branches shall be carefully padded at points of contact with the equipment. Trees exhibiting any mechanical damage will not be accepted.

6. Plants shall be transported in trucks equipped with solid side and tops, or framing and canvas or tarpaulin sheeting to protect the entire plant from any element of the transportation process that would desiccate, bruise, burn, distort or damage the quality or character of the plant. Crowns wrapped for transport must be unwrapped prior to inspection.

7. Trunks shall not be used for hoisting purposes.

8. Plants with broken or cracked rootballs, or plants which are strongly desiccated, will be subject to rejection upon arrival on the project site.

9. All plant materials which cannot be planted immediately upon arrival on the project site shall be properly heeled or well protected with soil or similar material to prevent drying out and shall be kept moist until planting.

1.6 Qualifications

1. All work of this section shall be carried out by experienced personnel under the direction of a skilled foreman and in strict accordance with the specification and best horticultural practice.

1.7 Substitutions

1. All plants shall be supplied as specified on the Plant List. Substitutions will not be accepted unless approved in writing by the Landscape Architect.

2. Give timely notice, in writing, to the Landscape Architect when applying for substitutions.

1.8 Inspection During Construction

1. Make all materials available for inspections at source of supply and/or upon arrival on the site.

2. Approval of plant materials at source of supply will not impair the right of the Landscape Architect to reject plant materials during or after planting operations, which have been damaged or which have poor form and habit or which do not conform to the specifications and/or drawings.

3. Give timely notice, minimum 48 working hours in writing, to the Landscape Architect when such materials are available for inspection.

4. Planting of materials prior to inspection by the Landscape Architect will be the Contractor's responsibility and subject to rejection by the Landscape Architect.

5. Remove all rejected materials from the site immediately.

6. Furnish all inspection certificates as may be required by federal, provincial and other applicable regulations.

7. Do not remove any labels from plants unless directed to do

so by the Landscape Architect.

PART 2 – PRODUCTS

2.1 Plant Material

1. All plant materials shall meet the highest horticultural standards of the Canadian Nursery Trades Association with respect to grading and quality, and shall be in strict accordance with the Plant List and Specifications.

2. All plants shall be number one (1) grade, nursery grown, under proper cultural practices with respect to fertile soil, ample spacing, regular cultivation, weed, pest and disease control, adequate moisture and pruning, in accordance with good horticultural practices as advocated by the Canadian Nursery Trades Association. All such plants shall have been transplanted and/or root pruned regularly, but not later than (12) twelve months prior to arrival on the site. The Contractor shall submit sources of plant material, in writing, if so requested by the Landscape Architect

3. All plants shall be legibly tagged with their proper name and size and source. Tags must remain in place until approved by the Landscape Architect.

4. Nomenclature of specified plants shall conform to the international Code of Nomenclature for Cultivated Plants and shall be in accordance with the approved scientific names given in the latest edition of Standardized Plant Names. The names of the varieties not named therein shall conform to the names accepted in the nursery trades.

5. Any plants dug from native stands, woodlots, orchards or neglected nurseries and which have not received proper cultural maintenance as advocated by the Canadian Nursery Trades Association, shall be designated as "Collected Plants". These plants should be used only with specific permission from the Landscape Architect.

6. Plants shall be sound, healthy, vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs or larvae and shall have healthy, well developed root systems. All shrubs and trees shall possess all characteristics of the specified kind with all the leaders intact, undamaged and uncut, growing from an un mutilated root system and exhibiting previous 2 years shoot elongation as typical. The stems shall be free from sun-scalds, frost cracks, abrasions, fire and rusts. All old injuries shall be completely calloused over. Pruning wounds must show vigorous bark on all edges. Root balls should be weed free.

7. All plants shall conform to the measurements specified in

the plant list, except that plants larger than specified may be used if approved by the Landscape Architect. Use of such plants shall not increase the contract price. If larger plants are approved, the ball of earth shall be increased in proportion of the size of the plants.

8. All plants shall be measured when the branches are in their normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to root base or from branch tip to branch tip. Trees that exhibit weak graft unions shall not be accepted. Minimum branching height for deciduous trees shall be 1800 mm.

9. Where trees are measured by Caliper (cal.), reference is made to the diameter of the trunk measured 150mm above ground as the tree stands in the nursery. All plant materials shall be nursery grown under climatic, soil and local site conditions similar to those on the contract site for at least two (2) years. Certification of the origin of the plant material shall be required.

10. All plant materials specified shall be the best available quality. Trees indicated as "specimen" on the plant list shall be supreme examples of the particular species without irregularities or blemishes. They shall be uniform in character with all other "specimens" of the same species required under this contract.

11. All plant materials shall be moist, showing active green cambium when cut. Coniferous plants that are dry, brittle or showing a faded green not typical of the species will not be acceptable. Coniferous trees, with the exception of Colorado spruce and ornamental cedars are to be unclipped. All trees shall have only one unpruned central leader

2.2 Topsoil

1. All topsoil for planting purposes shall be supplied to site and tested under the terms of the contract. Any required amendments will be supplied by the Contractor.

2. All topsoil used for planting purposes shall be screened, fertile, friable, natural loam containing four percent (4%) minimum organic matter for clay loams and two percent (2%) minimum organic matter for sandy loams. Acidity of topsoil shall range from 6.0 pH to 7.5 pH (levels of NPK and Mg are to be noted). It shall be free of any mixture of subsoil, clay lumps, stones, and roots over 50mm in diameter and any toxic materials or foreign objects and shall be reasonably free of weeds and weed seeds.

3. If requested the Contractor will Test the topsoil from

source providing 0.5kg samples to an approved testing laboratory, and indicate present use, type of subsoil and quality of drainage. Prepare and ship the samples in accordance with Provincial regulations and testing laboratory requirements.

a) Contractor shall prepare representative topsoil samples from each area of the project.
b) Tested samples shall be an amalgamation of at least three (3) samples taken randomly from each area or stockpile.

4. Test topsoil from source providing 0.5kg samples to an approved testing laboratory, and indicate present use, type of subsoil and quality of drainage. Prepare and ship the samples in accordance with Provincial regulations and testing laboratory requirements.

    a) The testing must identify if the following elements are present in harmful levels; atrazene, salts, pre-emergent herbicides, growth inhibitors or soil sterilants and heavy metals.
    b) Should the test results indicate the topsoil is not satisfactory the report shall include recommendations to improve the soil. The City reserves the right to reject topsoil that does not meet the standards.

5. Peat Moss:
    a) Partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses with a texture varying from porous fibrous to spongy fibrous, fairly elastic and substantially homogeneous with a ph value of not less than 4.5 and not greater than 6.0. It shall be baled and free of decomposed colloidal residue, wood, sulphur and iron, be brown in colour and finely shredded, suitable for horticultural purposes. Shredded particles shall not exceed one-quarter 6.3cm (1/4 inch) in size.

6. Fertilizers:
Organic fertilizers applied to surface of planting saucer or bed, 2 times per year. Rates of fertilizer application shall be adjusted upon receipt of soil test reports. The Contractor shall be required to add fertilizer to the topsoil planting mixture based upon the following minimum rates:
    a) Rate of application: 5-4-7 @ 5 kg. per 100 m2 for planting beds.
    b)
    c) For trees, fertilization is to be implemented as a liquid application injected in to the ground.
    d) Rate of application: 30-8-8, fertilizer is to contain magnesium

7. Bonemeal:
   a) Bonemeal shall be commercial raw bonemeal, finely ground and with a minimum analysis of four percent (4%) nitrogen and twenty percent (20%) phosphoric acid.
   b) Bonemeal shall be added at the rate of 600 grams per cubic meter of planting soil mixture.

2.3 Water

1. Free of impurities that would inhibit plant growth.

2.4 Guying Wire

1. Support wires shall be number four (4) aluminum wire

2.5 Stakes

1. 2" x 2" Wood stakes - 2400mm long for trees, shall be drilled to secure tire wires and be sufficiently long to be driven securely into the sub-grade minimum 1200mm to frost, see also details. Not to be placed through the rootball.

2.6 Guying Collar

1. Rubber Hose shall be 2 ply 12.5mm diameter new black rubber hose, heavy duty two-ply reinforced. Ensure that there is flex around the tree.

2.7 Trunk Protection

1. 100mm diameter Corrugated drain collar 450mm in height.

2.8 Mulch

1. Shredded Pine Mulch sample to be submitted to the Landscape Architect for approval prior to installation (Black mulch to be used for this project).

2.9 Anti-desiccant

1. Wax-like emulsion.

2.10 Landscape Fabric

1. Landscape Fabric installed as per manufacturers specifications and in accordance with the detail and bid form.

2. Erosion mat installed as per manufacturers specifications and in accordance with the detail and bid form

PART 3 – INSTALLATION

3.1 Pre-planting Operations

1. Ensure plant material acceptable to Landscape Architect.

2. Remove damaged roots and branches from plant material.

3. Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.2 Excavation and Preparation of Planting Beds

1. Excavate planting beds for shrubs and trees as detailed. Do not leave tree pits open over night. Planting pits for trees to be 2 ½ times the size of the rootball. Aerate soil 150mm beyond planting pit.

2. Scarify sub-grade under planting beds and tree pits to be minimum depth of 150mm for trees. And mound planting mix to 150mm beneath root ball.

3. Ball sizes shall be sufficiently large to contain at least seventy-five percent (75%) of the fibrous root system. all sizes shall be in accordance with the Canadian Nursery Trades Association Standards:

4. Planting beds for shrubs shall be excavated and filled with topsoil mixture to a minimum depth of 450 mm and to a depth of 450 mm for ground covers and perennials. Planting beds for shrubs shall be a minimum of 650mm wider than the diameter of the ball or the natural spread of the roots. The depth of the hole shall be deep enough so that the top of the ball is at the same level as the surrounding grade with a minimum of 150mm of topsoil mixture under the ball.

5. Where trees are to be planted "bare root" (B.R.) or container grown the diameter of the hole shall be at least 600mm wider than the natural spread of the roots. The hole shall be deep enough that when backfilling is completed the tree shall be the same depth as it previously stood in the nursery with a minimum of 150mm of topsoil under the roots.

6. Where trees are to be planted "balled and burlapped" (B/B) they shall be moved with the root system as solid units, with balls of earth wrapped with burlap. The diameter and depth of the balls must be sufficient to encompass a fibrous and feeding root system necessary for the healthy development of the plant. No canned or potted stock shall be accepted. No plant shall be accepted when the ball of earth surrounding its roots has been cracked or broken during transplanting. The least possible time shall elapse between the digging of a tree and its final planting. The Landscape Architect shall be the sole judge as to the allowable lapse of time.

7. Burlap and rope shall be manufactured of natural decomposable fibres without treatment for waterproofing or rot resistance. Plastic or metal fibres or strands shall not be used.

8. Planting pits for trees, which are to be planted with frozen ball shall be mulched with straw until tree is planted.

9. Remove from site all excavated material from planting beds and tree pits and dispose of as directed.

10. Backfill planting beds and tree pits with a soil mixture consisting of four (4) parts topsoil and one (1) part peat

moss. Add bonemeal to the soil mixture at a rate of 0.45 kg per cu m. Add commercial fertilizer at the specified rates mixing fertilizer thoroughly within the top 100 mm of the soil mixture and water well. Contractor is required to provide the empty bags of all peat moss, bone meal and fertilizer utilized on the site to the Landscape Architect upon completion of planting operations. For trees utilize slow release fertilizer.

11. Mix topsoil, peat moss, bone meal and any other additives thoroughly on the site, not more than two (2) days before backfilling.

12. Do not mix or backfill when topsoil or soil mixture is in a muddy or frozen condition.

3.3 Planting

1. Planting shall occur as the work progresses and as areas of work are completed. It will not be acceptable to complete planting as a single operation at the end of the project.

2. Planting shall be done during suitable periods with respect to weather conditions and locally accepted practice and to the Landscape Architect's approval. Plants shall be set plumb in the centre of the pit and with the original elevation of the nursery soil level and or with the root flare exposed allowing 50-100mm for settlement.

3. Trees and other plant materials shall be faced to give the best appearance or relationship to adjacent structures, and to the approval of the Landscape Architect.

4. Set plants in filled pits or beds of soil mixture, allowing at least 150mm of soil mixture under each plant. Place landscape fabric over bed, cut opening for plants. Overlap fabric as per manufacturers' specification. Remove all ropes, wires, etc., and pull burlap away from top 1/3 of rootball. Set bare root plants so that their roots lie in their natural position.

5. Backfill soil mixture in layers not exceeding 150mm in depth.

6. Constantly tamp soil around rootball to eliminate air pockets. Soak soil mixture thoroughly with water when hole is filled half-way. Fill hole completely, leaving a shallow saucer directly over root ball, and slightly smaller in diameter than the excavation.
7. Backfill to a height above finished grade sufficient to allow for normal, natural settlement. Finished grade, after settlement, shall be as shown on drawings.

8. Prune only as necessary to remove dead, broken or interfering branches and to compensate for loss of roots as a result of digging operations in nursery.

9. Supply and place mulches for tree saucers and planting beds as shown on drawings. Mulch shall be 100mm in depth for trees and in shrub beds 100mm and shall be pulled away from trunks.

10. Water trees and planting beds thoroughly immediately after planting.

11. Remove all wire, ropes etc and pull the burlap away from the top 1/3rd of the rootball.

3.4 Mulching

1. Ensure soil settlement has been corrected prior to mulching.

2. Spread mulch as indicated.

3. Ensure that mulch is pulled away from tree trunk.

3.5 Clean-up

1. Immediately after planting, remove all excess materials, rubbish and debris, from the site, leaving the area neat and tidy. Clean all areas which are contaminated as a result of planting operations and reinstate to existing conditions or better.

3.6 Certificate of Substantial Completion

1. Prior to the issuance of the Certificate of Substantial Completion, all plants and materials shall be completely free of disease and/or insect infestation and in a healthy and vigorous growing condition. Proof of fertilization, peat moss and bone meal additives will be required. Tree stakes shall be taut and all accessories in good condition as specified. Planting areas and tree saucers shall be freshly cultivated and free of weeds and debris.

2. At the end of the specified guarantee period the Landscape Architect will inspect all planting and provide Final Acceptance Certificate.

3.7 Guarantee

1. "Nursery Grown" plants installed during the period from April 15th to October 31st, and for which a Substantial Completion has been issued shall be guaranteed for twelve (12) months from date of substantial completion.

2. "Nursery Grown" plants installed after October 31st, for which a certificate of substantial completion has been issued shall be guaranteed for twelve (12) months from April 15th of the following year.

3. The guarantee of "Approved Collected Plants" shall extend for a period of two (2) years beyond the periods stated for "Nursery Grown Plants".

3.8 Maintenance during Establishment Period

1. Contractor shall provide a schedule indicating when fertilization, weeding, watering will be undertaken. Payment for this component is inclusive in the bid price.

Payment shall be commensurate with work preformed.

2. Maintenance of all plants shall include all measures necessary to establish and maintain all plants in an acceptable, vigorous and healthy growing condition, throughout the specified guarantee period, including, but not limited to:
    a) Cultivation and weeding of planting beds and tree pits. When herbicides are used for weed control, they shall be applied in accordance with manufacturer's recommendations, planting beds with significant weeds or grass should be sprayed with Round-up; all applications shall be in accordance with MOE application guidelines and within local or provincial by laws.
    b) Pruning including the removal of dead, or broken branches and treatment of pruning wounds.
    c) Disease, insect and rodent control, when required. When chemicals are used for such control, they shall be used in accordance with manufacturer's recommendations; and
    d) Maintenance of all accessories in good condition such as, tree guys, turnbuckles, stakes, etc., including adjustment of turnbuckles to keep tree guys tight and repair and replacement of accessories when required.
    e) Trees shall have trunk suckers removed as well as co-dominate leaders removed.

3.9 Maintenace During Waranty Period

1. The Contractor shall water all plants sufficiently to maintain vigorous, healthy growth from time of installation until the end of the specified guarantee period.

2. The Contractor shall be responsible for pre-winter rodent protection of all materials deemed susceptible to rodent attack, and pesticide applications necessary to control weeds and unwanted grasses.

3. Through the guarantee period the Contractor shall make periodic inspections of all plant materials and notify the Owner and the Landscape Architect of any corrective or preventative measures which are necessary to safeguard the plants.

4. All coniferous trees shall be wrapped with burlap by December 15th and removed by April 15th during the guarantee maintenance period.

5. Prior to final acceptance all planting saucers shall be cultivated and re-mulched, tree stakes and collars removed.

6. All plant material shall be maintained annually during the

guarantee period and shall be weeded, cultivated, fertilized and mulched twice over this period and prior to the final inspections, to eliminate weeds and promote water penetration.

7. Prior to cultivation, all mulch shall be removed from the pit areas, cultivated to a depth of 5cm and new mulch applied.

8. All plant materials shall be watered bi-weekly from May 15th until November.

9. All leaning trees shall be corrected prior to inspection

10. Corrective pruning shall be completed prior to the final inspections and in accordance of industry standards, to preserve the natural character of the tree and not to detract from the shape or form of the tree, or cause unsightly scars and to encourage apical dominance by removing co-dominate leaders as required.

3.10 Replacements

1. Plant material found dead within the special guarantee period, or not in a healthy, satisfactory growing condition, or which do not meet the requirements of the specifications, shall be replaced by the Contractor at his own expense.

2. The cost of replacements resulting from theft, vandalism, careless or neglect on the part of others, or any cause due to circumstances beyond the control of the Contractor, shall be borne by the Owner.

3. All replacements shall be plants of the same size and species as originally specified and shall be supplied and planted in accordance with the drawings and specifications as directed by the Landscape Architect. The guarantee period for replacements shall be the same length as the guarantee period for the original plant material and shall extend from the date of acceptance of the replacement. Any replacement must be undertaken immediately upon notification of the Owner or as identified by the Contractor during the periodic inspections required during the guarantee period.

4. Tag or mark, in a permanently visible manner, all replacement trees and notify the Landscape Architect in writing of the date on which replacements were planted. Include sketch showing location of replaced plants.

5. Plant replacements at a time which is in accordance with good horticultural practice.

6. When notified by the Landscape Architect, remove all accessories and cut a grade those trees which are to be

replaced at a later date

3.11 Measurement and Basis of Payment

1. Payment for Nursery Grown Plants shall be per the lump sum bid, and shall be full compensation for all labour, materials, and equipment necessary to complete the work as specified herein.

2. Payment for maintenance shall be in accordance with the bid form.

END OF SECTION

PART 1 GENERAL

1.1 Description of Work

.1 This section describes the labour, materials, and installation requirements necessary to complete the sodding turf planting related items as indicated or specified.

1.2 Related Work

.1	All Division 1	Specification Sections
.2	Section 02906	Planting of Trees, Shrubs,Groundcovers & Transplanting
.3	Section 02911	Site Topsoil & Finish Grading
.4	Section 02924	Seeding

1.3 Scheduling

.1 Scheduled sod laying to coincide with topsoil operations.

.2 Do not lay sod until topsoil finished grade. Obtain approval of topsoil fine grade prior to sodding.

1.4 Certification

.1 The supplier shall provide, upon request of the Contractor, a label or statement certifying the quality of grade, location of sod source and species of grass in the sod, and that the sod meets the specifications or requirements.

1.5 Delivery, Storage, And Acceptability

.1 All sod shall be reviewed by the Contractor at the job site prior to installation. The Contractor reserves the right to refuse the sod if it is deemed unacceptable.

.2 Schedule delivery in order to keep storage on the job site to a minimum without causing delays.

.3 Each palette, flat, or specified group of sod shall be labelled by the grower or manufacturer as separate items.

.4 During delivery, sod materials shall be protected from any drying or contamination by detrimental material.

.5 Deliver sod to site within twenty-four (24) hours of being lifted and lay sod within thirty-six (36) hours of being lifted.

.6 Do not deliver small, irregular, or broken pieces of sod.

.7 Turf materials shall be sprinkled with water and covered with moist burlap, straw, or other approved covering and protected from sun exposure to wind and direct sunlight. Covering shall be such that air can circulate and heating will not develop.

.8 During dry weather protect sod from drying and water sod as necessary to ensure its vitality. Dry sod is to be rejected by the Contractor.

.9 Deliver fertilizers and similar material to the site packed in standard containers, clearly marked with contents, weight, analysis, and name of manufacturer.

.10 Store fertilizer in dry, weatherproof storage areas.

1.6 Alternatives

.1 Should the Contractor proceed to use material not previously approved or materials contrary to the specifications, the Consultant will proceed to have such works rectified at the Contractor's expense.

1.7 Handling

.1 Sod shall not be dropped or dumped from vehicles.

1.8 Source Quality Control

.1 The Contractor shall:

.1 Supervise all work in this section including implementation and all maintenance until Substantial Performance of the Works.

.2 Shall obtain approvals for suppliers, Sub-Contractors, and materials to be used in this section of Work;

.3 Ensure the sod supplier meets the standards and requirements of the "Nursery Sod Growers Association of Ontario"

.4 Shall obtain approvals from Consultant of sod at source and submit proof to the Consultant that the sod delivered to the site was obtained from the approved source and is #1 Nursery Sod.

PART 2 PRODUCTS

2.1 Materials

.1 Turf Grass Nursery Sod: specifically sown and cultivated in a nursery field all in compliance with the specifications published by Nursery Sod Growers Association of Ontario, Number One Grade Turfgrass Nursery Sod.

.1 Broken, dry, discoloured pieces will be rejected by the Consultant.

.2 Size of Sections: Turfgrass shall be cut by able methods by machines designed for that purpose, to the suppliers length and width, plus or minus 12mm in width and plus or minus 5% in length. Broken pieces and torn or uneven ends are not acceptable.

.3 Thickness of cut: Turfgrass sod shall be cut at a uniform soil thickness (excluding top growth and thatch) of 15mm plus or minus 5 min.

.4 Strength of sod: Minimum age of twelve (12) months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

.1 Sod shall be strong enough that a nominal sized section can be grasped at one end, picked up and handled without damage.

.2 Sod shall have strong fibrous root system, free of stones, burned or bare spots.

.5 Moisture Content: Turfgrass sod shall not be harvested or transplanted when its moisture content is too low or too high, resulting in potential damage to the sod.

.6 Grass height: The height of the grass in the sod at the time of harvesting shall be between 40mm and 60mm.

.7 Thatch: Turfgrass sod shall be reasonably free from thatch. Up to 10 mm of thatch (uncompressed) is acceptable.

.8 Diseases, Fungi, Nematodes, Insects: Turfgrass sod shall be reasonably free from diseases, fungi, nematodes and soil-born insects, to the extent that with proper installation methods and initial maintenance new turf will not deteriorate due to such causes.

.9 Wire mesh: 40 mm, plastic.

.10 Wooden pegs, 25 x 25 x 250 mm.

.11 Water used should be potable and shall be free of impurities that would inhibit germination and growth or may be harmful to the environment.

.12 Fertilizer: As recommended by testing agency as per topsoil sample.

.13 Herbicide: type, rate, and method of application subject to approval by Consultant.

PART 3 EXECUTION

3.1 Laying of Sod

.1 Prior to sodding, the Contractor is to verify that the finished grade and depth of topsoil is satisfactory.

.2 Fertilizer as per recommendation by testing agency as per topsoil sample. Refer to Topsoil Section **02911, Subsection 3.5 Application for Fertilizer**.

.3 Sodding during excessively wet conditions, at freezing temperatures or over frozen soil is not acceptable.

.4 Lay sod in rows, perpendicular to slope, and with joints staggered. Butt sections closely without over-lapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.5 Where new sod abuts existing sodded areas/seeded areas, new sod must be knitted to existing with finish grade of new sod same as existing.

.6 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

.7 Water sod immediately after laying to obtain moisture penetration into top 100 mm of topsoil.

3.2 Laying of Pegged Sod

.1 Place approved mesh on top of topsoil of slopes steeper than 3:1. Secure mesh in place with wooden pegs or staples at maximum intervals of 1000 mm. Cover mesh lightly with topsoil.

.2 Lay sod sections perpendicular to slopes greater than 3:1 (run/rise) and secure with wooden pegs. Place pegs 3 per m2, 100 mm below to edge to prevent shifting of sod and drive pegs flush with top of sod soil.

3.3 Maintenance

.1 Maintain sodded area from the time of installation until the second cut has been completed AND until Substantial Performance of the Work.

.2 Maintenance shall include all necessary measures to establish and maintain grass in a healthy, vigorous growing condition. Maintenance shall include, but not be limited to the following work until Substantial Performance of the Work

.1 Watering: When required in sufficient quantities and at a frequency to prevent sod from drying out and to maintain topsoil under sod continuously moist to a depth of 75 to100 mm. Water sufficiently to ensure that sod has become firmly rooted in the topsoil.

.2 Mowing: Regular intervals to maintain a maximum height of 50 mm. Do not cut more than 1/3 of the grass height at any one mowing. Trim and clip edges. Remove clippings.

.3 Fertilizing: If instructed by the Consultant, sodded areas may be fertilized based on mixtures and rates as per supplier's and manufacturer's instructions and soil test results. Postpone fertilizing until the spring following a fall installation.

.4 Make good any erosion that results from faulty workmanship or material at no extra cost.

.5 Replace any deteriorated or bare spots with new sod.

3.4 Sod Acceptance

.1 Prior to Substantial Performance of the works, the sodded areas shall meet the following criteria:

.1 Sodded areas are properly established and are selfsustaining.

.2 Sod is free of bare and dead spots and without weeds.

.3 No surface soil is visible when grass has been cut to height of 40 mm.

.4 Sodded areas have been cut minimum two (2) times prior to acceptance review.

.2 The Contractor is responsible to arrange review of sod for acceptance review within one (1) week after second cut. Additional cuts will be required if acceptance review meeting doesn't occur in a timely matter.

.3 Areas sodded in fall will be accepted in following spring one (1) month after start of growing season provided acceptance conditions are fulfilled.

.4 The Owner will take over the cutting of the sod following a successful acceptance review.

3.5 Cleaning

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION - 02938

PART ONE – GENERAL

1.1 SECTION INCLUDES

1.1.1 Provision of all labour, materials, equipment, and incidental services necessary to provide concrete formwork and accessories as indicated on the drawings and specified herein.

1.2 RELATED SECTIONS:

.1 Section 03200 – Concrete Reinforcement
.2 Section 03300 – Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

(All Codes and Standards referred to herein are to be latest edition.)

.1 CAN/CSA-S269.3, Formwork.
.2 CAN/CSA-A23.1, Concrete Materials & Methods of Concrete Construction.
.3 CAN/CSA-A23.2, Methods of Test and Standard Practices for Concrete.
.4 CSA-086, Engineering Design in Wood.
.5 CSA 0121, Douglas Fir Plywood.

1.4 TOLERANCES

1.4.1 Perform forming operations and place hardware so that finished concrete will be within the tolerances set out in CAN/CSA-A23.1.

1.4.2 Variations in building lines which result in extension of the building over lot lines or restriction lines will not be permitted.

1.4.3 Tolerances referenced are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

1.5 DESIGN REQUIREMENTS

1.5.1 Design formwork to safely support vertical and lateral loads until they can be supported by the structure, as recommended in CAN/CSA-S269.3.

1.6 SHOP DRAWINGS

1.6.1 If requested by the Consultant submit shop drawings in accordance with Section 01300. Each shop drawing shall bear the stamp and signature of a Professional Engineer registered in the Province of Ontario.

1.6.2 Indicate method and schedule of construction, materials, arrangement of joints, ties, shores, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

PART TWO – PRODUCTS

2.1 MATERIALS

2.1.1 Formwork Lumber. Wood for form facing for exposed concrete shall be exterior PMBC concrete form grade Douglas Fir Plywood or aluminum.

2.1.2 For non-architectural concrete work: plywood and wood formwork materials to CSA-086.1.

2.1.3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25mm diameter in concrete surface.

2.1.4 Tubular Column Forms: round, spirally wound laminated fiber forms, internally treated with release material.

2.1.5 From Release Agent: chemically active release agents containing compounds that react with free lime in concrete, resulting in water insoluble soaps.

PART THREE – EXECUTION

3.1 FABRICATION AND ERECTION

3.1.1 Verify lines, levels and centers before proceeding with formwork and ensure dimensions agree with drawings.

3.1.2 Obtain Consultant's approval in writing for use of earth forms.

3.1.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

3.1.4 Form footing sides unless footings are strictly specified to be placed against undisturbed soil.

3.1.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

3.1.6 Do not place shores and mud sills on frozen ground.

3.1.7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations, and levels indicated within tolerances required by CAN/CSA-A23.1.

3.1.8 Where shown, camber formwork such that hardened concrete, prior to stripping of forms, is cambered as shown. Maintain beam depth and slab thickness from

cambered surface.

3.1.9 Align form joints and make watertight. Keep form joints to a minimum.

3.1.10 Use 25mm chamfer strips on external corners and/or 25mm fillets at internal corners of concrete members, unless specified otherwise.

3.1.11 Camber slabs and beams 1 in 500 of span unless shown otherwise.

3.1.12 Mark building, grid or other lines on forms to permit the accurate positioning of reinforcing steel.

3.1.13 Construct templates and supports to rigidly fix reinforcing dowels in the forms prior to concreting.

3.1.14 Provide suitable markers to indicate the location and configuration of continuing concrete members so that dowels can be positioned accurately in relation to their position in the continuing members.

3.1.15 Set anchor bolts, templates, steel connection units, hardware, or other inserts into the forms and secure them rigidly so that they do not become displaced during concreting. Set and secure these items to the tolerances specified and required in the appropriate Sections.

3.2 SLEEVES, CHASES AND FORMED OPENINGS

3.2.1 Form sleeves, chases and openings except where such items are specified to be formed or sleeved by the appropriate trade.

3.2.2 All openings, sleeves, chases are not necessarily shown on the structural drawings nor are their sizes or locations shown. Refer to architectural, mechanical and electrical drawings and specifications for openings and sleeving requirements not shown, located and dimensioned on the structural drawings.

3.2.3 No sleeves, chases and openings through structural members shall be formed without the Consultant's written approval.

3.3 REMOVAL AND RE-SHORING

3.3.1 Leave formwork in place for following min. periods of time after placing concrete:
- .1 3 days for walls
- .2 1 day for footings and abutments
- .3 3 days for beams, slabs, decks and other structural members
- .4 3 days for columns

3.3.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and immediately replace

with adequate re-shoring.

3.3.3 Provide all necessary re-shoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

3.4 DEFECTIVE MATERIALS AND WORK

3.4.1 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION

PART ONE – GENERAL

1.1 SECTION INCLUDES

1.1.1 Provision of all labour, materials, equipment and incidental services necessary to provide all concrete reinforcement and accessories such as chairs, supports, bolsters etc.

1.2 RELATED SECTIONS

1.2.1 Section 03100 – Concrete Formwork
1.2.2 Section 03300 – Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

(All Codes and Standards referred to herein are to be latest edition)

.1 Reinforcing Steel Institute of Ontario (RSIO), Manual of Standard Practice.
.2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
.3 CAN/CSA-A23.2, Methods of Test and Standard Practices for Concrete.
.4 CSA-A23.3, Design of Concrete Structures.
.5 CSA-G30.3, Cold Drawn Steel Wire for Concrete Reinforcement.
.6 CSA-G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.
.7 CSA-G30.14, Deformed Steel Wire for Concrete Reinforcement.
.8 CSA-G30.15M, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
.9 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.
.10 ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.
.11 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
.12 Ontario Provincial Standard Specification (OPSS) 1443 Material Specifications for Organic Coatings for Steel Reinforcement.

1.4 TOLERANCES

1.4.1 Perform fabrication and setting so that completed work will be within the tolerances set out in CAN/CSA-A23.1.
1.4.2 These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

1.5 SUBMITTALS

1.5.1 Mill Certificates
.1 Reinforcement from Canadian Mills need not be tested. Steel from foreign mills shall be tested at no cost to the Owner.

1.5.2 Shop Drawings
.1 Prepare placing drawings to a minimum scale of 1:50 in a clear complete manner that will permit placing of reinforcement to be performed without

reference to contract drawings.

.2 Detail reinforcement in accordance with the contract documents, CAN/CSA-A23.1 and detailing standards in RSIO Manual of Standard Practice As a minimum, show the following:

- .1 Bar sizes, spacing, location and quantities of reinforcement, welded wire fabric.
- .2 Identification of each bar with code mark corresponding to bar lists.
- .3 Details illustrating placement of reinforcement at openings, change of levels, spandrels, stairs, etc.
- .4 Clearances between reinforcement, and minimum concrete protection to reinforcement.
- .5 Location and embedment of dowels.
- .6 Location, number and type of support accessories.

1.5.3 Certificates

- .1 Canadian Manufacture: Provide Consultant with certified copy of reports of reinforcing steel showing physical and chemical analysis minimum (5) weeks prior to commencing reinforcing work.
- .2 Submit code marks or symbols used on reinforcement of each manufacturer so that Consultant may identify grades and size of reinforcement.

1.5.4 Substitutions

- .1 Substitution of different size bars permitted only upon written approval of Consultant.

PART TWO – PRODUCTS

2.1 MATERIALS

2.1.1 Reinforcing Steel: Only Canadian manufactured deformed steel to CSA G30 Series and to the material specification shown on the drawings. Reinforcement larger than 6mm (1/4") diameter shall be deformed bars. Hard grade billet steel or rail steel shall not be used for stirrups, column or beam ties or spirals.

2.1.2 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1. In the case of concrete exposed to view or weather the accessories shall be such that no metal is permitted to come closer than 40mm from a formed face and 50mm from a troweled surface. Use precast concrete supports for exposed concrete beams and soffits and concrete cast against soil/rock.

2.2. FABRICATION

2.2.1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and the RSIO Manual of Standard Practice.

2.2.2 Identify with a tag each bar with code mark corresponding to that appearing on bar list.

2.2.3 Bend reinforcement once only and at room temperature. Do not straighten or re-bend reinforcement. Do not use bars with kinks or bends not shown on the

drawings.

2.2.4 Replace bars which develop cracks or splits.

PART THREE – EXECUTION

3.1 PLACING REINFORCEMENT

3.1.1 Prior to concreting, place reinforcement, support and secure against displacement, as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
3.1.2 Place reinforcement accurately and secure against displacement by using ties or clips at intersections. Tack welding of reinforcement to secure in place will not be permitted.
3.1.3 Secure reinforcement in walls using sufficient spacers on each face to maintain the requisite distance between reinforcement and wall face and so that vertical bars are plumb. Provide spreader bars of minimum size 10M spaced at 2m centers in both directions.
3.1.4 Do not drive or force reinforcement into fresh concrete.
3.1.5 Set column and wall dowels prior to concreting with wooden templates or other approved means.
3.1.6 Where toppings are placed on waterproof membranes, vapour barriers and the like, prevent reinforcement or tie wire contacting these items.
3.1.7 Pre-assemble column and beam cages as necessary. Do not "spring" or bend ties and stirrups in order to place longitudinal reinforcement.
3.1.8 Pre-tie reinforcement for footings and lower into place so as not to disturb the soil at founding elevation.

3.2 FIELD BENDING

3.2.1 Do not field bend reinforcement except where indicated or authorized in writing by Consultant.
3.2.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
3.2.3 Replace bars which develop cracks or splits.

3.3 CONSTRUCTION JOINTS

3.3.1 Obtain written approval from the Consultant for location and details of construction joints not shown.
3.3.2 Continue reinforcement through the joint in its normal position. Add additional reinforcement across the joint as shown or directed.

3.4 QUALITY CONTROL

3.4.1 Provide a system of quality control to ensure that the minimum standards

specified herein are attained.

3.4.2 List the names, qualifications, duties and responsibilities of supervisory and quality control personnel.

3.4.3 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during Construction. The Consultant will decide upon corrective action and give recommendations in writing.

3.4.4 The Consultant's general review during construction and inspection and testing by Independent Inspection and Test Companies reporting to the Consultant is undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

3.5 NOTIFICATION

3.5.1 Prior to commencing significant segments of the work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford reasonable opportunity to review the work. Failure to meet this requirement may be cause for the Consultant to classify the work as defective.

3.6 INSPECTION AND TESTING

3.6.1 The Owner will appoint an Independent Inspection and Testing Company to make inspections or perform tests as the Consultant directs. Inspection and testing shall be paid from a cash allowance.

3.6.2 A series of specimens for each grade and size of reinforcing steel contained in any 100 tonnes of steel shipped may be tested. A series of tests will include two bars for each test required of each size and grade of steel used. Reinforcing steel tests will be made in accordance with CSA G30 Series.

3.7 DEFECTIVE MATERIALS AND WORK

3.7.1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Consultant may have additional tests, inspections or surveys performed, in order to determine if work is defective. Tests, inspections or surveys carried out under these circumstances will be made at the Contractor's expense in the event of defective work, or at the Owner's expense where work is in conformance.

3.7.2 Materials or works which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all cast-in-place concrete, complete in place, as indicated on the drawings, specified herein, and needed for a complete and proper installation.

1.1.2 Related work described elsewhere:
- .1 Section 03100 - Concrete Formwork and Accessories
- .2 Section 03200 - Concrete Reinforcement
- .3 Section 03345 - Concrete Finishing
- .4 Section 07211 - Insulation

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1.2.1 Anchors, bolts, hangers, sleeves, ties, inserts and other items required to be cast into concrete are to be supplied by applicable trade.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

1.3.1 All Codes and Standards referred to herein are to be latest edition.

1.3.2 Applicable Codes and Standards governing work of this Section:
- .1 CAN/CSA A23.1 - Concrete Materials & Methods of Concrete Construction.
- .2 CAN/CSA A23.2 - Methods of Test and Standard Practices for Concrete.
- .3 CAN/CSA A23.3 - Design of Concrete Structures.
- .4 CAN/CSA A5 - Portland Cement.
- .5 Ontario Building Code (OBC).

1.4 SOURCE QUALITY CONTROL

1.4.1 Supply concrete from a plant which has membership in the Ready-Mix Concrete Association of Ontario or otherwise approved by the Consultant.

1.5 SUBMITTALS

1.5.1 General: Comply with pertinent provisions of Section 01300.

1.6 INSPECTION AND TESTING

1.6.1 An independent Inspection and Testing Company may be appointed to perform material tests. The costs of testing will be paid, on approval by the Consultant, from the Allowances Section 01020.

1.6.2 Inspection Company shall:
- .1 Approve proposed concrete design mixes, if requested by the Consultant.
- .2 Perform testing in accordance with CAN/CSA A23.2
- .3 Submit complete reports including any abnormal conditions and

explanations if poor results obtained.

.4 Supply molds for test specimens.

1.6.3 Take concrete tests as follows:

.1 Record slump for each set of test specimens and perform air test when air entrainment specified.

.2 When placing concrete under cold weather requirements, take one additional specimen for each test set and store it on site under conditions similar to concrete it represents. Test this specimen at seven days before removing formwork.

.3 Ship cylinders to Testing Laboratory with complete shipping tags securely wired to cartons and pay costs of cartons and shipping.

.4 Frequency of tests: Take one set of cylinders for each day's placement and for each 50 cubic meters of concrete placed if daily placement exceeds 50 cubic meters and as further directed by the Consultant.

1.6.4 Contractor shall:

Pay for additional tests, including load tests and/or report on corrective measures due to:

.1 Changes in materials or proportions of mix requested by Contractor,

.2 Failure of test specimens to meet requirements,

.3 Failure of concrete in structure to meet requirements for strength, density, uniformity, protection and curing,

.4 Using unidentified reinforcing steel or reinforcing steel from non-Canadian Mills.

1.7 COLD WEATHER CONCRETING

1.7.1 When atmospheric temperature is at or below 5° C or when there is a possibility of it falling to that limit, place concrete in accordance with requirements of CAN/CSA A23.1 "Cold Weather Concreting" and ACI 306 "Recommended Practice for Cold Weather Concreting."

1.7.2 Exercise particular care to ensure that previously placed concrete and reinforcing steel are adequately heated to prevent freezing of new concrete placed directly against it.

1.7.3 Exercise care to avoid rapid temperature changes (thermal shock) when removing an area from temporary heating conditions.

1.7.4 Remove and replace all concrete damaged by frost or freezing at the direction of the Consultant at no cost to the Owner.

1.7.5 Accelerating chemical admixtures shall not be used without the written approval of the Consultant.

1.8 HOT WEATHER CONCRETING

1.8.1 When atmospheric temperature is at or above 27° C place concrete in

accordance with CAN/CSA A23.1 "Hot Weather Concreting" and ACI 305 "Recommended Practices for Hot Weather Concreting."

1.8.2 Exercise particular care to prevent surface crazing of floor slabs due to combined high temperatures and drying winds.

1.8.3 The use of water reducing-retarding chemical admixture in the concrete mix may be required at the Consultant's discretion.

PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 Use only materials specified.

2.1.2 Use materials in accordance with manufacturer's specifications. Have manufacturer's representative on site when material application is not familiar.

2.2 CONCRETE MATERIALS

2.2.1 All materials shall conform to standards specified in 1.3.

2.2.2 All cement in below grade concrete shall be moderate Portland cement Type 20. All other cement shall be normal Type 10 in accordance with CSA A5.

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2.2.3 Supplementary cementing materials in accordance with C.S.A. Standards A23.5.

2.2.4 Supplementary cement materials to be used to reduce CO_2 emissions in concrete. Maximum supplementary cement materials for suspended slabs on deck and beams is 20% and for slabs on grade is 50% use of slag or 30% use of fly ash, the use of supplementary cement material in slabs on grade also to be coordinated with the finishers. No supplementary cementing materials are permitted for concrete which is to be stained. Refer to Architectural Finish Schedules.

2.3 BONDING AGENT FOR PATCHING MORTAR

2.3.1 Daraweld C - W.R. Grace

2.3.2 Acrylic Concrete Adhesive - CPD

2.3.3 Acrylic Bond - U.S.E. Chemicals

2.3.4. Acry-lok by W. R. Meadows

2.4 GROUT, NON-METALLIC, NON SHRINK

2.4.1 Masterflow 713 - BASF

2.4.2 In-Pakt – CPD

2.4.3 CG-86 construction grade grout by W. R. Meadows

2.5 WATER REDUCING ADMIXTURE

2.5.1 Pozzolith - BASF

2.5.2 WRDA - Grace Construction

2.6 AIR ENTRAINING ADMIXTURES

2.6.1 MBVR - BASF

2.6.2 NVR - Sternson

2.7 ISOLATION JOINTS

2.7.1 Polyethylene or paint or other suitable inorganic material capable of isolating adjacent placements by acting as a bond breaker.

2.8 VAPOUR BARRIER

2.8.1 Vapour Barrier under slabs shall be in accordance with recommendation of Geotechnical Consultant and Soils Investigation Report or 15 MIL POLY, or as otherwise directed by the Architect in the contract documents.

PART THREE – EXECUTION

3.1 CONCRETE MIX DESIGN CRITERIA & PROPORTIONING OF CONCRETE - PROPERTIES

3.1.1 Design all concrete mixes for the compressive strength and slump requirements in accordance with CAN/CSA A23.1 and as specified in "Proportioning" of this section. Allow for the appropriate coefficient of variation for each strength class for the batch plant supplying the concrete.

3.1.2 Submit detailed mix designs for each class of concrete for review by the Material Testing Consultant at least two weeks prior to the commencement of concreting. Submit up to date statistical data for the batch plant confirming the coefficient of variation for each strength class.

3.1.3 Note that concrete that is to be stained may not have any supplemental cementitious materials in the mix.

3.1.4 Proportion the materials in accordance with the mix designs supplied to provide the following specified design strengths, slumps and air contents.

3.1.5 For fibre concrete provide fibres at the rate of 2.2 lbs (1.0kg) per cubic metre of concrete. Provide a compatible slump enhancer to ensure that no slump loss occurs with the addition of fibres.

CONCRETE PROPERTIES

LOCATION	28 DAY COMPRESSIVE STRENGTH (MPa)	WATER to CEMENT RATIO	SLUMP (1) (mm)	AIR CONTENT (2) (%)	CLASS of EXPOSURE
Mud Slabs & Lean Fill	10	--	125	--	N
Underpinning Blocks	20	--	100	--	N
Strip Footings, Isolated Column Footings, Raft Slab Footings (3)	25	--	100	--	N
Piers and Columns Isolated (3)	25	--	100	--	N
Piers and Columns cast monolithic with walls (3)	to match wall concrete				
Piers and Columns Exterior (3)	35 (6)	0.40	100	5~8	C-1
Grade Beams - Exterior	25	0.55	100	4~7	F-2
Grade Beams - Interior	25	--	100	--	N
Walls Foundation - Exterior	25	0.55	100	4~7	F-2
Walls Foundation - Interior	25	--	100	--	N
Walls Shear Wall Exterior Foundation	30	0.55	100	4~7	F-2
Walls Shear Wall Interior Foundation (4)	30	--	100	--	N
Retaining wall – Exterior	35 (6)	0.40	100	5~8	C-1
Interior Slabs on Grade	25	0.50 (8)	100 (10)	--	N
Interior Slabs on Composite Steel Deck	25	0.55 (9)	100	--	N
Suspended Slabs – Interior (7)	30	--	100	--	N
Suspended Slabs - Exterior	35 (6)	0.40	100	5~8	C-1
Housekeeping Pad	20	--	100	--	N
Topping (5)	30	0.55	100	--	N

Footnotes:
(1) Concrete slump for all concrete is 75mm plus or minus 25mm unless prior approval for mix and placement procedure is received from the Consultant. Slump shown in table is maximum value prior to addition of water reducing agent.
(2) If concrete is placed by pumping, addition sampling and air content testing is required at pump discharge.
(3) Unless noted otherwise in Column and Footing Schedule.
(4) Refer to shear wall elevations and/or schedules for concrete properties not specified here.
(5) Toppings less than 100 mm in thickness to have 10 mm maximum coarse aggregate.
(6) 56-day compressive strength.
(7) Unless noted otherwise on plan.
(8) 0.40 for polished concrete areas.
(9) 0.45 for polished concrete areas.

10) Interior slabs on grade to have slump 50-100mm without super P, 125-175mm with super P. For polished concrete floors maximum slump to be 80mm after addition of water Reducing agent.

3.1.6 Provide an approved water-reducing admixture in all concrete. (Obtain approval before using during hot weather).

3.1.7 Concrete exposed to freeze/thaw conditions shall be air entrained controlled at 5% plus or minus 1%.

3.1.8 **Do not use calcium chloride or products containing calcium chloride in concrete**.

3.1.9 Maximum size of coarse aggregate shall be 19mm, toppings less than 100 mm in thickness to have 10 mm maximum coarse aggregate.

3.2 INSTALLATION

3.2.1 Clean equipment, for mixing and transporting concrete, of hardened concrete and foreign materials before and after use.

3.2.2 Place concrete as rapidly and as near as possible to its final position.

3.2.3 Transport concrete, from mixer to place of final deposit by methods which will prevent separation or loss of ingredients.

3.2.4 Remove debris including ponded water from places to be occupied by concrete prior to pouring.

3.2.5 Concrete free fall not to exceed 2m.

3.2.6 Concreting once started shall be a continuous operation until placing of section is completed. Do not permit cold joint to develop.

3.2.7 Thoroughly consolidate concrete during and after placing by spading and vibrating to work concrete around reinforcement, water bars or other embedded materials. This includes footings.

3.2.8 Do not spread concrete horizontally into place by means of vibration.

3.2.9 Ensure that finished concrete is dense, uniform, free of air holes and honeycombs and that no segregation of cement paste and aggregate occurs.

3.2.10 Maximum time between batching materials and placing concrete is 1.5 hours.

3.2.11 Remove snow and ice from hardened concrete or forms with hot air.

3.3 FOOTINGS

3.3.1 Place footings on undisturbed soil or engineered fill as outlined on drawings.

3.3.2 Construct footing commencing from lowest elevation and proceeding to higher elevations.

3.3.3 Form sides of footings. Forms for footings shall be full depth for column footings. For wall footings forms shall be footing depth or less 20mm maximum.

3.3.4 Depths of footings called for on drawings are minimum.

3.3.5 Concrete shall not be placed until subgrade has been inspected and approved.

3.3.6 All footings shall be centered under load bearing elements unless approved otherwise in writing by the Engineer.

3.4 SLABS ON EARTH - Interior

3.4.1 All floor on grade shall be as outlined on drawings.

3.4.2 Concrete shall not be placed until subgrade has been inspected and approved.

3.4.3 Isolate all floors on grade from perimeter walls.

3.5 EXTERIOR SLABS

3.5.1 Provide slabs and curbs as detailed on drawings, of 32 MPa concrete.

3.5.2 Concrete shall contain entrapped plus entrained air controlled at 5% plus or minus 1%.

3.5.3 Place slabs over 150mm deep bed of granular "A".

3.5.4 Divide slabs with isolation joints at 6m maximum centers, at edge of building and along curbs. Provide false joints at 2 m maximum centers between isolation joints.

3.6 CUTTING AND PATCHING

3.6.1 Break out and make good all temporary openings in concrete work for pipes, conduits, ducts, shoring and other such work during construction using a mix or mortar of the same proportions as the surrounding work and finished to match surrounding work.

3.7 FINISHING OF FORMED SURFACES

3.7.1 Exposed surfaces: Immediately after stripping of forms, surfaces shall be inspected before any repairing or surface treatment is started.

3.7.2 Concrete members which are patched without approval will be classified as

defective work and may be required to be removed.

3.7.3 Remove honeycombed and other defective surfaces down to sound concrete, thoroughly wet, including surrounding areas, and repair with patching mortar containing bonding agents.

3.7.4 Producing smooth surfaces by means of cement plaster will not be permitted.

3.7.5 Walls shall have fins ground smooth, plastic cones removed and form ties cut back.

3.7.6 Fill tie holes with patching mortar containing an approved bonding agent.

3.7.7 When forms are removed before concrete is seven days old, cure surfaces immediately.

3.8 MISCELLANEOUS CONCRETE ITEMS

3.8.1 Filling In: Fill in holes and openings left in concrete structures for the passage of work of other trades, unless otherwise directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling to concrete block lintels, solid courses, beams, etc. to complete the work.

3.8.2 Miscellaneous Concrete Work: Provide all miscellaneous foundations, piers and slabs as detailed on the drawings.

3.8.3 Concrete for Exterior Curbs and Landscaping: Provide and install curbs and bands of 32 MPa, air entrained and concrete sawcut control joints at 1.5m on centre at corners and depress where indicated.

3.9 REMEDIAL WORK

3.9.1 General: Reinforce or replace deficient work as directed by the Consultant and at no additional cost to the Owner.

3.9.2 Patching: Repair defective areas and fill form-tie holes and similar defects in accordance with Chapter 9 of ACI 301. Where, in the opinion of the Consultant, surface defects such as honeycomb occur, repair the defective areas as directed by the Consultant.

END OF SECTION

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work Included: Provide all concrete finishing, complete, as indicated on the drawings, specified herein, and needed for a complete and proper installation.

1.1.2 Related work described elsewhere:
.1 Section 03300 – Cast-in-Place Concrete

1.2 QUALITY ASSURANCE

1.2.1 Standards:
.1 Comply with CAN/CSA A23.1 and the requirements of the Concrete Floor Contractors Association.
.2 In case of conflict between the reference standards, the more stringent requirements shall govern.

1.3 QUALIFICATIONS

1.3.1 Only skilled competent workmen, familiar with products and their application shall be permitted to perform work.

1.4 TOLERANCES

1.4.1 Allowance shall be from level given on Drawings, as determined by straight edge placed anywhere on the slab in any direction.

1.4.2 Finishes with a Class A tolerance shall be true planes within 6mm using a 3m straight edge (1/4" in 10'-0").

1.4.3 Finishes with a Class B tolerance shall be true planes within 6mm using a 1m straight edge (1/4" in 3'-0").

PART TWO - PRODUCTS

2.1 MATERIALS

2.1.1 Use only materials specified.

2.1.2 Use materials in accordance with manufacturer's specifications. Have manufacturer's representative on site when material application is not familiar.

2.2 CURING AND SEALING COMPOUND

2.2.1 Acrylic cure and seal - CPD.

2.2.2 Clear Seal 150 - Grace Construction Ltd.

2.2.3 CS-309-20 by W. R. Meadows.

2.2.4 Alternate materials approved equal.

2.3 FILLER IN SAW CUTS

2.3.1 Rezi-weld-flex by W. R. Meadows.

2.3.2 Loadflex – Sika.

2.3.3 Alternate materials approved equal.

PART THREE - EXECUTION

3.1 FLOATING

3.1.1 After all bleed water and water sheen has left the concrete surface and concrete is stiffened enough to walk on, mechanically float large open concrete surfaces using a machine fitted with float blades on a steel disc. Shake applied floor hardener is to be applied according to manufacturer's instructions to achieve a uniform surface.

3.2 STEEL TROWELLING

3.2.1 Machine or hand trowel concrete to produce a hard, smooth surface.

3.2.2 Repeat trowelling, with necessary time intervals in between to allow concrete to further harden until desired finish is achieved.

3.2.3 Keep trowel blades relatively flat for initial trowelling, raising blade on angle with subsequent passes.

3.3 GRINDING

3.3.1 Where steel trowel finish is not of specified quality, remove ridges, undulations or other imperfections by grinding.

3.4 CURING AND PROTECTION

3.4.1 Protection and curing of concrete in accordance with Section 21 of C.S.A. Standard CSA-A23.1.

3.4.2 Maintain all equipment and materials for the protection and curing of concrete on site, ready to use before concrete placing is started.

3.4.3 Cover walls, piers, columns, beams, and slab edges with wet burlap or tightly wrap with properly lapped 4 mil polyethylene sheeting, immediately after stripping to continue the curing periods. (Surfaces which will not be exposed to

view, or which will not have other surface treatment may be sprayed with curing compound after stripping).

3.4.4 Cure horizontal surfaces immediately after finishing operations, but not later than 12 hours, in normal weather, after concrete is placed. Floor and roof slabs shall be kept constantly damp for 14 days by fog spraying or completely covered with wet burlap or 4 mil polyethylene sheeting, properly lapped at side and edge laps and weighted down immediately after finishing, or by the application of Sika FLOR-SEAL or equivalent curing and sealing compound. **Polished** concrete surface shall be completely covered with wet burlap or 4 mil polyethylene sheeting.

3.4.5 Cover sidewalks, curbs, gutters, and exterior paved areas with wet burlap or polyethylene sheeting.

3.4. 6 A sprayed-on membrane curing compound may be used for surfaces listed under paragraph 3.4.3, 3.4.4 and 3.4.5, in lieu of polyethylene sheeting for concrete poured between April 1st and October 14th, except as follows: Floor areas or wall surfaces which are to have topping, **polished** concrete surface or other specialty surface treatments are <u>not</u> to have spray-applied compounds employed but must be polyethylene cured. Coordinate with the flooring contractor to ensure compatibility with flooring adhesives.

3.4.7 Freshly finished floors are not to be used for seven (7) days after completion and only light use is permitted for an additional 7 days.

3.4.8 Make good cracking and/or reduced strength and/or curling due to concrete drying out too rapidly. Assure that concrete is placed on thoroughly dampened subgrade, except where a poly vapor barrier is used.

3.4.9 Protect concrete from harmful effects of heaters, mechanical shock, sunshine, drying winds, cold weather and running or surface water.

3.4.10 No materials shall be piled, stored, shovelled or handled on slabs, across slabs, until seven days after placing concrete.

3.5 <u>CONTROL JOINTS</u>

3.5.1 Sawcut control joints in slabs on grade. Locate control joints where shown on drawings but in any case of sufficient quantity and at locations to have maximum uncut dimensions of 3.6m (3.0m for polished concrete surface) in any direction and at all reentrant corners. Cut shall be 3.2mm wide and one fourth of slab thickness deep. Flush out sawcut immediately with water.

3.5.2 Make sawcuts no sooner than 12 hours or later than 24 hours after finishing, depending upon curing conditions. Alternatively, use the "soft" cut technique where directed by the Engineer. Do not fill sawcuts for at least 28 days.

3.5.3 After 28 days, clean out sawcuts using brushes and compressed air, removing all dirt and foreign material. Fill sawcuts with specified filler. Finish to match surrounding surfaces.

3.6 SLABS

3.6.1 Top of all concrete floor slabs and toppings shall be steel trowel finished to Class A tolerance, except for floors receiving carpet, tile or quarry tile to be Class B.

END OF SECTION

PART ONE - GENERAL

1.1 RELATED WORK

1.1.1 Cast-in-Place Concrete: Section 03300

1.2 REFERENCE STANDARDS

1.2.1 All Codes and Standards referred to herein are to be latest edition.

1.2.2 Do precast pre-stressed concrete work in accordance with CAN3-A23.4 and CAN3-A23.3.

1.2.3 Do welding in accordance with CSA W59 for welding to steel structures and CSA W186 for welding reinforcement.

1.3 QUALIFICATIONS OF MANUFACTURER

1.3.1 Manufacturers of precast concrete elements to be certified by CSA requirements of CSA A251.

1.3.2 Manufacturers shall be approved by C.M.H.C.

1.4 DESIGN CRITERIA

1.4.1 Design precast prestressed concrete units to CAN3-A23.3 and to carry handling.

1.4.2 Design loads in accordance with applicable codes for use and occupancy, wind, temperature, and earthquake.

1.4.3 Consider vibration characteristics in accordance with NBC.

1.4.4 Design prestressed units to meet (2) hour fire resistance rating.

1.5 SOURCE QUALITY CONTROL

1.5.1 Upon request, provide Engineer with certified copies of quality control tests and inspection related to project as specified in CAN3-A23.4 and CSA G279.

1.5.2 Inspection of prestressed concrete tendons is required in accordance with CSA G279. Upon request, provide Engineer with certified copy of mill test report of reinforcing steel supplied, showing physicals and chemical analysis.

1.6 SHOP DRAWINGS

1.6.1 Submit shop drawings in accordance with Section 01340 – Shop Drawings, Product Data.

1.6.2 Submit shop drawings in accordance with CAN3-A23.4 and CAN3-A23.3. Upon request the following items shall be provided:
- .1 Design calculations for items designed by Manufacturer
- .2 Camber
- .3 Finishing schedules
- .4 Methods of handling and erection
- .5 Openings, inserts and related reinforcement

1.6.2 Each drawing submitted to bear stamp of qualified Professional Engineer registered in the Province of Ontario.

1.7 WARRANTY

1.7.1 The Contractor hereby warrants that the precast prestressed elements will not spall or show visible evidence of cracking, except for normal hairline shrinkage cracks, in accordance with GC24, for a one year period.

PART TWO – PRODUCTS

2.1 MATERIALS

2.1.1 Cement, aggregates, water, admixtures to CAN3-A23.4 and CAN3-A23.1, CAN3-A23.1S1, CAN3-A23.1S2.

2.1.2 Prestressing steel: Uncoated 7 wire cable conforming to CAN/C.S.A.-S6 and CSA G279.

2.1.3 Reinforcing steel: To C.S.A. G30.12.

2.1.4 Anchorages and couplings: To CAN3-A23.1, CAN3-A23.1S1, CAN3-A23.1S2.

2.1.5 Embedded steel: To CAN/C.S.A.-G40.21, Type M300W.

2.1.6 Welding materials: To C.S.A. W48.1.

2.1.7 Bearing pads: 3mm masonite smooth one side.

2.1.8 Insulation: Expanded polystyrene to CAN/CGSB-51-20.

2.1.9 Air entrainment admixtures: To CAN3-A266.1.

2.1.10 Chemical admixtures: To CAN3-A266.2.

2.2 CONCRETE MIXES

2.2.1 Use concrete mix designed to produce 41 MPa (6000 psi) compressive cylinder strength at 28 days with maximum water/cement ratio to CAN3-A23.1, Table 7 for Class D exposure, CAN3-A23.1S1, CAN3-A23.1S2.

2.2.2 Air entrainment of concrete mix: To CAN3-A266.4.

2.2.3 Admixtures: To CAN3-A266.4, CAN3-A266.5.

2.2.4 Do no use calcium chloride or products containing calcium chloride.

2.3 GROUT MIX

2.3.1 Cement grout: One part type 10 Portland cement 2-1/2 parts sand, sufficient water for placement and hydration.

2.4 MANUFACTURE

2.4.1 Manufacture units in accordance with CSA 251.

2.4.2 Mark each precast unit to correspond to identification mark on show drawings for location on part of unit which will not be exposed.

2.4.3 Provide hardware suitable for handling elements.

2.4.4 Provide 50mm (2") thick insulation plug at each cell end of hollow core at exterior.

PART THREE – EXEUCTION

3.1 ERECTION

3.1.1 Erect elements within allowable tolerances indicated or specified.

3.1.2 Non-cumulative erection tolerances in accordance with CAN3-A23.4, Section 10.

3.1.3 Install 3mm masonite bearing pads, smooth side up on bearing ends, of concrete or masonry.

3.1.4 Set units in a tight, level position on true level bearing surface provided by others, Minimum bearing 90mm (3 ½") on masonry and 75mm (3") on structural steel.

3.1.5 Fasten precast units in place as indicated on reviewed shop drawings.

3.1.6 Level differential elevation of horizontal joints with grout to slop not more than 1:12

3.1.7 Clean field welds with wire brush and touch up with primer.

3.1.8 Field cut holes and openings up to 150mm (6") diameter for mechanical trades. Openings larger than 150mm (6") to be located on shop drawings at time of approval and to be cut in field. Do not cut reinforcing without approval of precast slab manufacturer and Engineer.

3.2 TOPPING

3.2.1 This contractor shall provide a suitable top finish to accept direct application of finished flooring/roofing as per room finish schedule.

3.2.2 Where concrete topping (Minimum 37mm [1 ½"]) is to be applied use 30MPa, peastone concrete. The top surface of the precast prestressed slabs is to be raked (roughened) for bonding of topping.

3.3 EXPOSED CEILINGS

3.3.1 Caulk exposed ceiling longitudinal joints, using standard caulking.

3.3.2 The underside of precast shall be finished ad per C.S.A. A23.4 (24.2.2) STANDARD FINISH.

3.4 CLEAN-UP

3.4.1 Upon completion of the work of this section, all surplus material and debris shall be removed from this side.

*Items relating to precast prestressed slabs to be carried out by other trades, and covered in their respective specifications:

(1) Dry packing of gap between precast prestressed slabs at all locations where load bearing walls are parallel to length of slab.
(2) Perimeter caulking.
(3) Electrical holes.
(4) Concrete topping 30MPa pea-stone concrete depth as per drawings. Apply slurry bonding agent (ACRY-LOK™ Acrylic Polymer Admixture by W.R. Meadows or approved equal) to manufacturer's recommendations prior to pouring topping.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements is a part of this Section and shall apply as if repeated here.

1.2 REFERENCE STANDARD

1. Do masonry mortar and grout work in accordance with latest CSA A179-M1994 edition except where specified otherwise.

1.4 SAMPLES

1. Samples of coloured mortar will be evaluated when built into mock-up wall. Three colours to be built into mock-up for exterior masonry mock-up for the Architect's review.

PART 2 PRODUCTS

2.1 MATERIALS

1. Masonry Cement: Conform to requirements of CAN/CSA-A8-M93, Masonry Cement.

2. Sand: Conform to requirements of C.S.A. A82.56-M1976 "Aggregate for Masonry Mortar".

3. Water: Potable, free from injurious or other substances detrimental to mortar, or will cause efflorescence.

4. Portland Cement: Conforming to CAN/CSA-A5-M88, white or grey as indicated.

5. Hydrated Lime: Conforming to ASTM C207-79 "Specifications for Hydrated Lime for Masonry Purpose" Type S. Hydrated lime shall be "soaked" 48 hours before paste is mixed with sand.

6. Mortar Colour: Pigment type as supplied by Harcott Pigment Ltd. or approved equal colour to match masonry. Allow for three (3) colours at exterior areas where three (3) colours of masonry are used. Colour admixture not to exceed 10% of cement content by mass.

7. Use of any admixture to meet cold weather requirements is expressly forbidden.

8. 1:1:6 Masonry Mortar for Clay Brick: equal to 1:1:6 Type "N" mortar.

2.2 MORTAR TYPES

1. Mortar types shall be as designated and conform to latest C.S.A. A179-M1994 edition, "Mortar and Grout for Unit Masonry".

2. The following mortar types shall be used:

    1. For masonry foundation walls and masonry in contact with earth - Type S.

    2. For interior block unit masonry above grade - Type S unless noted otherwise on plans.

    3. For clay brick masonry exterior (exposed) block veneer, quarried stone and glazed block - 1:1:6 Type "N" mortar.

    4. For structurally reinforced masonry walls - Type "S".

2.3 GROUT

1. To current CSA A179-M1994 standard. The following grout types shall be used:

Type	Fine Grout	Coarse Grout
Portland Cement - cu. ft.	1	1
Hydrated Lime (optional cu.ft.)	1/10	1/10
Damp Loose Sand - cu. ft.	2¼ to 3	2¼ to 3
Pea Gravel - cu. ft. -----	1 to 2	

2. Water - only enough to give creamy pouring consistency. Use a 1 cu. ft. (or metric box) in measuring portions for use in bond beams, lintels, and vertical cells.

3. Low lift grout as per structural drawings.

4. Grout Masonry components where indicated.

2.4 PARGING

1. Parging Mortar: Type M to latest CSA A179-M1994.

PART 3 EXECUTION

3.1 MIXING

1. Mortar used in the construction of unit masonry walls shall conform to C.S.A. A179-M1994.

2. Material proportions, acceptable compressive strengths, locations of use, incorporation of admixtures included in C.S.A. A-179-M1994, shall be modified as may be required by Jurisdictional Authorities.

3. Mix premixed 1:1:6 mortar as in strict conformance with directions provided by the manufacturer.

4. All grouting to conform to the requirements of CSA Standard CAN3-A371-M84.

3.2 MIXING OF COLOURED MORTAR

1. Premix colouring agents with dry cement in large batches (for best control) in strict accordance with pigment manufacturer's instructions, accurately measured to ensure constant and even colour of mortar throughout the job. Submit mortar colour "recipe" in operations and maintenance binders.

2. Maintain sufficient mixers on job site, one for regular mortar and one for each coloured mortar exclusively.

3. Three colours of mortar at exterior masonry may be selected by Architect at areas where three colours of masonry are used. Colours as selected by Architect.

3.3 TESTING

1. Testing of mortar materials will be carried out by testing laboratory designated by Architect.

2. Submit samples of sand and water for testing to ensure that mortar will not produce efflorescence.

3. Submit samples of sand and water and premixed mortar for testing to ensure that mortar will not produce efflorescence.

4. Mortar shall be tested in accordance with the requirements of clause 4.4.1 in CSA S304.1-94 and CSA A179-94.

5. Testing shall be completed for each 250 m^2 of masonry, for each storey.

END OF SECTION

BID FORM

Project/Contract: New Port Elgin School Flat Roof Installation
BWDSB

To (Owner): Bluewater District School Board (BWDSB)

Submitted To: Pretium Engineering Inc.
540 Bingemans Centre Drive Unit 100
Kitchener, ON N2B 3X9
Attention: Richard Shaw, RRO

From (Bidder):

We, _____
(Company Name)

of _____
(Business Address)

_____

having carefully examined the Bid Documents and Addenda No.____ to No.____ inclusive, and having visited the *Place of the Work* and examined conditions; hereby offers to perform the combined stipulated and unit prices *Work* in accordance with the Bid Documents for the combined extended price of, excluding the Harmonized Sales Tax:

_____

_____ Canadian Dollars ($_____)

The Harmonized Sales Tax applicable to the combined extended price is:

_____

_____ Canadian Dollars ($ _____)

The total cost of the combined stipulated and unit prices Work, including the Harmonized Sales Tax is:

_____

_____ Canadian Dollars ($_____)

It is understood that:

.1 The quantities indicated in the Schedule of Prices are estimated; actual quantities of work to be performed may vary,

.2 The unit prices and actual quantities, measured as specified in the Bid Documents, will form the basis for payment of the unit price component of the *Contract Price*,

.3 The total amount of our bid is the estimated *Contract Price*, which is the sum of the stipulated price component of the *Work* and all unit price extensions for the unit price component of the *Work*,

.4 The extensions of unit prices, and the addition of the stipulated price and unit price components of the *Work*, will be checked by the *Consultant*; if arithmetical errors are discovered, the unit prices will be considered as representing our intentions and the unit price extensions and total amount of our bid will be corrected accordingly, and

.5 Failure to state a required unit price may render the bid non-compliant, however if we fail to state a unit price for an item, but state an extended amount for that item, a unit price determined by dividing the extended amount by the estimated quantity will be considered as representing our intentions.

We, the undersigned, declare that:

.1 We are qualified to perform the *Work* in accordance with the Bid Documents and our bid price covers all of our obligations and things necessary for the performance of the *Work*,

.2 Our bid price includes the allowance(s) specified in Section 01 21 00 – Allowances,

.3 We agree to perform the work in accordance with the agreed schedule, to be prepared after the award of *Contract*,

.4 We are able to have forces on site to commence work by the _____ day of _____ , 20____ (weather permitting),

.5 We agree to attain Ready-for-Takeover by the _____ day of _____ , 20____ ,

.6 The full-time work force to include a minimum of _____persons.

.7 We have arrived at this bid without collusion with any competitor,

.8 All bid form supplements called for by the Bid Documents form an integral part of this bid, and

.9 This bid is open to acceptance by the *Owner* for a period of sixty (60) calendar days from the bid closing time.

.10 No person, firm or corporation other than the Tenderer has any interest in this tender or in the proposed *Contract* for which this tender is made; and

.11 This tender is made without any connection, comparison of figures or arrangements with or knowledge of any other corporation, firm or person making a tender for the same *Work* and is in all respects fair and without collusion or fraud, and

.12 All bid form supplements called for by the Bid Documents form an integral part of this bid.

Signed, sealed and submitted for and on behalf of:

Company: _____
(Name)

_____
(Street Address or Postal Box Number)

_____
(City, Province & Postal Code)

Signature: _____

Name and Title: _____
(Print or Type)

Dated at this_____ day of _____, 20____.

SCHEDULE OF PRICES

STIPULATED AND UNIT PRICE BREAKDOWN

The following price breakdown is for the items listed below. The prices include the specified cost, overhead, profit and any applicable taxes in force at the date of tender with the exception of the Harmonized Sales Tax (H.S.T.). The H.S.T. is shown as a separate line item.

Item No.	Description of Work	Unit	Estimated Quantity	Unit Cost	Contractor's Total Bid
1.0	**General**				
1.1	Mobilization, Access and Protection	L.S.			$_____
2.0	**Flat Roof Replacement**				
2.1	Roof Assembly and Related Roof Area 1.1	L.S.			$_____
2.2	Roof Assembly and Related Roof Area 1.2	L.S.			$_____
2.3	Roof Assembly and Related Roof Area 2.0	L.S.			$_____
2.4	Roof Assembly and Related Roof Area 3.0	L.S.			$_____
2.5	Roof Assembly and Related Roof Area 4.1	L.S.			$_____
2.6	Roof Assembly and Related Roof Area 4.2	L.S.			$_____
3.0	**Extended Amount**				
3.1	Subtotal (Contractor's Total Bid Items)				$_____
3.2	Harmonized Sales Tax (H.S.T.)				$_____
3.3	**Total Extended Amount**				**$**_____

Notes:

1. If required by the *Owner*, the successful bidder should be prepared to submit a price breakdown. The scope of work may be altered to suit *Owner*'s requirements.
2. **ALL** quantities / measurements to be confirmed by *Contractor* from on-site take-offs.
3. Costs above include co-ordination of all locates to determine location of all services necessary to perform work.
4. For unit price items, payment will be based on actual quantity of work performed as measured on site jointly with the *Consultant* and *Contractor*.
5. If required by the *Owner*, portions of the *Work* may be deleted from the *Contract* at the costs provided above.

END OF SECTION – 00 41 45

ALTERNATIVE PRICES

We offer the alternative prices stated below. The effect on our base bid price stated in the Bid Form and the effect on the Contract Time, if any, is entered for each alternative. All alternative prices exclude Value Added Taxes. If there is no change to the base bid price for an alternative or if there is no change to the Contract Time for an alternative, we have so indicated. It is understood that:

.1 The *Owner* may accept any of the alternatives and corresponding alternative prices in any order or combination, including all or none;

.2 The alternative prices may be taken into account in determining the lowest compliant bidder;

.3 The *Work* of the *Contract*, the *Contract Price*, and the *Contract Time* will reflect the alternatives and alternative prices, if any, accepted by the *Owner* at the time of contract award, and

.4 Where applicable, alternative prices include the cost of coordinating all related *Work* and modifying adjacent or affected *Work* as required to integrate the *Work* of each alternative.

No.	Description of Work	Unit	Effect on Bid Price		Effect on Contract Time (Days)	
			Add	Deduct	Add	Deduct
1.	Roof Area 1.1 - 2-ply Self-Adhered Modified Bitumen (MB) assembly	L.S	$_____	($_____)	_____	_____
2.	Roof Area 1.2 - 2-ply Self-Adhered Modified Bitumen (MB) assembly	L.S	$_____	($_____)	_____	_____
3.	Roof Area 2.0 - 2-ply Self-Adhered Modified Bitumen (MB) assembly	L.S	$_____	($_____)	_____	_____
4.	Roof Area 3.0 - 2-ply Self-Adhered Modified Bitumen (MB) assembly	L.S	$_____	($_____)	_____	_____
5.	Roof Area 4.1 - 2-ply Self-Adhered Modified Bitumen (MB) assembly	L.S	$_____	($_____)	_____	_____
6.	Roof Area 4.2 - 2-ply Self-Adhered Modified Bitumen (MB) assembly	L.S	$_____	($_____)	_____	_____

END OF SECTION – 00 43 23

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PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements are part of this Section and shall apply as if repeated here.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

1. Conform to the latest Ontario Building Code, as currently amended and Local Bylaws, except where indicated otherwise on drawings or specified herein. In case of conflict between Codes, the Ontario Building Code will govern.

1.3 STANDARDS

1. Materials, equipment, and practice shall conform to CSA3-S304-14 and CSA-A371-14, Masonry Code of Practice and CAN/CAN/CSA-A82-14 for brick. Brick masonry units must comply to CAN3-A82.2 M78 and concrete masonry units shall comply to CSA A165 Series-14. Brick masonry units must not have a greater Saturation Coefficient than .78 as set by test method CAN3-A82.2 M78 and must meet specifications CAN/CAN/CSA-A82-14 for SW grade FBX type brick. Brick masonry units will be tested once they are delivered to the site and shall not be installed until testing is complete and units have surpassed the tests.

2. Work of this section to comply with "Plain and Reinforced Masonry-Canadian Structural Design Manual" Supplement to the National Building Code of Canada and CSA-A371-14.

3. Ensure fire rated walls, partitions or separations are in accordance with "Fire Performance Ratings Supplement" of the National Building Code of Canada.

1.4 SAMPLES

1. Construct 3'-0" (900 mm) high by 6'-0" (1800 mm) long wall with 3'-0" (900 mm) long corner return sample masonry wall on site (separate from building) where directed by the Architect. Construct one cavity wall panel of the types of brick, stone and block. Construct with mortar, masonry specified and approved by the Architect, to show colour range, texture, banding, bond, and flashing, joint reinforcement, flashings, membrane flashings, cavity insulation, air vapour/barrier system, weepers, and mortar joints. Construct as many times as required to provide a wall to the satisfaction of the Architect, before commencing masonry work. Prepare similar panels for approval using, acoustical sound block, and all other architectural block types specified.

2. Remove rejected sample walls. Protect approved sample wall from damage and retain in place through duration of project until removal is directed by Architect.

3. Only masonry matching approved sample walls in all respects will be accepted for work of this project.

4. Submit brick and acoustic block samples for architect's choice of colour prior to ordering materials and constructing the sample wall.

1.5 DELIVERY AND STORAGE

1. Stockpile masonry units on platforms or other approved supports to keep units free from ground contact. Prevent staining of masonry units from contact with any material while stored. Secure waterproof covering entirely over each stockpile when masonry work not in progress.

2. Deliver, handle and store masonry units by methods which will guard against soiling or chipping. Protect all holes and reglets from water and ice during freezing weather.

3. Dry out units which fail to meet moisture content limitation during storage on job site and do not lay until tests prove satisfactory.

1.6 SPECIAL PROTECTION

1. Protect exposed masonry corners and projections by methods which will not mar finished surfaces.

2. Masonry stained or damaged shall be replaced as directed by Architect.

3. Cover tops of all walls with well-secured, approved, non-staining and waterproof material while work is not in progress and until satisfactorily covered by metal deck structure or roof membrane. Cover shall be at least 2'-0" (600 mm) wider than width of wall.

4. In cold weather protect masonry and heat materials as provided in CSA-A371-94 and "Recommended and Guide Specifications for Cold Weather Masonry Construction" available through Ontario Masonry Contractors Association. Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in winter.

5. In hot weather, protect freshly laid masonry from drying too rapidly by means of waterproof, non-staining coverings.

1.7 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 - Shop Drawings, Product Data, Samples and Mock-ups.

2. Show all interior and exterior wall elevations indicating all control joints and expansion joints.

3. Submit shop drawings of masonry ties stamped by a professional engineer licensed in the Province of Ontario.

4. Submit samples and shop drawings for Bent Metal Closures and Compartment Control Joints (CCJ).

1.8 DEFECTS DEFINED

1. In addition to non-compliance with specified requirements or other contract requirements, the following will be considered defects:

1. shrinkage in individual units and erected work;

2. spalling;

3. poor colour of texture blending of units;

4. surface deterioration, dusting;

5. discolouration, crumbling and similar deterioration of mortar;

6. failure of built-in items to remain anchored;

7. chipped units - any chipped area on exposed surface.

1.9 EXTRA MATERIALS

1. Provide the following extra number of masonry units of each type of unit as follows. Store in building at job completion.

    1. Face Brick - 50 units

    2. Arch. Block – 50 units

1.10 ADDITIONAL CONCRETE BLOCK:

1. Include in base tender sum labour and material for an additional 30 m² of 190mm block installed for items not indicated on drawings or found field conditions on site.

PART 2 PRODUCTS

2.1 MATERIALS

1. Water: Clean, free from salts that will cause efflorescence and other substances detrimental to masonry.

2. Dampproof Coursing and Base Wall Flashing: Blueskin TWF by Bakor, ensure membrane is supported on a slope, where there is no support, copper TWF to be installed than Blueskin TWF over top and seal.

3. All Thru Wall Copper Flashings / Copper Drip Flashings: ASTM Specification B370, cold rolled, copper weighing not less than 16 oz. per sq. ft. (3.15 kg per square metre). Copper flashings are to be formed and installed where the word 'flashing', or 'metal flashing', or pre-fin. Metal flashing' are indicated on the drawings to suit flashings above window and door heads, at low roof high wall, at copper bellows, closures and waterstops locations, below window sills, etc. Cover top of copper flashing with Bakor Blueskin TWF membrane reinforced flashing at all locations by this section sealed to wall sheathing 200mm minimum or in reglet in concrete block, both sealed.

4. Copper flashings are required at all locations where there is no continuous structural or rigid insulation support, especially at cavity locations.

5. Pre Fin. Metal Flashing (except where copper flashing required): to be powder

coated to match adjacent wall material colour.

6. TWF Membrane / Base Membrane / Rein. Flexible Membrane Base Flashing: Bakor Blueskin TWF membrane reinforced flashing at all locations with "Air Bloc 21" by Bakor. Install below window sills; and below all metal flashing locations above low roofs at high wall locations, over top of all copper flashings above windows, doors, low roof high wall locations, etc.

7. Sealant: Tremco Dymeric 240 as per Section 07900.

8. Asphalt Emulsion: Conform to CSGB-37-GP-2M.

9. Joint Filler: purpose-made elastomer to ASTM D. 2240-81 of size and shape.

10. Control Joint: "RS Series – Rubber Control Joint", sizing to suit masonry widths as required as manufactured by Hohmann & Barnard Inc. or approved equal.

11. Masonry Weep Holes and Vents: "QV – Quatro-Vent" weep hole ventilator as manufactured by Hohmann & Barnard Inc. (colour to match mortar colour and as selected by Architect).

12. Joint Reinforcement:

    1. Exterior Walls: Fero or Blok-Lok Ltd. stainless steel Slotted Block Tie Connector Plate and V-Tie in combination with ladder type continuous joint reinforcing by Hohmann & Barnard Inc. The Block Shear Connector Plate length shall suit concrete block (inner wythe) width and thickness of insulation. The Fero V-Tie shall be of length to provide placement of V-Tie legs at centreline of veneer (outer wythe). Provide Block Shear Connector Plate Ties at 600 mm horizontal x 400 mm vertical spacing or as noted on drawings. All components shall be stainless steel in accordance with ASTM 79 - AISI Type 302 & 304.

    1. Below Grade Walls: 3/16" (4.7mm) diameter truss design stainless steel joint reinforcement at all below grade block walls by Hohmann & Barnard Inc. or Blok-Lok Ltd.

    2. Interior Walls: 9 ga. (3.66mm) truss design mill galvanized joint reinforcement at all interior walls as manufactured by Hohmann & Barnard Inc. or Blok-Lok Ltd.

    3. Sizes: 2" (50 mm) less than wall thickness.

    4. Rod Size: Side rods 3/16" (4.7mm) and cross rods 3/16" (4.7mm) unless noted otherwise.

    5. Provide prefabricated tees and corners at all locations.

    6. Masonry Piers: 2" (50 mm) wide stainless steel ladder masonry reinforcing. The brick shall be tied back to the block with stainless steel "Zee" ties.

    7. Nailing Inserts: 26 gauge hot dipped galvanized steel 1" x 2¼" (50 mm x 55 mm) all metal wall plugs.

    8. Galvanizing: In conformance with ASTM A153 Class B2.

9. Dovetail Anchor Slots and Ties: stainless steel dovetail anchor slots with minimum 9 gauge hot dipped galvanized dovetail triangle ties by Hohmann & Barnard Inc. or Block-Lok Ltd.

10. "Z"-Tie: 3/16" (4.76mm) diameter "Z" Tie. See Structural Drawings for details. Provide galvanized finish at interior wall locations and stainless steel at exterior wall locations.

11. Individual Column and Wall Columns: Hot dipped galvanized. For details see structural drawings.

13. Concrete Masonry Units: Standard Weight and Lightweight Units

1. The following concrete masonry units are to be autoclaved masonry units as manufactured by Boehmers or Day & Campbell:

1. Standard Weight Concrete Masonry Units: to CSA-A165.1.

1. Classification: H/20/A/M.

2. Size: CCMPA metric modular. Sizes as indicated on the drawings.

2. Lightweight Concrete Masonry Units: to CSA-A165.1.

1. Classification: H/20/C/M.

2. Size: CCMPA metric modular. Sizes as indicated on the drawings

3. 75% Solid & Solid Concrete Masonry Units: to CSA-A165.1.

1. Classification: S/20/A/M.
2. Size: CCMPA metric modular. Sizes as indicated on the drawings

14. Bull Nose Cornering:

1. For concrete block (other than architectural concrete block) all vertical exposed outside corners and door jambs shall have a 1" (25 mm) radius and window jambs shall be pencil round radius. Provide square edge block for first course above finished floor and pencil round edge from the base course on. Round off the edge of first block course above the top of the base to match bull-nosed edge of other courses.

15. Acoustic Concrete Block: to CSA-A165.-1M and ASTM C90.

1. Manufacturer: Richvale York Block Inc

2. Size: CCMPA metric modular. Sizes as indicated on the drawings.

3. Product: Sound Cell, factory installed noise attenuating foam fillers meeting UL94 HF-1. These units shall not be cut.

16. Brick Veneer Masonry Units:

1. Provide full size sample of at least 3 colours /finishes to Architect for final colour selection prior to ordering. Provide pattern bond / configuration through shop drawings. Follow manufacturer pattern, instructions and guidelines for installation and basic care.

1. Brick Veneer: (Base Bid)

1. Acceptable Manufacturers: Canada Brick, Brampton Brick.
2. Classification: CAN/CAN/CSA-A82-06 for SW grade FBX type brick and CAN/CSA-A82-06 testing
3. Size: Metric Norman
4. Colour: Ironstone
5. Product: Face Brick

2. Architectural Block Veneer (Alternate price option)

Where brick is indicated on drawing provide 90 x 90 x 390 architectural concrete block with smooth finish. Products to be manufactured by Permacon, Richvale York, Brampton Brick or Day & Campbell. Colour to match Permacon Rockland Black or approved equal.

17. Cavity Wall Insulation:

1. See Section 07211 – Rigid Insulation and 07214 – Sprayed Foam Insulation / Air Vapour Barrier for installation execution requirements.

18. Building Paper Felt: 30 lb. building paper felt, (13600 g.).

19. Grouting and Steel Reinforcement for Vertical Reinforced Masonry (VRM):

1. Grouting and reinforcement steel to be supplied and installed by this section. All materials and installations to conform to structural drawings and specifications. Provide a mechanical device to hold vertical reinforcement at centres of block cores.

20. Cavity Closures: 12 gauge 304 Stainless Steel supplied and installed under Section 05500.

21. Compartment Control Joint (CCJ): 12 gauge 304 Stainless Steel supplied and installed under Section 05500.

22. Cavity Mortar Stop Mesh: equal to "Mortar Net" 1" (25mm) thick x 10" (250mm) height 90% open mesh of high density polyethylene.

2.2 DATE STONE

1. Contractor to install engraved date stone as part of base bid contract.

2. 400mm x 800mm x 90mm with blackened New Times Roman lettering 300 mm height. Engraving, location to later instruction.

3. Supply of date stone is by cash allowance. Installation of the date stone is included in base bid. Install where directed by Architect.

PART 3 EXECUTION

3.1 ERECTION

1. General Workmanship

    1. Install unit masonry work in complete conformance to governing requirements of Jurisdictional Authorities.

    2. Lay face work from face side. Perform work by skilled mechanics according to best standard practice.

    3. Lay masonry level, true to line, square, plumb, and as detailed. Vertical joints in perpendicular line.

    4. Distribute exposed masonry of varying colours, tones and textures, evenly over wall surface to avoid patches and streaks and to produce a homogeneous blend. Avoid using units that are too contrasting in appearance for satisfactory blending.

    5. Chipped or blemished units may only be used where concealed. Defective and broken units shall be rejected.

    6. Make joints uniform in size and tool to match sample joints. Unless specified or indicated otherwise tool all interior joints whether or not they are behind cabinets or fitments or drywall. Close all cracks and crevices. Strike off flush all joints in unparged masonry covered by earth. Press in flush joints at exterior cavity side of inner block wythe so no voids occur. No mortar shall protrude from joints on wall surfaces to which insulation and waterproofing are to be applied. Rake out joints at juncture of masonry walls and columns on exterior and interior, as necessary to permit caulking detailed or specified, in walls to be plastered upon directly to provide bond, and where otherwise noted on drawings.

    8. Fill all joints completely with mortar including webs. Buttering corners of units, throwing mortar scraping into joints, slushing, deep or excessive furrowing of bed joints not permitted. Do not shift or tap units after mortar has taken initial set. When work is resumed on walls previously laid, and which are either partially or totally set, remove all loose brick and mortar from top and adjoining surfaces. Remove mortar completely when masonry is removed and replace with new.

    9. Wet clay and shale masonry units before placing as well as faces of such units in walls previously laid which are either partially or totally set and on which work is resumed. DO NOT wet concrete masonry units. Wetting shall ensure that complete hydration is permitted, but units shall be free from water adhering to their surfaces when they are laid. Wet units:

1. During hot drying weather so that the mortar is not too rapidly dried;

2. When their absorption rates are greater than 0.025 oz. per sq. in. (1 gram per sq. cm.) per min. so that rate of absorption when laid does not exceed this amount.

10. Brace walls and piers during construction until structure provides sufficient lateral support.

11. Extend masonry walls to underside of structure above unless indicated otherwise. Cut and fit masonry work as required. Install anchors at top of masonry to provide lateral support, to Structural Consultant's approval. Fill space at block walls at underside of steel deck solid to conform to code and at all interior partitions and at fire separations. Install formed metal closures where top of block and bottom of metal deck is exposed.

12. Build in steel lintels, base plates and wall plates, as specified in Division 5 and reinforced concrete lintels as specified in Division 3. Set steel lintels in a bed or mortar. Install steel reinforcement and grouting as noted and detailed on structural drawings.

14. Install hollow metal door frames with lintels where specified in masonry walls, in accordance with manufacturer's instructions to present a rigid, true, plumb installation.

    1. Note: Completely fill frames with mortar. Keep faces of frames free of mortar during installation and leave clean. Maintain protective coverings.

15. Build in water stops, bellows, bent closures, sheet metal flashings, accessories, access panels, and anchors required for frames, guards, sills, etc., and as otherwise provided in other sections. Cooperate in the setting and aligning of this work.

16. Work shall include damp-proof coursing and membrane reinforced flashing at base flashing as detailed.

17. Consult other trades (including Athletic Equipment Section 11500) and make necessary provisions to permit the installation of their work in a manner to avoid cutting, patching and fitting.

18. Supply and locate dovetail anchor slots in time for placing in concrete formwork at locations where masonry walls abut concrete and where anchorage is required. Install slots at 2'-0" (600 mm) on centre horizontally and install joint reinforcement ties at 16" o.c. vertically.

19. Where flashing, membrane reinforced flashing or waterproofing turns out and terminates in horizontal mortar joints at lintels, shelf angles, spandrels, bases and bottom of cavities in cavity walls, provide clear, free drawing weep holes in the mortar joints of outer wy thes at 32" (800 mm) apart horizontally.

20. Chases shall be built, not cut.

21. Bearings and piers required for structural members shall be constructed as indicated on structural drawings.

22. Cut bricks, blocks, and stone to be used in exposed walls with carborundum saw and as per manufacturer's instructions.

23. Where low roof meets high wall leave out one masonry unit every 8'-0" o.c. at weep hole level at locations to be selected by Architect. At the appropriate time, this Contractor shall bring this matter to the architect's attention. These bricks are to be mortared in only when authorized by the architect.

24. A water test will be held by the Architect. This Contractor is to supply hose and water for this test upon Architect's request and carry out test under Architect's directions.

25. Install cavity mortar stop mesh 10" (250 mm) in height in bottom of air cavity space at all cavity wall locations and tops of all lintels or flashing at doors, windows and high wall low roof locations.

2. Concrete Masonry Workmanship

1. Lay out work to minimize cutting of units.

2. Use power driven abrasive disc for coping units and splitting units, or for cutting units to accommodate flush mounted electrical outlets, grilles, pipes, etc. Leave 1/8" (3 mm) clearance between edge of item and opening in masonry unit.

3. Use solid unit where bonding is required if webs of hollow blocks do not align one over the other.

4. Concrete masonry units will be rejected if face blemishes, smears or slicks appear whether wall is painted or not. Do not use chipped block where exposed to view.

5. The Maximum open space in the cavity wall is 25mm per code and will be strictly enforced.
KEEP ALL CAVITY SPACES FREE OF MORTAR IN CAVITY WALLS.

6. Use blocks with 1" (25 mm) radius vertical edges for external corners including door jambs and pencil round at window jambs. At bottom block course where quarry tile base is to be installed, install square edge outer corner block at first course for quarry tile installation and grind block external corner edge round to 1" (25 mm) radius above quarry tile base to top of first course.

7. Where beams or lintels bear on concrete block walls, the blocks under the bearing shall be solid or filled with concrete for a depth of two courses and a width of 32" (800 mm) or as noted otherwise.

8. Where joists bear on hollow masonry walls provide minimum 5½" (140 mm) solid masonry under joist bearing, where concealed masonry may be

brick.

9. Provide reinforced block lintels (where steel lintels are not indicated on Structural drawings):

    1. Over square head openings where noted and at all other locations as detailed on structural and architectural drawings.

    2. Over openings not exceeding 5'-0" (1500 mm) where no other support is shown, fill lintels solid with min. 3000 p.s.i. (21 m.p.a.) concrete and reinforce with min. two #5 steel bars; Note: Conform to structural drawings for bond beam reinforcing and concrete detailing

    3. Cast lintels at least 7 days before setting; provide bearing at ends as detailed on structural drawings min. 8" (200 mm).

10. Where walls 12" (300 mm) and thicker have exposed face on both sides, lay block using two units in wall thickness.

11. Exposed joints shall be concave unless indicated otherwise.

12. Use lightweight concrete units for all exposed interior walls.

13. Provide all structural work at masonry walls as indicated on structural drawings.

3. Brick/ Architectural Concrete Block Masonry Unit Workmanship

    1. Lay all brick/architectural concrete block masonry units as detailed on drawings. Vertical and horizontal joints shall be 3/8" (10 mm).

    2. Fill the entire space between facing and back-up units with mortar. Keep all cavity spaces free of mortar in cavity walls.

    3. Joints shall be tooled concave or as directed by Architect.

    4. Do not use chipped face unit where exposed to view.

    5. At some openings, units will have to be cut to fit at sills and lintels to suit coursing. See drawing details.

    6. Install stack bond coursing where indicated on elevations.

    7. All architectural concrete block mortar joints (cladding/veneer) shall line up with other concrete block mortar joints where abutting.

    8. All architectural concrete block (cladding/veneer) mortar joints shall line up with concrete block wall mortar joints behind.

4. Damp-proof Course

    1. Lay dampproof course over tops of all foundation walls. Lap strips a minimum of 4" (100 mm) at junction and angles and install sealant to

secure joints.

2. Install dampproof course at floor level for all interior partition walls on floor slabs on grade

5. Flashings

1. All Thru Wall metal flashings that are unsupported by a rigid item, shown or required built into walls to be 16 oz./sq. ft. (3.15 kg/sq. m.) copper unless indicated otherwise.

2. All Thru Wall flashings that are supported can be Bakor thru wall flashing membrane.

3. Install metal wall flashings above structural supports, where low roof meets high walls projecting above; to support membrane reinforced flashing where it would cross a cavity and be unsupported; above windows; above doors; and where indicated on drawings.

4. Unless otherwise shown, flashing extends through exterior wythe of masonry and carried 8" (200 mm) minimum up the exterior face of interior wythe. Terminate top edge of flashing 3/4" (19 mm) inside a horizontal mortar joint. Rake joint.

5. All metal wall flashings shall be placed to direct any moisture to the exterior of a wall (slope mortar below) and step flashing vertically to form a positive dam, with outside edge set in a mineral colloidal asphalt emulsion Type 2 or equal. Ends of all metal flashings to have a 1" (25 mm) up turn at ends to direct moisture to the exterior of the wall.

6. All formed copper flashings to be preformed to shape shown on drawings. Drip to be ¼" (6 mm) at 45 degrees F. (7.2 degrees C.) at exterior face of brick, except flashings at lintel ends to be trimmed flush. Lap seams 6" (150 mm) with three (3) or more beads of sealant between copper.

7. Cover entire top side of copper flashing with membrane reinforced flashing by this section.

8. At stepped flashings at high walls above low, turn up ends of flashing to maintain a positive water flow out of the cavity wall.

9. Blueskin TG to form flashing at base of all cavity walls at grade and Blueskin TWF over all formed copper flashings where membrane is not supported by structure. Lap all seams a min. 4" (100 mm) and secure entire surfaces with adhesive.

10. At low roof high wall flashing locations install a reinforced membrane flashing below the copper flashing as well as Blueskin TWF above. The lower reinforced membrane flashing is to tie down into roof membrane.

6. Shrinkage Control Joints

1. Work shall include shrinkage control joints in wall constructed entirely or partially of masonry units manufactured of concrete:

2. At all locations indicated on drawings.

3. Provide additional interior control joints at junction of walls and columns at maximum horizontal spacing not exceeding 20'-0" (6 mm) in runs of walls where no openings occur at all locations where control joints are not indicated. Obtain Architect's approval of additional control joints prior to proceeding. Carry joints from support of wall to top of wall at structure above.

4. Control joints shall be constructed as detailed and shall provide a complete vertical separation through the wall. Joints shall be a nominal 3/8" (10 mm) wide.

5. Form control joints for interior block masonry walls by placing a layer of building paper up the height of the wall separating block on one side from adjacent block or column. Fill void between blocks with mortar. Rake joints back 3/8" (10 mm). Building paper shall not be exposed.

6. Form shrinkage control joints in exterior masonry walls by placing premoulded joint filler in continuous vertical joint, full height of wall. Leave pre-moulded filler back from face of wall to allow space for joint filler and sealant under Section 07900

7. Joint Reinforcement

1. Reinforce all walls and partitions of concrete masonry units, solid and cavity, and single wythe block walls with joint reinforcement placed in horizontal joints at alternate courses 16" (400 mm) unless indicated otherwise. DO NOT extend joint reinforcement through control joints. Overlap all joints a minimum 8" (200 mm).

2. Where openings occur in these walls, place joint reinforcement in joints at every 8" (200 mm) course, within 32" (800 mm) above and below openings for a distance of 24" (600 mm) beyond opening.

3. Reinforce all masonry walls where thickness is reduced by a column or chase with a 48" (1200 mm) length of joint reinforcement placed in horizontal joints at 16" (400 mm) centres. Centre reinforcement on column or chase.

4. Install prefabricated corner sections in reinforced joints at corners and prefabricated tee sections at reinforced joints where partitions intersect other partitions or walls, unless lateral support is being provided or walls or partitions are erected on a different foundation.

5. Where intersecting walls are erected on different foundations and lateral support is not required, provide straight joint full height of wall with masonry ties at every second joint. Rake joint 3/8" (10 mm).

6. All exterior wall reinforcing to be stainless two wire truss type with stainless steel Fero Block Shear Connector Tie with V-Tie leg. All interior partition wall reinforcing, and anchors mill galvanizing truss design

7. Provide structural work as detailed on structural drawings.

8. Place masonry reinforcement according to CSA-S304-94.

8. Bonding

1. Wythes of masonry walls shall be bonded by means specified and/or shown on drawings, or as otherwise required by authorities having jurisdiction.

2. Use running bond unless otherwise indicated. Specialty bonding, banding, stack bonding, soldier coursing to be as indicated on drawings. Use stack bond where indicated on drawings.

3. Cavity wall wythes shall be bonded with joint reinforcement at 16" (400 mm) o.c. and staggered cross members of reinforcement at alternate courses.

9. Built-in Work

1. Set all loose and miscellaneous items of steel and iron, including all isolated beams, lintels, shelf angles, bearing plates, ventilators and all other loose iron and steel work specified for erection or setting by others when built into masonry work. These items shall be grouted in place using cement mortar.

2. Install 30 pound (13600 g) building paper felt under steel lintel bearing on one side only. Locate this bond breaker on the same as the control joint occurs.

3. Supply and install all vertical steel reinforcement and grouting indicated on the structural drawings. Grouting to be installed using at maximum 5'-0" lifts (1525 mm) using low lift grout.

10. Closures, Bellows and Water Stops

1. Provide 16 oz. per sq. ft. preformed copper water stops and closures formed as indicated on drawings.

2. Overlap all joints a min. 6" (150 mm) to obtain water flow to the exterior and apply 3 beads of sealant at joint.

11. Bent Metal Closures

1. Supplied and installed under Section 05500.

12. Filled Block Partitions

1. Fill all cavities in block partition with concrete and/or grout where indicated.

3.2 POINTING AND CLEANING

1. Point using concave joint at all areas except at single scored block which shall be

tooled to match square score in block and provide other joint finishes where directed by Architect.

2. Point all holes, except weepers in masonry. Cut out all defective joints and repoint them with mortar.

3. Clean exposed masonry to satisfaction of Architect after mortar has hardened.

4. Wire brushes or abrasives shall not be used for cleaning.

5. Use of muriatic acid shall not be used for cleaning.

6. Leave masonry clean and free of mortar daubs and with tight mortar joints. Submit data for Architect's approval of chemical cleaner to be used to remove excess mortar on bricks.

7. Rinse masonry surfaces with water immediately after cleaning.

8. Remove and replace defective material at Architect's direction and at no cost to the Owner.

9. Clean up masonry debris and remove from site.

END OF SECTION

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Furnish all labour, materials, equipment and services specified, indicted or required to supply, install and complete all structural steel and open web steel joists (OWSJ).

1.2 RELATED WORK DESCRIBED ELSEWHERE:

.1 Section 03300 - Grouting under column bases and bearing plates
.2 Section 05500 - Miscellaneous Metals

1.3 SUBMITTALS

1.3.1 Comply with the pertinent provisions of Section 01300.

1.3.2 Erection diagrams and shop drawings shall be consistent with the design drawings prepared by the Consultant. Submit copies of erection diagrams to the Consultant for review before preparation of shop drawings. Submit shop drawings to the Consultant for general review of arrangement of details and type of connections before commencing fabrication. Furnish copies of erection diagrams and shop drawings to the Consultant for distribution. The Consultant's review of these shop drawings will not relieve the Contractor of responsibility under the Contract.

1.3.3 Shop drawings shall show the size, spacing, and location of structural steel and joists and all connections, attachments, reinforcing and anchorage. Diagrams shall include all necessary plans, elevations and details. Identify each member by a standard mark, to be listed in the schedule shown on the fabricator's erection drawings and placed legibly on each unit at the time of fabrication.

1.3.4 Shop drawings shall show the seal and signature of a Professional Engineer, registered in the Province of Ontario, responsible for the design of the OWSJ and its ability to meet the design criteria shown on the drawings and/or OBC requirements. Maximum live load deflection for all open web steel joists is L/360 unless noted otherwise on the drawings Camber joists for dead load.

1.3.5 Shop drawings of structural steel shall show the seal and signature of a Professional Engineer, registered in the province of Ontario, for design of connections.

1.4 DEBRIS

1.4.1 Promptly, as the work proceeds and on completion, clean up and remove from the site all rubbish, surplus materials and equipment.

1.5 STANDARDS

1.5.1 All Codes and Standards referred to herein are to be latest edition.

1.5.2 Applicable Codes and Standards governing the work of this Section:
- .1 CAN/CSA S16 - Limit States Design of Steel Structures.
- .2 CAN/CSA - G40.20 - General Requirements for Rolled or Welded Structural Quality Steel.
- .3 CAN/CSA - G40.21 - Structural Quality Steels.
- .4 CSA-W59 - Welded Steel Construction (Metal Arc Welding)
- .5 CSA-W47.1 - Certification of Companies for Fusion Welding of Steel Structures.
- .6 CSA - W48 Series Latest Editions - Welding Electrodes.
- .7 ASTM-A325M - High-Strength Bolts for Structural Steel Joints.
- .8 CAN/CGSB-1.40 - Primer, Structural Steel, Oil Alkyd Type
- .9 Current Ontario Building Code

1.6 CUTTING AND PATCHING

1.6.1 Make all necessary adjustments and cut and fit to suit adjacent work of other Sections. Make good all finishes after installation has been completed.

1.7 INSERTS AND OPENINGS

1.7.1 Supply anchor bolts, loose base plates and other items when required for setting by other Sections. Provide holes and openings required in the work of this Section for the work of the Sections.

1.8 DIMENSIONS AND FIELD MEASUREMENTS

1.8.1 Check all dimensions before commencing shop drawings, fabrication, and installation and report all discrepancies to the Consultant. Where dimensions are not available before work is commenced, the dimensions required shall be agreed upon between the various trades concerned and approved by the Consultant.

1.8.2 Before commencing operations, verify the location and obtain all necessary measurements of structures which might affect the work of this Section. Before commencing erection verify the location and elevation of all anchor bolts for columns and verify that the foundations or piers are at the proper elevation and ready to receive the base plates. Check any existing floor levels for the proper alignment of new floors.

1.9 WORKMANSHIP

1.9.1 The work of this Section shall be done in accordance with the best practice by skilled labour.

1.10 INSPECTION AND TESTING

1.10.1 An inspection and testing company may be appointed and paid by the Owner to inspect the work of this Section. Give full cooperation to the Inspectors and the Consultant in the making of inspections and tests at all places where work is being done or stock is piled. The Inspector will report to the Consultant the

progress of the work, the manner of procedure, the quality of the materials and workmanship and the compliance with the Contract Documents.

1.10.2 The Inspector will call to the attention of the Contractor or his representative any improper workmanship or defective materials and it is understood and agreed that the Inspector shall have authority to direct stoppage of any improper practices until the Consultant has investigated the matter and made his decision. The Inspector will give his instructions directly to the Contractor or his representative on the job; he is not authorized to give orders to any other employees of the Contractor. Inspectors are not authorized to change, enlarge or diminish the provision in the Contract Documents in any degree whatsoever.

PART TWO - PRODUCTS

2.1 MATERIALS

2.1.1 Structural steel shall be new material of the sizes and shapes indicated on the drawings and all W-shapes & S-shapes sections shall conform to ASTM A992 & ASTM A572 Grade 50 Fy=345MPa, all C-shapes sections & Angles shall conform to G40.21-350W Fy=350MPa, all HSS hollow structural sections shall conform to G40.21-350W Class C Fy=350MPa, all others (plates, rods) shall conform to G40.21-300W Fy=300MPa.

2.1.2 Welding materials shall comply with CSA W59.

2.1.3 High strength bolts, nuts and washers shall comply with ASTM A325M.

2.1.4 Bolt heads shall be identified on the top of the head by three radial lines, the legend "A325" and the manufacturer's mark.

2.1.5 Standard primer for shop paint and touch-up in the field shall comply with CISC/CPMA Standard 1-73a One-Coat Paint and CISC/CPMA Standard 2-75 Primer.

PART THREE - EXECUTION

3.1 FABRICATION

3.1.1 Use shop and field connections indicated on the structural drawings. In the absence of such indication, comply with current CAN/CSA S16.

3.1.2 Trim and cut top plates to shape by machine gas cutting or carefully guided manual gas cutting to avoid rough or damaged edges caused by shearing. Accurately cut beams and plates which are exposed in the finished work to avoid excessive widths of welds forming connections. Continuously weld and

weatherproof connections which will be exposed on the exterior of the building in the finished work. Grind all such welds to present true and straight lines.

3.1.3 Cut steel members in the field only when directed by the Consultant, who may direct that holes be suitably reinforced with welded steel plates.

3.1.4 At any time before the detailed drawings are completed and approved, if requested, provide punched holes up to 20mm diameter for the convenience of other trades in attaching wood or other materials to structural members. Place holes for connections, wood lagging or for other purposes so as not to cause any appreciable reduction in the strength of members. Provide holes for services and reinforce as indicated on the structural drawings.

3.2 DESIGN OF CONNECTIONS

3.2.1 If requested by the Consultant, or the local authority having jurisdiction over the work, submit structural calculations and such further proof as may be called for to show that the design, fabrication and erection of the work of this Section complies with the specifications, drawings, local by-laws and all relevant codes and standards.

3.2.2 Design the minimum connections for beams in accordance with CISC framed beam connection details based on 20mm high strength bolts to develop the stated reaction or the full uniform-load capacity for the given span or the **50%** of maximum full shear capacity of the member, whichever is greater. Use double angle connections where possible.

3.3 WELDING

3.3.1 Welding shall comply with CSA W59. Any fabricator undertaking to weld under this contract shall be fully approved by the Canadian Welding Bureau, under the requirements of CSA W47, Division 1 or 2.1.

3.3.2 Do not field weld during rain, snow or sleet. Drive off moisture from dew or fog by heat before welding commences. Provide windbreak protection to protect the work area form direct wind. Do not weld when the air temperature is below -18°C (O°F). If the air temperature is above -18°C (0°F), but is cold enough to prevent the welder from producing sound work then welding will not be permitted.

3.3.3 Prepare ends of beams, girders, and other members to be welded by gas cutting in the shop, taking into account the relative position of the member in the finished structure, and the grade, camber or curvature of the member.

3.3.4 Minimum pre-heat and interpass temperatures, within 75mm of the location of weld deposits, shall be in accordance with good welding practice. Form welds with sound clean metal completely fused to the base metal. Ensure complete penetration of the joint. Gouge out and re-weld all welds which show inclusions, porosity, lack of fusion, poor penetration or uneven contour, sagging or overlapping parent metal. Clean welds between passes and at completion and remove slag with a descaling tool and wire brush. Where welds show

undercutting run in a small stringer bead along the toe of the undercut using a smaller diameter electrode than that used for the original weld. Fill weld craters flush with weld metal. Check root passes for penetration and cracks from the back side of the joint. Gouge out any crack, regardless of size, 50mm beyond each end of the crack and reweld.

3.3.5 Before final acceptance of welding make a thorough check to ensure that all welds required have been made. Check all fillet welds with a gauge to determine that none are undersize or short in length.

3.3.6 Check welds for cleanliness before painting.

3.4 ERECTION

3.4.1 Make adequate provision for erection stresses and for temporary bracing to keep the structural steel frame plumb and in true alignment during construction of the building. Bracing members shown on the drawings are required for the finished structure and it is not to be assumed that they are adequate for construction purposes. It shall be the sole responsibility of the Contractor to make proper and adequate provisions for erection stresses and for temporary bracing.

3.4.2 Plumb and level individual pieces of the structural frames to a tolerance not exceeding 1 to 500, except that for exterior columns the tolerance shall not exceed 1 to 1000.

3.4.3 Straighten small bends and kinks received during transportation before members are erected. At the discretion of the Consultant replace all members seriously damaged. Provide any temporary beams required for erection purposes, and remove them when no longer required. Set column bases on steel shims or concrete screeds ready for grouting by the Concrete Section. Use wooden malls for driving or hammering steel members into position. Do not use steel or iron sledges. Take every care to prevent the structural members from falling or being subjected to heavy shock or impact from other members being swung into position.

3.4.4 Report to the Consultant every failure of fabricated materials to fit together properly before taking any corrective measures.

3.4.5 Unless noted otherwise high-strength bolts shall be tightened in accordance with Turn-of-nut method specified in CAN/CSA S16 Design of Steel Structures.

3.5 SHOP PAINTING

3.5.1 Before commencing shop painting, clean all steel surfaces by wire brushing to remove loose mill scale, rust, oil, dirt, and other foreign matter. Clean welds prior to painting, by wire brushing and washing down with clean water, to remove the chemical residues left by the welding electrodes. Material to be painted shall be completely dry, shall be painted under cover and shall remain under cover until the paint is thoroughly dry. Apply shop paint only when the air and steel surface temperatures are above 5°C (40°F). Do not paint the following surfaces:

.1 Steel to be encased in concrete or to receive **contact-type** fireproofing such as intumescent fireproofing or cementitious fireproofing.
.2 Surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 50mm on all side of the joint.
.3 The contact surfaces of connections assembled by high-tensile bolts within friction type joints.

3.5.2 Apply one coat of the specified prime paint by dipping, brushing or spraying.

3.5.3 Work paint into all joints and open spaces.

3.5.4 After erection spot paint with the specified prime paint, field bolt heads and nuts, field welds and any abrasions, rust or damage to the shop coat of paint.

3.5.5 All steel exposed to exterior environment shall be hot dipped galvanized in accordance with CSA G164. This will include interior lintels that are connected to steel exposed to the exterior environment (i.e. a combined lintel for brick and block).

END OF SECTION

PART ONE -GENERAL

1.1 SECTION INCLUDES

1.1.1 Structural steel roof deck.

1.1.2 Structural hi-bond floor deck.

1.1.3 Structural acoustic roof deck.

1.2 RELATED SECTIONS

.1 Section 03300 - Cast-In-Place Concrete: concrete topping over metal deck.
.2 Section 05120 – Structural Steel.
.3 Section 07500 - Membrane Roofing: installation of acoustic deck insulation.
.4 Section 07250 - Applied Fireproofing: cementitious fireproofing.

1.3 REFERENCES

(All Codes and Standards referred to herein are to be latest edition.)

.1 ASTM A446: Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
.2 CAN/CSA-S136: Cold Formed Steel Structural Members.
.3 CSA W47.1: Certification of Companies for Fusion Welding of Steel Structures.
.4 CSA W55.3: Resistance Welding Qualification Code for Fabricators of Structural Members Used In Buildings.
.5 CSA W59: Welded Steel Construction (Metal Arc Welding).
.6 Canadian Institute of Steel Construction: Handbook of Steel Construction.
.7 CSSBI 101: Specification for Zinc Coated Structural Quality Steel Sheet for Roof and Floor Deck.

1.4 SYSTEM DESCRIPTION

1.4.1 Design metal roof and hi-bond floor deck to CSA-S136.

1.4.2 Design deck units to span continuously over 3 spans, supplied in proper length for support conditions. Roof deck is designed as a diaphragm.

1.4.3 Maximum Live Load Deflection: 1/360th of span.

1.5 SUBMITTLAS

1.5.1 Submit erection and detail shop drawings to requirements of Section 01310.

1.5.2 Indicate decking plan, support locations, projections, openings and reinforcement, outlet box locations, pertinent details and accessories.

1.5.3 Design deck layout, spans, fastening, joints, and openings under the direct supervision of a Professional Structural Engineer experienced in design of this work

and licensed in the Province of Ontario. Deck drawings shall be stamped by the Professional Engineer responsible for the direct supervision.

1.6 QUALITY ASSURANCE

1.6.1 Welding: undertaken only by organizations fully approved by the Canadian Welding Bureau, meeting the requirements of CSA W47.1 and CSA W55.3.

1.7 DELIVERY, STORAGE AND HANDLING

1.7.1 Transport and store the fabricated metal deck at the Site in such a manner as to ensure the panels are not bent, warped or subject to corrosion.

1.7.2 Damaged material will be rejected.

PART TWO - PRODUCTS

2.1 MATERIALS

2.1.1 Steel Roof Deck, Type B Deck: 0.76mm (or 0.91mm, or 1.22mm, see drawings) thick, 38mm deep; fluted steel roof deck to ASTM A653M SS Grade 275 (Fy = 275 MPa) galvanized steel with a zinc coating of ZF75 Galvanneal, flutes spaced at 150mm centers c/w interlocking male and female side laps. Canam **P-3615 (1.5BI)** or approved equal.

2.1.2 Steel Floor Deck: 0.76mm (or 0.91mm, or 1.22mm, see drawings) thick, 38mm deep; fluted steel floor deck, composite floor type ASTM A653M SS Grade 275 (Fy = 275 MPa) galvanized steel with a zinc coating of ZF75 Galvanneal, flutes spaced at 152mm centers, with integral lugs on the web face of the flutes to achieve proper composite action. Canam **P-3615 (1.5BLI) composite** or approved equal.

2.1.3 Acoustic Steel Roof Deck, Type N Deck: 0.76mm (or 0.91mm, or 1.22mm, see drawings) thick; 76mm deep; fluted steel roof deck to ASTM A653M SS Grade 275 (Fy = 275 MPa) galvanized steel with a zinc coating of ZF75 Galvanneal, flutes spaced at 150mm centers; webs continuously perforated with 3mm diameter holes staggered at 9mm centers c/w interlocking male and female side laps. Canam **P-2436 Acoustic** or approved equal. All flutes to be welded to supporting steel members for this deck.

2.1.2a Steel Floor Deck: 0.76mm (or 0.91mm, or 1.22mm, see drawings) thick, 76mm deep; fluted steel floor deck, composite floor type ASTM A653M SS Grade 275 (Fy = 275 MPa) galvanized steel with a zinc coating of ZF75 Galvanneal, flutes spaced at 152mm centers, with integral lugs on the web face of the flutes to achieve proper composite action. Canam **P-2432 composite** or approved equal.

2.1.3a Steel Roof Deck, Type N Deck: 0.76mm (or 0.91mm, or 1.22mm, see drawings) thick; 76mm deep; fluted steel roof deck to ASTM A653M SS Grade 275 (Fy = 275

MPa) galvanized steel with a zinc coating of ZF75 Galvanneal, flutes spaced at 150mm centers c/w interlocking male and female side laps. Canam **P-2436** or approved equal. All flutes to be welded to supporting steel members for this deck.

2.1.4 Sound Attenuating Insulation: mineral fiber sound attenuating insulation strips, shaped to fill acoustic flutes; Owens-Corning AF110.

2.1.5 Cover Plates, Cell Closures and Flashings: steel sheet; 0.76mm thick; ZF75 zinc coating.

2.1.6 Closures to External Walls: neoprene or polyvinyl chloride, closed cell type.

2.1.7 Sealant: as specified under Section 07900.

PART THREE - EXECUTION

3.1 EXAMINATION

3.1.1 Verify that field conditions are acceptable and are ready to receive work.

3.1.2 Ensure openings in deck required by others have been designed for.

3.1.3 Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

3.2.1 Erect metal decking to requirements of CSSBI standards.

3.2.2 Erect decking on support surfaces with 50mm minimum bearing. Align and level.

3.2.3 Fasten deck to steel support members at ends and intermediate supports with 19mm OD puddle welds at 300mm OC maximum, Marginal (perimeter) welds at 150mm OC maximum unless note otherwise, refer to deck fastening pattern schedule on drawings.

3.2.4 Mechanically clinch male/female side laps at 600mm OC maximum unless noted otherwise, refer to deck fastening pattern schedule on drawings.

3.2.5 Cut and structurally reinforce openings in the deck as shown and to requirements of the approved shop and erection drawings.

3.2.6 Structurally reinforce openings 300mm square or smaller, but larger than 150mm square or 150mm round. Openings smaller than outlined above need not be reinforced.

3.2.7 Do not allow additional openings in deck without prior written approval by

Consultant.

3.2.8 Install 150mm minimum wide sheet steel cover plates, of same thickness or decking, where deck changes direction. Fusion weld at 300mm OC maximum.

3.2.9 Make connections and deck alignment neat and to the approval of the Consultant. Replace dented, damaged, or weld-perforated deck.

3.2.10 Install wet concrete stops at floor deck edge, upturned to top surface of slab. Provide stops of sufficient strength to remain stationary without distortion during concrete pours.

3.2.11 Install enclosures and angle flashings to close openings between deck and walls, columns and openings, as described below:

.1 Where fluted end of metal decking rests on exterior masonry walls, fill web spaces with closed cell neoprene or polyvinly chloride closures as recommended by manufacturer.

.2 Where deck flutes are perpendicular to exterior walls, and decking exposed on underside extends beyond these walls, caulk interlocking side laps of decking for 400mm immediately over walls. Install interior and exterior closures. Caulk exterior closures to prevent air infiltration and interior closures to prevent water vapour exfiltration. Provide Section 07500 with sufficient quantity of closures to close off topside flutes directly over face of wall.

.3 Where flutes run perpendicular to interior partitions, install double run of steel closures as recommended by manufacturer.

.4 Where flutes are parallel to interior partitions, install steel closure flashings to provide neat juncture between two materials, as recommended by manufacturer.

.5 Closures are not required between interior partitions and underside of decking in areas designated to receive suspended ceiling.

3.2.12 Provide sound attenuation strips to Section 07500 for installation in acoustic flutes.

3.3 FIELD QUALITY CONTROL

3.3.1 Field inspection and testing will be performed under Section 01410.

3.3.2 Inspect steel deck welds for structural integrity.

3.4 ADJUSTING

3.4.1 After erection and anchorage, grind smooth all welds and make good zinc coating wherever scratched, chipped or damaged.

3.4.2 Fill all holes blown through the deck during welding with weld metal.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this section and shall apply as if repeated here.

1.2 SHOP DRAWINGS

1. Submit shop drawings in sepia form in accordance with Article G.C. 3.11 of CCDC Document 2-2008.

2. Submit shop drawings for review by the Architect prior to fabrication.

3. Design Criteria-Applicable Standards:

    1. All standards in accordance with latest issue.

    2. CSA Standard CAN3-S16.1-M, "Steel Structures for Buildings" Limit States Design.

    3. CSA Standard W59, "Welded Steel Construction" (Metal Arc Welding).

    4. CSA Standard W.55.2, "Resistance Welding Practice."

    5. CSA Standard W55.3, "Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings."

    6. CSA Standard W.47, "Certification of Companies for Fusion Welding of Steel Structures."

    7. CSA Standard S.136, "Cold Formed Steel Structural Members".

    8. Current Ontario Building Code.

4. Certificates:

    1. Provide a certificate signed and sealed by the licensed/registered professional engineer responsible for the stair designs and the detailed steel connections (including guards) stating that the stairs and connections have been designed, detailed and fabricated in accordance with the applicable standards.

    2. Certification must bear the original seal and signature of the engineer and be dated. Photocopies are not acceptable.

3. Clearly indicate construction details, sizes of steel sections, thickness or gauge of steel sheet, connections, joints, method of anchorage, number

of anchors, supports, reinforcement and accessories. Confirm all dimensions on site.

1.3 STANDARDS

1. Materials and workmanship shall conform to the requirements of the Ontario Building Code - 1990, as currently amended.

2. Do welding work to CSA W59, unless specified otherwise. Welders to qualify under CSA W47, CSA 55.2 and CSA W55.3.

3. Design of steel fabrications, unit stresses and workmanship to conform to CSA CAN3-S16 1-M.

1.4 DESIGN CRITERIA

1. Design stair: landing construction; guards and railings and connections to conform to the Ontario Building Code.

2. Design detail and fabricate in general to CSA CAN3-S16 1-M.

1.5 QUALITY ASSURANCE

1. Welding Applicable Standards:

    1. CSA Standard W59, "Welded Steel Construction" (Metal Arc Welding).

    2. CSA Standard W.55.2, "Resistance Welding Practice."

    3. CSA Standard W55.3, "Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings."

    4. CSA Standard W.47, "Certification of Companies for Fusion Welding of Steel Structures."

    5. Fabrication and erection of **ALL** components to be by companies holding current C.W.B. Certification as Division 1 or Division 2.1. All welding by welders holding current certification for the required welding positional.

    6.

1.6 SCOPE

1. Supply and install steel bollards.

2. not used.

3. Supply and install hot dipped galvanized steel plate connections at top and bottom of exterior wood posts as detailed on the drawings.

4. See also Fabrication in this section.

5. Provide all miscellaneous metals (including aluminium) items as detailed and noted under other sections.

6. Provide all steel items where detailed on the Architectural drawings but not indicated on the Structural Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

1. Ferrous Metals:

2. Unless otherwise indicated, hot rolled mild steel in .15% to .25% carbon range.

3. Steel sections and plate: CSA G40.21-/M1987, minimum 260W grade.

4. Square steel tube: CSA G40.21-/M1987, Grade 350W.

5. Steel pipe: ASTM A53-76, Type E, Grade A.

6. Sheet Steel: hot dip galvanized, cold rolled, with stretcher level degree of flatness to ASTM A526; zinc coating designation Z275.

7. Aluminum: CSA HA Series - M1980 for aluminum and aluminum alloys, Alcan 50S Alloy.

8. Prime Paint: Zinc Chromate, rust inhibitive primer conforming to CGSB-1-GP-18M or oil alkyd type (shop coat) conforming to CGSB-1-GP-40M. Colour to be grey.

9. Expansion Joints: as specified.

10. Welding Materials: CSA W59-1984.

11. Bituminous Enamel: Alkali resistant asphaltic coating conforming to CGSB1-GP-108M.

12. Non-shrink Grout: Por-Rok by Hallemite Products Ltd., or SET 15 Minute Anchoring Cement by SET Products Ltd.

13. Galvanized Touch-Up Paint: Zinc rich, Galvafroid by W.R. Meddows of Canada Ltd. or approved equal.

14. Hot Dipped Galvanizing: conform to CSA G164-M1981.

15. Bolts and Anchor Bolts: to ASTM A307-82a.

16. Stainless Steel:

1. Handrails to have brushed finish, Type 304 finish to be ornamental grade AISI No.4.

17. Stainless Steel for Millwork : To have brushed finish for Type 304 and Type 316; finish to be ornamental grade AISI No.4.

    1. To be used for toe kicks, trims, and baseboards where indicated.

    2. Heights as indicated on drawings

2.2 FABRICATION - GENERAL

1. Fabricate components in the shop in largest size practicable to minimize field jointing.

2. Fabricate components square, straight, true, free from warpage and other defects. Accurately cut, machine file and fit joints, corners, copes and mitres.

3. Reinforce fabricated components to safely withstand expected loads.

4. Make joints in built-up sections with hairline joints in least conspicuous locations and manner.

5. Make allowance for thermal expansion and contraction when fabricating exterior work.

6. Joints shall be welded unless otherwise indicated and unless details of construction do not permit welding. Exposed welds shall be continuous and shall be ground smooth.

7. Close exposed open ends of tubular members with welded on steel plugs.

8. Where work of other Sections is to be attached to work of this section, prepare work by drilling and tapping holes, as required to facilitate installation of such other work.

9. Work of this Section, supplied for installation under other Sections, shall be prepared as required ready for installation by: drilling, countersinking and tapping holes, forming shapes and cutting to required sizes.

10. Grind off mill stampings and fill recessed markings on steel components left exposed to view.

11. Make workmanship of best grade of modern shop and field practice known to recognized manufacturers specializing in this work. Fit joints and intersecting members accurately. Make work in true plumb, true, square, straight, level, and accurate to sizes and shapes detailed, free from distortion or defects detrimental to appearance or performance.

12. Insulate metals where necessary to prevent corrosion due to contact between

dissimilar metals and between metals and masonry, concrete or plaster. Use bituminous paint, butyl tape, building paper or other approved means.

13. Supply all fastenings, anchors and accessories required for fabrication and erection of the work. Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum and inconspicuous, spacing them evenly and setting them out neatly. Make fastenings of permanent type.

14. Draw mechanical joints to hairline tightness and seal countersunk screws and access holes for locking screws with metal filler where these occur on exposed surface.

2.3 FINISHES

1. Thoroughly clean steel of lose scale, rust, oil, dirt and other foreign matter. Suitable prepare steel surfaces by power tool cleaning to receive specified finishes.

2. Grind smooth sharp projections.

3. Remove oil and grease by solvent cleaning.

4. Apply coatings in the shop and before assembly. Where size permits, galvanize components after assembly.

5. Shop apply coat of primer to interior components after fabrication except where galvanized finish and stainless steel is required.

6. Hot dip galvanize exterior components and other components, where so indicated, after fabrication in accord with requirements of CSA Standard G164-M1981.

7. Apply coat of bituminous enamel to contact surfaces of metal components in contact with cementitious materials and dissimilar metals.

8. After erection and installation, thoroughly clean the work and apply field touch up of same formula as shop coat to all damaged or unpainted surfaces. Work all paint well into all joints, crevices and open spaces.

2.4 MISCELLANEOUS STEEL SECTIONS

1. Supply all miscellaneous steel angles, plates, lintels, etc., indicated on the architectural drawings & not indicated on the structural drawings or noted on the structural drawings by others. Size according to loads, set plumb and true and securely fix. Continuously weld and grind smooth exposed connections. Others may be welded or bolted.

PART 3 EXECUTION

3.1 INSTALLATION

1. Install components plumb, square, straight and true to line. Drill, cut and fit as necessary to attach this work to adjoining work.

2. Provide temporary supports and bracing required to position components until they are permanently anchored in place.

3. Securely anchor components in place; unless otherwise indicated, anchor components as follows:

    1. To concrete and solid masonry with expansion shields and bolts.

    2. To hollow construction with toggle bolts.

    3. To thin metal with screws or bolts.

    4. To thick metal with bolts or by welding.

    5. Fill space between railing members and sleeves with non-shrink grout.

    6. To wood with bolts or lag screws.

4. Provide all components required for anchoring. Make anchoring in concealed manner wherever possible. Make exposed fastenings, where approved by Architect neatly and of same material, colour, texture and finish as base metal on which they occur. Keep exposed fastenings evenly spaced.

5. Dissimilar metals and metals in contact with cementitious elements shall have contact surfaces coated with bituminous paint or be isolated by other means as approved by Architect.

6. After installation, clean and refinish injured finishes, welds, bolt heads and nuts. Refinish with zinc rich paint or primer to match original finish.

3.2 LATERAL SUPPORT FOR MASONRY

1. Provide deflection and lateral support angles for non-loadbearing masonry walls. Coordinate with structural drawings for details and locations of structural steel joists & beams and locations of structural steel deck.

    Note: Item to be covered under this section.

3.3 BENCH AND SHELF SUPPORTS

1. Provide all metal angles and brackets to wood benches and coat hook brackets for extent indicated. Refer to drawings and details for size and shapes. Provide

1/4" (6.5 mm) thick aluminum brackets for benches where shown on drawings.

2. Bench brackets are required in Change Rooms. Refer to 9 series drawings for locations of benches. Refer to drawings for details.

3. All items to be primed for paint after fabrication.

4. Prepare all metal work, ready to receive wood members by Section 06200 Finish Carpentry.

3.4 SECURITY GATES

1. Provide hot dipped galvanized security gates where shown on drawings.

3.5 MISCELLANEOUS ITEMS, STEEL BRACKETS SUPPORTS AND ANGLES

1. Supply for installation by respective trades, steel brackets, supports, and angles as indicated on drawings. Drill for countersunk screws and anchor bolts. Prime paint for interior, galvanize for exterior.

2. Provide support brackets for vanities and counters, cabinets and storage units as indicated.

3. Provide other metal fabrications which are not a part of a manufactured item or covered under another section in Division 5. Refer to drawings.

3.6 STEEL FOR HOLLOW METAL SCREEN/PARAPET WALL

1. Provide support steel for hollow metal work, refer to drawings. Provide for all support steel including overhead bracing for hollow metal screens where not indicated by structural drawings.

3.7 BOLLARDS

1. Supply and install hot-dipped galvanized steel bollards as shown on Drawings. Bollards shall be 150 mm x 9.5 mm thick wall x height as noted on drawing, seamless steel pipe as detailed on drawings. Install 1200 mm into a concrete foundation. Fill bollard with 25 MPa concrete and round top. Round top of footing also. Location of Bollards: as indicated on drawings and on Site Plan.

3.8 STEEL ROOF PARAPET CURB

1. Provide steel roof parapet curb as detailed on drawings.
2. Predrill for fastening wood blocking to it and prime paint.

3.9 BENT METAL CAVITY CLOSURES / COMPARTMENTALIZATION CLOSURES

1. Bent Metal Closures: 12 gauge 304 stainless steel with 2B finish cold rolled formed to suit continuous bent closure profile:

1. Around all window and curtain wall openings;
2. Around all door openings;
3. Around all other misc. openings through exterior cavity wall;
4. At expansion joints and control joints.

2. Compartment Control Joint (CCJ): 12 gauge 304 stainless steel, 2B finish cold rolled formed, complete with ss reinforcing wire @ 400 o/c through slotted holes.

    1. Exterior wall locations. Install CCJ at:
    1. All exterior corners, 300mm from corner on both sides;
    2. All interior corners

3. Max. 20m horizontally on walls and wherever indicated on the drawings.

3.10 BENT METAL CAVITY FIRE STOP CLOSURES

1. Bent Metal Fire Stop Closures: 12 gauge hot dipped galvanized continuous angle. Angle dimensions to suit specific condition. Refer to Drawings for locations.

END SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 STORAGE

1. Materials shall be protected from damage and kept dry during delivery and while stored at job site.

2. Do not store materials in areas where glazing is not complete or concrete completely dry.

1.3 STANDARDS

1. Materials and workmanship shall conform to the requirements of the Ontario Building Code as currently amended.

PART 2 PRODUCTS

2.1 MATERIALS

1. Sawn lumber shall be No. 2 spruce, pine or fir of best merchantable lumber, straight and sized, shaped to the correct dimensions from the nominal sizes noted on the drawings and specified herein. Lumber shall be well-seasoned stock, free from large loose resinous knots, shake, waned edges, splits, dry rot or other defects which would impair its strength or durability.

2. Moisture content of all lumber for rough carpentry, at time of building-in, shall not exceed 17%.

3. Wood Preservative: C.C.A. (chromium copper arseniate) by "Wolmanized".

4. Rough Bucks, Battens, Blocking, Framing: Eastern Spruce, Jack Pine or Fir No. 2 or better.

5. Exterior Rough Bucks Batten Blocking, Framing and Plywood and Interior Wood Attached to Masonry or Concrete: Jack Pine No. 2 or better "Wolmanized" pressure treated wood conforming to C.S.A. 081.1-M1983. Sizes as indicated on drawings and/or as required. All pressure treated lumber shall bear the trademark "Wolmanized" and bear a mark certifying conformance with AWPB Standard LP-2 or LP-22.

7. Fire Retardant Lumber: to be CSA 080.20 DRICON FRT Lumber and plywood distributed by J. Brewer (Canada) Ltd; (519) 621-7701. Sizes as indicated on drawings and/or as required.

8. Grounds, Nailing Strips, Strapping, Furring: Eastern Spruce or Jack Pine Construction Grade allowing 10% to 15% standard grade.

9. Plywood Sheathing: Construction grade and paint grade good one side fir plywood sheathing, exterior type, conforming to C.S.A. 0121-M1978. Square edge or T&G as required.

10. Galvanized Nails and Spikes, Carriage Bolts, Screws and Washers: Hot dipped galvanized nails and spikes for exterior work and mill galvanized for interior work.

11. Nails, Spikes and Staples: To C.S.A. B111-1974, plain finish. Use spiral thread nails.

12. Adhesive: Waterproof wood adhesive.

PART 3 EXECUTION

3.1 WORKMANSHIP

1. Work shall be executed by skilled mechanics according to best practice, as specified herein and indicated on drawings.

2. Lay out work carefully and to accommodate work of other trades. Accurately cut and fit, erect in proper position, true to dimensions, align, level, square, plumb, adequately brace and secure permanently in place.

3. Bore holes for bolted work true to line and same size as bolts, drive into place for snug fit, use plate or washer to prevent nut from bearing directly on wood, and turn up nuts, bolts and lag screws tight at time of installation and again immediately before being concealed with other work or at completion of work.

4. Give painter sufficient notice so that untreated or unprimed carpentry items or materials shall be primed immediately upon delivery to site.

5. Co-operate with others engaged in work on the building to the end that proper unity of action will assure the orderly progress of the work. Do necessary boxing and protecting of sills, jambs, corners, and the like. Construct scaffold, ramps, and other temporary staging necessary.

3.2 WOOD PRESERVATIVE

1. Treat fresh cut ends of pressure-treated Jack Pine with two coats of end preservative.

3.3 ROUGH HARDWARE

1. Supply rough hardware such as nails, bolts, nuts, washer, screws, clips, strap iron, and hardware for temporary enclosures.

3.4 ROOF CURBS, BASES AND SUPPORTS

1. Construct pressure treated wood roof curbs for ventilation ducts, fan bases, etc., as detailed or required by other trades. Construct suitable approved pads to

receive duct supports. Note tops of all curbs for roof top units shall be a minimum 14" (350 mm) above finished roof surface.

3.5 ROUGH BUCKS, GROUNDS, BLOCKING, STRAPPING, FURRING

1. Furring, blocking or strapping indicated is not to be regarded as exact or complete. Location and methods of securing these pieces to option of Contractor. Provide adequate nailing.

2. Cut grounds and screeds in long lengths as practical with square ends. Erect to create true, plumb planes and fasten rigidly in place.

3. Provide minimum 2" x 4" (38 mm x 89 mm) blocking as necessary for attachment of base, trim, cabinets, fixtures, hardware, miscellaneous specialties, equipment and the like unless indicated otherwise. Cut ends square and fasten rigidly to building structure.

4. Rough bucks shall be minimum 2" (38 mm) thick wood of width indicated, set straight, true and plumb, braced and fastened securely in place.

5. For general strapping, set treated wood strips vertically spaced 16" (400 mm) on centre, unless otherwise indicated. Shim so faces form a true plane. Provide intermediate horizontal strapping at all joints to wall finishes applied over grounds.

3.6 FRAMING

1. Frame walls, partitions, roofs, platforms, etc., as indicated. Note: metal studs supplied and installed under Section 09110 – Metal Stud and Ceiling Suspension Systems.

2. Set wood joists 16" (400 mm) o.c. unless otherwise noted, using a single bottom plate and double top plates. Double studs at openings and triple at corners and partition intersections. Provide one row of horizontal bridging of same material as studs.

3.7 BLOCKING

1. Provide minimum 2 x 4 (38 mm x 89 mm) blocking or size as required for secure attachment of base, trims, cabinets, fixtures, miscellaneous specialties, equipment etc. and the like unless specified otherwise. Cut ends square and fasten rigidly to building structure. Cut ends square and fasten rigidly to building structure. Coordinate blocking requirements with work of sections listed in 1.4 of this section.

3.8 PARAPETS (Typical)

1. Supply and install pressure treated wood block and framing as detailed, and exterior grade pressure treated plywood at parapets, and include blocking to allow ventilation from masonry cavity over exterior masonry allowing ventilation behind parapet flashing. Create vented space using 1" x 3" (19 mm x 75 mm) cutouts in blocking

at 16" (400 mm) o.c. for ventilation All cut ends to be primed with 2 coats of end cut wood preservative. Co-ordinate installation of air/vapour barrier membrane at back and top of parapets with roofing and masonry trades. Installation of membrane by masonry/air barrier trade. Refer to drawings for typical detail. Secure parapet wood frame blocking to block and brick securely with tapcon type fasteners into masonry with a min. of two fasteners for each wood member at every 16" o.c.

3.8 FIRE RETARDANT WOOD

1. Electric and Telephone Backboards and Panel Boards: Supply and install 19 mm thick backboards and panel boards, fire pressure treated, fir plywood. Consult electrical drawings for locations and requirements. Provide wood strapping as required. Fasten to wall using fasteners and spacing suitable to wall type to provide secure, sturdy installation which will carry equipment load without damaging.

3.9 WINDOWSILLS

1. Supply and install first layer of plywood (pressure treated at windowsills). Second layer, nosing and plastic laminate by Finish Carpentry. Refer to drawings for detail and locations.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements, is a part of this Section, and shall apply as if repeated here.

1.2 REFERENCE STANDARDS

1. Standard of finished carpentry, metal work and cabinet work in accordance with the "Architectural Millwork Standards" of the Architectural Woodwork Manufacturers Association of Canada (AWMAC).

1.3 QUALIFICATIONS

1. The work of this trade shall be executed by a company having a minimum of 5 years proven first class experience in this type of work and having adequate equipment and skilled personnel. Refer to Instructions to Bidders for list of Prequalified Trades.

1.4 SHOP DRAWINGS

1. Submit Shop Drawings in accordance with Section 01300 – Submittals.

2. Before Shop Drawings and fabrication are started, take critical measurements at the site to facilitate installation and fitting of work.

3. Design Criteria - Applicable Standards:

    1. All standards in accordance with latest issue.

    2. Ontario Building Code

4. Certificates:

    1. Provide a certificate signed and sealed by the licensed/registered Professional Engineer responsible for the Lobby Ceiling Feature designs and the detailed wood and steel connections stating that the feature and connections have been designed, detailed and fabricated in accordance with the applicable standards.

        1. Certificates must bear the original seal and signature of the Engineer and be dated. Photocopies are not acceptable.

    2. Clearly indicate construction details, sizes and wood and steel sections, thickness or gauge of wood and steel sheet, connections, joints, method of anchorage, number or anchors, supports, reinforcement and accessories. Confirm all dimensions on site.

1.5 DELIVERY AND STORAGE

1. Give Painter sufficient notice so that untreated or unpainted carpentry items or materials can be primed immediately upon delivery to site.

2. No equipment shall be delivered to the site until a portion of the building in which it is to be installed is completely ready for equipment as approved by the Architect.

3. Store finished work properly and keep under cover both in transit and at site. Finish woodwork shall not be delivered to site until concrete and masonry work has dried out.

4. Cover all plastic laminate and melamine faces at shop with heavy Kraft Paper.

5. Check access clearance at site before assembling.

1.6 SAMPLES

1. Submit duplicate 12" x 12" (300 mm x 300 mm) samples of each type of panelling and each type of solid wood or plywood to receive stain or natural finish.

2. Submit duplicate 12" (300 mm) long samples of each type of moulding.

3. Submit samples of construction methods and all hardware.

1.7 WARRANTY

1. The warranty period stipulated in the General Conditions of the Contract shall be extended five (5) years in writing against defects.

1.8 MOISTURE CONTENT

1. Finish material to be dried to a uniform maximum moisture content of 12% for exterior work and 6% to 8% for interior work.

PART 2 PRODUCTS

2.1 MATERIALS

1. Materials used for finish work shall be sound, free from defects that would mar finished appearance, well seasoned and air dried and of good quality for intended purposes. Wood laminates pressure bonded.

2. Plywoods: shall be plain sliced Maple architectural grade "AA" No. 1 Face Grade and shall comply to C.S.A. 0115-M1982, with plywood core, laminated with water-proof adhesive. Plywood shall be good both sides.

3. Hardwoods - Shall be solid selected Maple Architectural Grade 'AA'. Wood shall be selected for uniform colours and graining when at stained and varnished items. Finger jointed woods will not be accepted.
4. Framing Lumber - No. 2 or better spruce, pine or fir best mercantile lumber.

5. Penetrating Sealer - "Penetrim" by Tremco Mfg. Co. (Canada) Ltd., or "1402" by MacNaughton Brooks Ltd.

6. Painted Hardwood: American Poplar ("White Wood") "C" select grade.

7. Plastic Laminate: 0.048" (1.22 mm) thick decorative, high pressure laminated plastic sheeting conforming to CAN3-A172-M1979 and all applicable requirements of O.B.C. (not limited to flame spread rating and smoke development classification.) Manufacturer shall thoroughly sand back of sheet to form a homogenous bonding surface. Accepted Plastic laminate manufacturers are; Formica, Wilsonart, Arborite and/or Nevamar. Backing Sheet .020" (.5 mm) thick, sanded one side. Final colour pattern and finish to be selected by Architect from manufacturer's full range of products. For plastic laminate wall panels located in Lobby and Corridors, the plastic laminate substrate must have a flame spread rating of not more than 150. Allow for 8 different colours of plastic laminate including white dry erase marker board laminate. Refer to the drawings for a complete listing of finishes and colours to be used

8. Reveal Moldings: For use with Plastic laminate finished wall panels DCS 625-50 by Fry Reglet or approved equal. Prime painted at factory and finish painted at site to match Plam. colour.

9. Adhesive: As recommended by manufacturer for required application and to conform to C.S.A. 0121-M1978.

10. Nails, Spikes and Staples: To C.S.A. B111-1974, plain finish nails. Use spiral thread nails and barbed staples.

11. Pressure Treated Wood: Conforming to Section 06100, sizes as indicated and detailed.

    1. Note: Warped, twisted, loose or missing knots in wood will not accepted.

12. Exposed fasteners: All exposed fasteners to be stainless steel. At exposed screw locations use stainless steel screws and cup washers.

13. Laminate Wall Panels:

    1. Refer to drawings and specification section 06210 for materials to be supplied and installed.

PART 3 EXECUTION

3.1 WORKMANSHIP

1. Work shall be executed by mechanics skilled in their respective trade, according to best practice, or specified herein and indicated on drawings.

2. Check job dimensions and conditions and notify the Architect in writing of unacceptable conditions. Do not proceed until remedial instructions are received. Commencement of work will imply acceptance of site conditions and re-working or modification of the work as deemed necessary by the Architect will be done at no extra cost to the Owner.

3. As far as practical, assemble work at the shop and deliver to the job ready for

installation. Leave ample allowance for fitting and scribing on the job.

4. Fabricate work square and to the required lines.

5. Lay out work carefully as indicated and to accommodate work of other trades. Accurately cut and fit; erect in proper position true to dimensions. Align, level, square, plumb, adequately brace, and secure permanently in place.

6. Use treated lumber for studs, blocking nailers, furring and other wood permanently installed in building. Brush coat freshly cut ends with two coats of concentrated form of preservative.

7. Recess and conceal fasteners and anchor heads. Fill with matching wood plugs. Set nail heads and fasteners occurring within exposed interior carpentry work.

9. Provide wood members free from bruises, blemishes, mineral marks, knots, shake and other defects and select for uniform colour grain and texture. Machine and hand sand surfaces exposed in the finished work to an even, smooth surface free from defects detrimental to appearance.

10. Provide running members in the maximum lengths obtainable. Provide thickness of members in maximum dressed size of standard lumber. Where thickness of width indicated is not available in hardwoods, use glue laminations to obtain sizes required. Provide unexposed backs of veneers having the same physical characteristics as the face veneer.

11. Give painter sufficient notice so that untreated or unprimed carpentry items or materials can be primed immediately upon delivery to site. No exposed end grain of plywood shall be permitted; edging shall be solid 3/8" (10 mm) wide by thickness of plywood and of same species of wood. Finger jointed edging will not be accepted.

12. Co-operate with others engaged in work on the building to the end that proper unity of action will assure the orderly progress of the work. Do necessary boxing and protecting of sills, jambs, corners and the like. Construct scaffold, ramps, and other temporary staging necessary.

    3. Chamfer edges of plastic laminate to avoid chipping.

3.2 DOOR HARDWARE INSTALLATION

1. Install finishing hardware supplied under Section 08700 – Finishing Hardware on doors.

2. Installation is to be performed by a certified hardware installer.

3. Complete preparation of wood doors for all hardware including mortise type latch sets.

4. At completion of the work, moving parts shall be gone over, made to work easily, smoothly and efficiently. Work carefully cleaned down and left in complete and finished condition satisfactory to Architect.

8. As per Section 08700 – Finishing Hardware, hardware supplier shall check all hardware for proper operation when it has been installed and shall notify the Architect of any cases where it has not been properly installed, is defective, or is not as specified.

3.3 TRIM

1. Work includes miscellaneous trim as required of maple unless indicated otherwise.

2. Trim members shall be of sizes and profiles indicated. Trim members shall be slow-fed work, free from chatter and other machine marks.

3. Install trim after it has been back primed.

4. Members shall be full length and secured with wire nails, set and holes filled.

5. Mitre all joints.

3.4 PLASTIC LAMINATE SILLS

1. Construct window sills using 2 layers of plywood wood preservative treated plate and with plastic laminate on top exposed surface complete with stained and varnished hardwood nosing.

2. All wood to have wood preservative installed on all sides.

3.5 WASHROOM ACCESSORIES

1. Install all washroom accessories as supplied in Section 10800 – Washroom Accessories.

3.6 HOLLOW METAL DOOR AND FINISH DOOR HARDWARE FOR HOLLOW METAL DOORS INSTALLATION

1. Install/hang all hollow metal doors. Install as specified in Section 08110 – Hollow Metal Doors, Frames and Screens.

2. Install all finish door hardware.

3.7 PLASTIC LAMINATE WALL PANELS IN LOBBY AND CORRIDORS

1. Where indicated on the drawings provide plastic laminate faced wall panels complete with plastic laminate installed on all exposed edges.
Substrate to be 19mm high density particle board with a flame spread rating not more than 150. Install on walls using French clip system for concealed fastening. Provide shop drawings indicating joint locations. Wall panels to be finished in colour noted on Interior Finishes schedule. Colours to be confirmed by architect prior to ordering material.

3.8 DRY ERASE MARKER BOARD PLASTIC LAMINATE PANELS

1. Where indicated on the drawings (Collaboration Rooms) provide white dry erase marker board laminate.

    1. Dry-Erase Markerboard, high gloss melamine impregnated decorative surface papers are combined with phenolic treated kraft paper with the sheet back sanded to maintain a uniform thickness and facilitate bonding.

    2. Laminate Limitations: Do not use in areas exposed to temperatures exceeding 135 degrees F.

    3. Finished panel width should not exceed 24-inches maximum for Grade 20/VGP when using contact adhesive.

    4. Laminate Substrate: 45# density, industrial grade particleboard (CS 236-66; Type 1, Grade B, Class 2) or Medium Density Fiberboard (MDF).
    5. Plywood substrate not acceptable.

2. Laminate Grade:

    1. Grade 12 HGP, 0.035 Inches (0.9 mm)

    2. Laminate Finish: -90 Gloss.

    3. Edge Banding:

        1. Laminate Grade

            1. PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

    4. Backing sheets:

        1. Provide where recommended by manufacturer to minimize lamination warpage.
    5. Adhesives:

        1. Bonding Laminate: Provide type recommended by manufacturer.

        2. Bonding Edge Molding: Provide type recommended by manufacturer.

3.9 FABRICATION

1. Conform to Formica Corporation standard practices, procedures, conditions including preconditioning, panel balancing, material recommendations, machining, equipment and workmanship.

2. Formica Brand Laminate with low sheen surfaces are subject to marring. Fabricating with peel coat on surface (if applicable) is recommended. Router base should be clean and free of burrs and debris. Table saws should be clean, flat, and free of burrs.

3. Do not adhere laminates directly to plaster, gypsum board or concrete Construction.

3.10 INSTALLATION

1. Deliver Finish Carpentry Items to the site. Provide units of such sizes as will not present difficulty of entry to the place of installation. Where units are shipped in knock-down form provide clear instructions for assembly.

2. Install Finish Carpentry items in accordance with manufacturer's written instructions, plumb, square, true, rigid and secure with concealed fastening at exposed areas and with stainless steel screws and cup washers where secured inside of millwork units.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section, and shall apply as if repeated here.

1.2 REFERENCE STANDARDS

1. Standard of finished carpentry, metalwork and cabinet work in accordance with the "Millwork Standards" of the Consultantural Woodwork Manufacturers Association of Canada (AWMAC).

1.3 QUALIFICATIONS

1. The work of this trade shall be executed by a company having a minimum of 5 years proven first class experience in this type of work and having adequate equipment and skilled personnel. Contractor to be from pre-approved list.

1.4 WORK INCLUDED

1. Provide prefinished cabinets, display cases, shelving units, counters, vanities, and similar items where shown on drawings and as specified herein, and as needed for a complete and proper installation.

2. Provision of rough hardware, including fastening devices required to secure in place items of carpentry and millwork.

3. Supply and installation of finishing hardware for millwork by this millwork contractor Section 06400 – Consultantural Woodwork.

4. Supply and installation of grilles, etc. on millwork items.

5. Installation of all miscellaneous metals for millwork items by Section 05500 Miscellaneous Metals.

6. Supply and installation miscellaneous trims, scribers, filler panels.

7. Provide cutouts in the counter tops for the sinks, electrical outlets, and all other necessary cutouts regarding the millwork.

1.5 SHOP DRAWINGS

1. Submit Shop Drawings in accordance with Section 01300 – Submittals.

2. Before shop drawings and fabrication is started, take critical measurements at the site to facilitate installation, fitting of work and

access required to move millwork into final location. Take such measurements prior to fabrication of the Work of this Section and in ample time to avoid delays in the work.

3. Draw Shop Drawings in related and/or dimensional positions with sections. Scale minimum 1:10. Shop drawing detail numbering to be same as Consultantural Drawing detail numbering.

4. Shop Drawings shall show fabrication details, materials, jointing, description of anchorage and hardware.

1.6 DELIVERY AND STORAGE

1. Give Painter sufficient notice so that untreated or unprimed carpentry items or materials can be primed immediately upon delivery to site.

2. No equipment shall be delivered to the site until portion of the building in which it is to be installed is completely ready for equipment as approved by Consultant.

3. Store finished work properly and keep under cover both in transit and at site. Finish woodwork shall not be delivered to site until concrete and masonry work has dried out.

4. Cover all plastic laminate and prefinished top surfaces at shop with heavy Kraft Paper.

5. Carefully protect from damage of any kind.

1.7 SHOP FINISH

1. All cabinet work, to be shop finished by this Section as per Section 09900 – Painting and Finishing.

1.8 SAMPLES

1. Submit duplicate 12"x12" (300 mm x 300 mm) samples of each type of paneling (plastic laminate, melamine c/w edging) and each type of solid wood or plywood to receive stain or natural finish.

2. Submit duplicate 12" (300 mm) long samples of each type of moulding.

3. Submit samples of construction methods and of all hardware.

1.9 INTENT

1. The intent of this Section is that the majority of the casework is to be constructed of melamine composite panels as detailed on the drawings. Allow for two different finishes. Finish for all classroom millwork to be Hardrock Maple. Finish in other areas to be as indicated on drawings Tafisa, Finish Colour "Mojave" L546. Some items require maple hardwood veneer plywood construction as detailed on the drawings. The finish to match the finish of the melamine millwork in the same room. All casework shall be manufactured in transportable sections and finished at the plant, delivered to the Site and immediately installed by this Section including provision of necessary strapping, backings, bearers, rough hardware and finish hardware and miscellaneous support metals and stainless-steel metal components. Touch up finish immediately prior to completion of the Work and leave in perfect condition.

1.10 CO-OPERATION

1. Water, drainage and air piping, faucets, traps, ventilation ducts, sinks, electric receptacles and wiring are supplied and installed by the Mechanical and Electrical Sections at all rooms. Co-ordinate the work with these trades and make provision in the construction of the fitments to accommodate this work. Methods of construction shall be such as to permit mechanical and electrical work being concealed in the fitments, cut and frame, accordingly, provide removal access panels in the units or provide proper access for installation and repairs.

2. Cabinet hardware, pilaster strips, locks, finishing hardware and miscellaneous metals will be supplied by this Section.

3. Woodwork, not shop primed, will be primed and back painted as per painting section immediately upon delivery to the site. Care shall be taken that all surfaces cut after priming are brush coated with an approved primer before installation. This section to ensure that woodwork and trim which are to be installed directly against masonry are back painted with one coat of priming paint before installation.

4. Work of this Section shall be coordinated with work of other sections where such work is adjacent to or dependent on the placement of the Work of this Section. Review all drawings for all such related work and coordinate scheduling, sizes, mounting location, required cutouts, clearances, etc. required for proper installation of all related work. Modification of the Work of this Section due to lack of coordination will be done at no extra cost to the Owner.

1.11 MAINTENANCE

1. Provide Owner with printed instructions for "Care and Maintenance of Plastic Laminate" and millwork finishes.

1.12 WARRANTY

1. Warranty workmanship against manufacturing defects, including warpage or delamination, for a period of five (5) years from date of acceptance of the completed installation. Make good or replace work showing defects in this period, as requested, at no expense to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

1. Finishing Work: Materials used for finishing work shall be sound, free from defects that would mar finished appearance, seasoned and air dried and of good quality for intended purposes. Wood laminates pressure bonded.

2. **WD1&2** - Hardwood Veneer Plywood:

    1. Select Quarter Maple consultantural Grade 'A' No. 1 Face grade (varnish grade) as in compliance with C.S.A. 0115-M1982 with a minimum 5 ply plywood veneer waterproof core, stained & varnished. Plywood shall be good both sides except where concealed by construction. Exposed faces to be natural grade per AWMAC. Interior of doors to be classified as exposed. Refer to millwork finish schedule for material colour and location.

3. Plywood:

    1. Select Plain Sliced Maple consultantural Grade 'A' No. 1 Face grade (varnish grade) as in compliance with C.S.A. 0115-M1982 with a minimum 5 ply plywood veneer waterproof core, laminated with waterproof adhesive. Plywood shall be good both sides except where concealed by construction. Exposed faces to be natural grade per AWMAC. Interior of doors to be classified as exposed.

2. Hardwood: shall be selected Clear Maple, all shall be Consultantural Grade (knots will not be accepted). It shall be selected for colours and graining when used for stain work.

3. Wood Edging: 1/8" (3 mm) hardwood to match plywood unless indicated otherwise (if maple, use hard maple).

4. **MEL1&2** - Melamine Faced Particle Board: to CAN3-0.188.1-M78, grade "R" particle board sanded faces, 13 mm, 16 mm, 19 mm, 28.6 mm and 32 mm thickness, faced with laminated plastic. Melamine resin impregnated cover sheet with coloured and/or patterned paper inner layer. Melamine shall be thermally fused to rigid particle board substrate. Melamine faces shall be 130 Gram Weight Paper. Maximum three

colours/patterns to be chosen by Consultant from manufacturer's full range. The finish of the millwork in all classroom areas will be Hard Rock Maple per the Board's standards. Refer to finish schedule and millwork drawings for melamine colour selections and locations.

5. Melamine Faced Particle Board Edge Banding: Solid polyvinylchloride (PVC), 3 mm thickness x full width of board. PVC to be wood grain type to match melamine face by Canada Wood tape or approved colour equal. Edging rigid PVC with a measured degree of hardness of " 95 shore D" and thickness of "3mm (+0.15mm, -0.2mm)" with the primer side having a concave measuring 0.10 to 0.25mm. All edges and all corners of this 3mm PVC edge banding are to be machined to a 3mm radius for all cabinet parts

   Edging adhesive: ethylene vinyl acetate thermal set adhesive with a temperature resistance of not less than 100 degrees C; A Processing range of 190 degrees - 200 degrees C and natural in colour.

   Edging is to be applied using only equipment designed for the application of thick PVC in strict accordance with the specifications of both the thick PVC and hot-melt adhesive manufactures.

   Care should be taken during application to achieve the thinnest glue line consistent with a good bond without causing skips or unspread areas. Colour to be "Hardrock Maple" unless otherwise noted.

6. Plywood Concealed by Construction: Douglas Fir plywood shall be veneer core, waterproof, bonded, sanded, complying with C.S.A. 0121-M1978. Solid grade where concealed by construction.

7. Concealed Framing Lumber: N.L.G.A.C. select eastern white pine, kiln dried to a 5% moisture content.

8. Unexposed Plywood for Framing: Waterproof fir plywood minimum 1/2" (12.7 mm) thickness unless indicated otherwise.

9. Adhesive:

   1. Waterproof synthetic resinous glue of approved general type conforming to C.S.A. 0112.

   2. For plastic laminate - as recommended by plastic laminate manufacturer and to conform to C.S.A. 0120-M1978.

   3. Approved waterproof type.

10. Plastic Laminate:

    1. Laminated Plastic for Flatwork: .062" (1.6 mm) thick decorative

surfaced, high pressure laminated plastic sheeting to conform to CAN3-A172-M1979 Grade G.P., Type 1. Manufacturer shall thoroughly sand back of sheet to form a homogeneous bonding surface. Plastic laminates shall be as manufactured by Arborite, Formica, Wilsonart or Nevamar. Backing sheet .020" (.5 mm) thick, sanded one side. Products may be selected based upon manufacturer's full standard range of colours, patterns and textures. Allow for 8 different colours, Consultant to confirm final selection.

1. **PLAM 1** – Formica, colour to be Ashwood Oak, 5768.
2. **PLAM 2** – Formica, colour to be Beige Elm, 05794.
3. **PLAM 3** – Formica, colour to be Stormy Night Granite, 009537.
4. **MEL 1** – Formica, colour to be Aged Ash, 08844.

2. Laminated plastic for postforming work and performing work: to CAN3-A172-M79 Grade P.F., Type 3, .050" (1.25 mm) thick, based on standard colors with suede finishes as selected by consultant. Plastic laminates shall be as noted in 1.

11. Nails and Staples: To C.S.A. Bill-1974. Use spiral threaded nails and barbed staples.

12. Woodwork Finish: Refer to Section 09900 – Painting and Finishing.

13. Shelves: adjustable shelves longer than 950 mm and fixed shelves without center supports longer than 950 mm to be 28.6 mm thick wood veneer plywood detailed. Shelves shorter than lengths specified above are to be 19 mm thick melamine composite panels. Front and rear edges of adjustable shelves to have solid wood edges if plywood construction. Front edges of fixed shelves to have solid wood edges, rear edge to be secured to cabinet back panel.

14. Miscellaneous Metals: Miscellaneous angles, tubes, brackets, supports, etc. as noted/ detailed on drawings or as required for complete and proper installation. provided by Section 05500 – Miscellaneous Metals.

15. Egg Crate: 12mm x 12mm x 12mm deep chrome finished plastic egg grate louvre in display cabinet, complete with chrome finished support angle trim equal to standard Acoustic Ceiling corner angle.

16. Glazing: Doors shall be Oldcastle Glass Entrance System and shelves 6mm tempered clear glazing, complete with CRL Vienng 045 Series Chrome 135° Glass to Glass hinge swinging doors complete with locks. Glass to conform to Glass and Glazing Section 08800.

17. Display Glazing: Glass to conform to Glass and Glazing Section 08800.

18. Aluminum Angles: 50 mm x 50 mm x 3 mm aluminum angles for vertical corners at mobile storage units where indicated on drawings.

19. Exposed Fasteners: All millwork units secured to walls shall be secured with stainless steel screws and cup washers. All specialty fasteners such as acorn head bolts shall be supplied and installed by this section. Submit samples for Consultant's approval. All exposed fasteners to be stainless steel.

20. Aluminum Grilles: Brush finished aluminum size as indicated on drawings.

21. Toe Kicks: All toe kicks to be 3/4" (19mm) veneer core waterproof fir or spruce plywood

2.2 HARDWARE

1. The cabinet work manufacturer shall furnish and install cabinet hardware. Finish of hardware shall be used US26D or US28 depending on base material. Hardware shall be manufactured as follows or approved equal:

    1. Hinges: Cupboard doors 3/4" (19mm) - Hettich - Selekta Pro 2000 - 270E Degrees opening.

    2. Cabinet locks:

        1. Cupboard doors: 3/4" (19mm) - Hafele Lock two-way latch.

        2. Cupboard drawers: 3/4" (19mm) - Hafele Lock.

        3. All cupboard doors in a room to be keyed the same. Each room to be keyed different. Provide 6 master keys for cupboard locks.

    3. Pulls (door/drawers): Richelieu, Product # BP267896195, 96mm Center to Center, Brushed Nickel Finish or approved equal.

    4. Drawer Slides: Hettich full extension ball bearing slide KA 5632

    5. Display Case hanging shelves & cables:

        1. CR Laurence Floor to Ceiling Cable Kit for 10mm tempered glass shelves, length to suit glass shelf width & height as shown on details (approx.720mm x 1620mm); item #Y0001CR. Stainless steel aircraft cable and nickel-plated components including tensioner, adapter, cable holders

and cover disks, hanger bolts, threaded studs and shelf connectors to provide a complete system.

6. Display Case Door Hardware:

    1. CRL-Blumcraft Satin Anodized 1301 Series Display Case Door – 3/8" (10mm) Tempered Glass swinging doors complete with keyed alike locks. Glass to conform to Glass and Glazing Section 08800.

7. Computer Grommets: Standard recessed 3" (75mm) diameter. Colour as selected by Consultant.

8. Slide Bolts: Gallery 73 - 3" (75 mm).

9. Shelf Standards: Knape & Vogt #255.

10. Shelf Clips: Knape & Vogt #256 - for pre-drilled 32mm spaced holes in all gables.

11. Shelf Brackets (fixed shelves): 8 x 10 Knape & Vogt or Stanley.

12. Silencer bumpers: mechanically fastened rubber or neoprene bumper (at all cupboard door and drawer fronts).

13. Coat Rods: Heavy duty stainless steel.

14. Coat hooks: Kitchener Forging 209 zinc plated model.

15. Teachers Closets/Storage Cabinet Doors hardware:

    1. Keyed cylinder for both doors: provided by Section 08700 - Finish hardware and installed by this Section.

2.3 FABRICATION

1. General

    1. Fitments shall be machined, assembled in mill where possible and delivered to job in units. Construct in accordance with details using first class cabinet construction with joints dowelled, glued and properly fastened.

    2. Check job dimensions and conditions and notify the Consultant in writing of unacceptable conditions. Design construction methods for expansion. Do not proceed until remedial instructions are received.

3. Deliver work to the job ready for installation. Leave ample allowance for fitting and scribing on the job. Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings, Design units to fit together if site assembly is required.

4. Fabricate work square and to the required lines. Recess and conceal fasteners and anchor heads. Fill with matching wood plugs.

5. Comply with glue manufacturer's recommendations for lumber moisture content, glue life, pot life, working life, mixing spreading, assembly time, time under pressure and ambient temperature.

6. The interior of counters, cupboards, shelving units, desks, shall be considered "exposed". Counter tops which are to receive plastic laminate coverings may be 3/4" (19 mm) thick sanded veneer core plywood. Plywood plate wood core shall be used for shelving and gables, countertops and high moisture areas unless specifically called for as solid material. Provide biscuit wafers fully glued at all countertop butt joints c/w two draw bolts Richelieu 516-2G.

7. Refer to Drawings and Consultantural Detail Sheets for location, details, number of units required and location of fittings.

8. Interior fitments shall be complete in every respect with special fittings required and hardware.

9. Provide exposed end grain of solid members and edges of exposed plywood with matching solid hardwood edging at least 1/4" (6.4 mm) thick and thicker where specified. At melamine faced particle board provide 3 mm P.V.C. edging complete with 3 mm radius on all exposed edges and corners. Edging to melamine faced particle board shall be applied with an Edge-Bander using hot melt adhesive.

10. Make all necessary cut-outs in the furniture for sinks, appliances, and electrical switch and outlet boxes and pre-drill all mounting holes for faucets, fittings and outlet boxes. Refer to electrical and mechanical drawings and specifications.

11. Provide and install pipe covers, scribing pieces, top, bottom and/or closures and filler panels where necessary, including wherever units require furring out or blocking to existing conduits, pipes, etc.

12. Service cover panels to be provided at all kneehole drawer units, kneehole front rails and knee drawer table assemblies. End

closing panels to be provided at all exposed ends of service strips and island/peninsula assemblies. Front filler panels to be provided where called for on Drawings and as required by field conditions.

13. Telephone and electrical receptacles and wiring are specified under Electrical Division. Co-ordinate work of this trade, make provision to accommodate this work and cut tops for and provide wood bearers for support.

14. Cooperate with others engaged in work on the building to the end that proper unity of action will assure the orderly progress of the work. Do necessary boxing and protecting of sills, jambs, and the like. Construct scaffold, ramps, and other temporary staging necessary.

15. Provide 3/4" (19 mm) plywood adjustable or fixed shelving where detailed. Maximum unsupported span for shelving shall be 3'-0" (900 mm). Fixed shelves shall be housed into gables and divisions. Where adjustable shelves are set on angle clips on metal pilaster strips occurring on both sides of a divider, they shall be staggered. **NOTE**: All adjustable shelves on metal pilasters shall have pilaster recessed flush with face of the gables. Where shelves are set on clips only, gables shall be drilled 32 mm o.c. for total height of gables. Provide 3 rows of holes and clips for shelves deeper than 400 mm.

16. The plywood used in interior fitments throughout regardless of whether for paint or stain finish, shall have exposed edges edged with solid strips 1/4" (6 mm) wide, unless noted otherwise by full thickness of plywood. No exposed edges of plywood will be permitted. Strips shall be glued and accurately fixed to edges. Adjustable shelves shall have strips applied to front edge.

17. Exposed framing members and trim shall be solid hard maple or birch.

18. Plastic laminate coverings to fitments, cupboards and counters shall be in colours selected by Consultant and applied in accordance with manufacturer's directions. Where plastic laminate occurs, exposed edges and edges around cut-outs such as sinks shall be edged in the same material. Where tops and splash backs are indicated, the laminate backing sheets shall be used on back face of material on which plastic laminate facing sheets are applied to minimize twist. Bond plastic laminate using waterproof glue. Self-edging shall be 1/16" (1.5 mm) material electro pressure sealed and with edges beveled. Joints will not be permitted except in lengths exceeding 8'-0" (2400 mm) in length. Butt joints tightly together. Chamfer edges of plastic laminate to avoid chipping. Apply backing sheet to

plywood. Seal remaining exposed edges of surfaces with heavy Kraft paper prior to shipment. Paper shall not be removed until final cleaning. When cutting holes in plastic laminate work, corners shall be rounded and filed smooth.

19. When cutting holes in plastic laminate work, corners shall be rounded and filed smooth.

20. Protection erected by this trade shall be removed, damage to this work and adjoining work due to the lack or failure of such protection, made good and debris, surplus materials, plant and equipment removed and premises and the whole left clean and tidy to Consultant's satisfaction.

21. Fabricate all plywood and melamine faced particle board backs, gables and bottoms of millwork units together by means of 8 mm x 25 mm hardwood dowels or with hardwood biscuits. All backs to be 5/8" (16 mm) stock. Dowel all panel cabinet components using 5 mm x 25 mm hardwood dowels or biscuits at maximum 4" (100 mm) o.c. All drawer bottoms and backs are 2" stock or greater. All exposed edges to be at least 1/4" (6.4 mm) thick matching hardwood edge banding at Maple units and thicker where specified. At melamine faced particle board (alternate price) provide 3 mm P.V.C. edging complete with 3 mm radius on all exposed edges and corners. Kick material for normal application shall be 3/4" (19 mm) waterproof fir plywood to be used. Resilient base by Section 09650 and quarry tile base by Section 09300.

2. Cupboard Doors

1. Doors at teacher's closets and as noted on drawings shall be 44mm thick solid core wood doors stained to match MEL1.

2. Cabinet doors shall be 3/4" (19 mm) thick europly core veneer plywood. Doors shall be flush, slab type, accurately fitted, free of warp and twist. Care must be taken in sawing and assembling so that there is no splintering of finish face. Splintered doors that mar the appearance will be rejected by the Consultant.

3. Provide two door silencers/bumpers per panel mechanically fastened to the cabinet frames.

3. Drawers

1. Fronts, sides and backs shall be solid. Fronts 3/4" (19 mm) thick, sides and backs ½" (13 mm) thick. Drawer bottoms shall be 1/4" (6 mm) thick plywood, grooved into sides and front and nailed to

underside of drawer backs. Sides shall be fitted to fronts with dovetail joints, grooved to receive backs.

2. Fronts to match cupboard doors finish.

3. Provide all drawers with spring hinged stops to prevent accidental removal.

4. Provide two drawer silencers/bumpers per drawer panel mechanically fastened to the cabinet frame.

4. Counters, Cupboards, Shelving, Reception Desk etc.

1. Frame as detailed:

1. with 3/4" (19 mm) thick, or as noted otherwise, plywood gables, backs, tops and bottoms. House intermediate dividers and plywood backs, into gables and top and bottom shelves, for all fitments. Plywood shall be birch or maple as called for in this Section unless otherwise indicated.

2. Counter tops with sinks to be 3/4" (19 mm) waterproof fir plywood post formed with solid bullnose & coved backsplash and plastic laminate finish as specified herein.

2. Cut countertops for sinks and provide bearers. Provide splashback at back of sink for entire length of the unit and at return ends where walls occur.

3. Countertop and splashback will be plastic laminate unless noted otherwise.

4. Provide removable plywood access panels, screwed in place, where necessary for access to concealed wiring.

5. Fit trim and scribe moulds to fitments as shown and as required to hide voids at walls, partitions and ceilings.

6. Provide cut-outs for inserts, outlets, grilles, appliances, etc. occurring in fitments.

7. Bottom of units blocked up to form a 4" (100 mm) high x 3" (75 mm) deep toe space and fabricated with waterproof plywood tenoned to gables (for melamine units as well).

8. Fit fillers between fitments, of same material as fitments, where necessary to fill voids between fitments and walls.

9. Corners of countertops that do not butt against a wall or fixed object, shall be rounded with 1" (25 mm) radius corners.

10. Lighting fixtures and outlets to be supplied and installed under Electrical Sections. Provide all necessary cutouts, clearances, etc. for work by Electrical Sections.

11. Provide cutouts and access panels where required for Mechanical Sections and covers over ductwork (stove exhaust fans) or piping that run exposed above counters and upper shelves. Coordinate with Mechanical Sections for locations and quantities.

12. Provide extended top, bottom, and exposed gables where furring out of upper cupboards is required due to pipes, conduits, and the like behind to provide a flush face at walls.

13. Side splash at counter tops required only when the distance between the side of a sink and the adjacent vertical surface is less than 400mm.

14. Plastic Laminate Work:

    1. Comply with CAN3-A172-M79, Appendix "A".

    2. Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Provide cores of not less than 3/4" (19 mm) nominal thickness solid face Douglas Fir.

    3. Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.

    4. Use straight self-edging laminate strip .062" (1.6 mm) thick for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 deg. Do not mitre laminate edges. Curved self-edging shall be postformed material or bending grade.

    5. Apply laminate backing sheet to reverse side of core of plastic laminate work. Provide backing sheet of sufficient thickness to compensate for stresses caused by the facing sheet.

    6. Locate joints where indicated, where not indicated at approximately 8'-0" (2440 mm) or 12'-0" (3660 mm) centres

also include joints at corners, and changes in superficial area.

7. Accurately fit decorative laminate together to provide tight, flush, butt joints. Joints in cored panels shall be made with 3" (6 mm) blind splines and draw bolts, one draw bolt for widths up to 6" (150 mm), two or more draw bolts at maximum 18" (450 mm) o.c. for widths exceeding 6" (150 mm).

8. Keep joints min. 2'-0" (300 mm) from sink cutouts.

9. Seal the core at joints and exposed edges with sealer.

PART 3 EXECUTION

3.1 PREPARATION AND PROTECTION

1. Protect work of other trades from damage.

2. Make good any resulting damage, to the satisfaction of the Consultant, at no additional cost to the owner.

3.2 WORKMANSHIP

1. Fabricate and install work in accordance with the best practice. Finished work shall be free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding. Give finished work smooth surfaces, ready for painting or varnish application.

2. Mortise and tenon joints shall be glued and pinned. All panels shall be secured together with specified glued and dowelled method. Glue blind screw all fabricated component work unless otherwise specified. Set surface nails and plug countersunk screws with matching wood plugs. Use screws with cap washers where units with doors are secured to walls behind.

3. Finished woodwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects.

4. All metal items such as grilles, tracks, supports, legs, brackets, etc. supplied by other trades shall be built into fitments, paneling, wood doors, etc., in strict accordance with directions of trades supplying such.

5. Furnish rough hardware, nails, expansion shields, screws, brackets and incidentals required to assemble and install the fitments in their proper locations.

6. Fit small scribe moulds or fillers of same materials as fitment to hide or fill voids at walls, partitions ceilings, furrings, exposed tops of millwork units, at base locations where rubber base occurs.

7. Support for Hanging Cabinets and Shelves: All cabinets and shelves shall be supported 1" x 3" (65 mm) hardwood bearers and prevented from tipping with steel angles fastened to top of cabinet or shelf, spaced 36" (900 mm) O.C. and lagged into wall surface. 1' (19 mm) x 2" (44 mm) hardwood rails shall be at top and bottom of cabinet or shelf unit, secured into gables of units and fastened to supporting wall with expansion shields and lag screws. Where bulkheads occur over cabinets, upper framing shall be secured to the ceiling.

3.3 MILLWORK WORKMANSHIP

1. Fitments shall have joints dowelled and all joints shall be glued and nailed or screwed. All cabinet bases shall be of 3/4" plywood, blocked 3'-0" O.C. maximum and at corners.

2. All plywood used in millwork shall be maple and birch faced graded for stain finish. Counter tops shall have splash backs where sinks occur.

3. Shelving shall be 3/4" (19 mm) plywood, adjustable or fixed as detailed. Maximum unsupported span for shelving shall be 3'-0" (900 mm). Adjustable shelves shall be set on angle clips on metal pilaster strips. Loose shelves shall have hardwood edges on all edges.

4. Laminates shall be pressure bonded to back-up board. Counter tops shall be self-edged and have plastic laminate covered back splash. Back-up material for counter tops shall be waterproof plywood core.

5. Plastic laminate surface shall be level, without bubbles and core ghosting. Core edges in counter cut outs shall be sealed with asphalt compound. All exposed plastic edges shall be matched and sanded.

3.4 INSTALLATION

1. Installation and assembly work on the job shall be executed by skilled forces under supervision of a competent joinery foreman.

2. Furnish rough hardware, nails, expansion shields, screws, brackets and incidentals required to assemble and install fitments in proper locations. Units shall be adequately fastened and secured in place with concealed fixings wherever possible. Include grounds and furring where required.

3. Fitments shall be installed level, plumb and true and complete in all respects.

4. Provide smooth surfaces with fastenings sunk and filled over to receive stain and sealer.

5. Use draw bolts in countertop joints. Two per joint to be Richelieu 516-2G.

6. At junction of plastic laminate counter, back splash and adjacent wall finish, apply small bead of silicone sealant as per Section 07900 in colour as selected by Consultant.

7. Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

8. Commencement of installation implies acceptance of adjacent site conditions and coordination of related work of other sections.

3.5 HARDWARE INSTALLATION

1. Locate hinges in accordance with manufacturer of hinge and with best standard practice. Set knobs, locks, and cylinders square with doors and escutcheons plumb. Apply accurately and neatly, to operate quietly and smoothly. Knobs shall turn easily; bolts slide freely and smoothly.

2. All cupboard doors and drawer locks except as noted below, shall be keyed alike in each room unless otherwise stated. All such keys shall be labeled as to their lock location and shall be turned over to the Owner. All locks, slide bolts, etc. shall be supplied with the appropriate strikes and screws. Provide slide bolts at all locked pair of doors on interior side of door leaf without lock.
NOTE: No locks on doors below sink units.

3. All pilaster strips, where specified, shall be recess mounted and installed with the numbers on the pilaster at equal heights.

4. All drawers shall be fitted with side mounted ball bearing drawer slides and spring hinged stops to prevent accidental removal.
5. At completion of the work, moving parts shall be gone over, made to work easily, smoothly and efficiently. Work carefully cleaned down and left in complete and finished condition satisfactory to Consultant.

3.6 FLOORING BASE

1. Supply and installation of Resilient Base at millwork units as indicated is by Section 09650 for rubber base locations and Section 09300 for porcelain tile locations.

2. Provide hardwood base to match millwork where rooms are finished with wood base

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

1. This Section includes horizontal and trim solid surface in the following locations:

   Reception desk in Admin office, seating booths in Lobby and elsewhere where called for on the drawings
   Refer to the A7 Interior elevation drawings and I-#04 millwork Interior Design drawings for reference.

1.3 DEFINITION

1. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 SUBMITTALS

1. Product data:

   1. For each type of product indicated.

   2. Product data for the following:

      1. Chemical-resistant tops

2. Shop drawings:

   1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.

      1. Show full-size details, edge details, thermoforming requirements, attachments, etc.

      2. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

      3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

3. Samples:

   1. For each type of product indicated.

1. Submit minimum 6-inch by 6-inch sample in specified gloss.

2. Cut sample and seam together for representation of inconspicuous seam.

3. Indicate full range of color and pattern variation.

2. Approved samples will be retained as a standard for work.

4. Product data:

1. Indicate product description, fabrication information and compliance with specified performance requirements.

5. Product certificates:

1. For each type of product, signed by product manufacturer.

6. Fabricator/installer qualifications:

1. Provide copy of certification number.

7. Manufacturer certificates:

1. Signed by manufacturers certifying that they comply with requirements.

1.5 QUALITY ASSURANCE

1. Qualifications:

1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

2. Fabricator / Installer Qualifications:

1. Work of this Section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

3. Applicable standards:

1. Standards of the following, as referenced herein:

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. National Electrical Manufacturers Association (NEMA)
4. NSF International

2. Fire test response characteristics:

1. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:

    1. Flame Spread Index: 25 or less.
    2. Smoke Developed Index: 450 or less.

4. Coordination drawings:

    1. Shall be prepared indicating:

        1. Plumbing work.
        2. Electrical work.
        3. Miscellaneous steel for the general work.
        4. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.

    2. Content:

        1. Project-specific information, drawn accurately to scale.

        2. Do not base coordination drawings on reproductions of the contract documents or standard printed data.

        3. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.

        4. Provide alternate sketches to designer for resolution of such conflicts.

            1. Minor dimension changes and difficult installations will not be considered changes to the contract.

5. Drawings shall:

    1. Be produced in 1/2-inch scale for all fabricated items.

6. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.

    1. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.

7. Job mock-up:

1. Prior to fabrication of architectural millwork, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution.

2. Build mock-up to comply with the contract documents and install in a location as directed by the Design-Builder

3. Notify the architect two weeks in advance of the date of when the mock-up will be delivered.

4. Should mock-up not be approved, re-fabricate and reinstall until approval is secured.

    1. Remove rejected units from project site.

5. After approval, the mock-up may become a part of the project.

6. This mock-up, once approved, shall serve as a standard for judging quality of all completed units of work.

8. Pre-installation conference:

    1. Conduct conference at project site.

1.6 DELIVERY, STORAGE AND HANDLING

1. Deliver no components to project site until areas are ready for installation.
2. Store components indoors prior to installation.

3. Handle materials to prevent damage to finished surfaces.

    1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.8 WARRANTY

1. Provide manufacturer's warranty against defects in materials.

    1. Warranty shall provide material and labor to repair or replace defective materials.

    2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

2. Warranty period:

    1. Two years from date of substantial completion.

1.9 MAINTENANCE

1. Provide maintenance requirements as specified by the manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers:

1. Subject to compliance with requirements, provide products by one of the following:

1. **SS1** – Solid Surface: Corian, Designer White. Confirm colour selections with Architect prior to ordering.

2. **SS2 –** Solid Surface: Corian Dove. Confirm colour selections with Architect prior to ordering.

2. Alternate: Wilsonart or as found acceptable by architect.

2.2 MATERIALS

1. Solid polymer components:

1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.

2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

2. Thickness:

1. 1/2 inch

3. Performance characteristics:

Property	**Typical Result**	**Test**
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10^{-6} psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10^{-6} psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale ASTM D 785
	56	Barcol Impressor ASTM D 2583
Thermal Expansion	3.02 x 10^{-5} in./in./°C (1.80 x 10-5 in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000
Wear and Cleanability	Passes	Method 3.3 ANSI Z124.3 & Z124.6

Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
IZOD Impact Strength (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact	No fracture 1⁄2 lb. ball:	NEMA LD 3-2000
Resistance: Sheets	1⁄4" slab—36" drop 1⁄2" slab—144" drop	Method 3.8
Weatherability	ΔE^*_{94}<5 in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	
Water Absorption	Long-term 0.4% (3⁄4") 0.6% (1⁄2") 0.8% (1⁄4")	ASTM D 570
Toxicity	99 (solid colors)	Pittsburgh Protocol
	66 (patterned colors)	"LC50"Test
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	

† Approximate weight per square foot: 1⁄4" (6 mm) 2.2 lbs., 1⁄2" (12.3 mm) 4.4 lbs.
Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.
NEMA results based on the NEMA LD 3-2000

2.3 ACCESSORIES:

1. Joint adhesive:

    1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

2. Sealant:

    1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

2.4 FACTORY FABRICATION

1. Shop assembly

    1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.

2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.

    a. Reinforce with strip of solid polymer material, 2" wide.

3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.

4. Rout and finish component edges with clean, sharp returns.

    1. Rout cutouts, radii and contours to template.
    2. Smooth edges.
    3. Repair or reject defective and inaccurate work.

2.5 FINISHES

1. Color to be selected from the manufacturer's standard color chart.

2. Finish:

    1. Provide surfaces with a uniform finish.

PART3 EXECUTION

3.1 EXAMINATION

1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

    1. Provide product in the largest pieces available.

    2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.

        1. Exposed joints/seams shall not be allowed.

    3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.

    4. Cut and finish component edges with clean, sharp returns.

5. Rout radii and contours to template.

6. Anchor securely to base cabinets or other supports.

7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.

8. Carefully dress joints smooth, remove surface scratches and clean entire surface.

9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

2. Coved backsplashes and applied side splashes:

1. Install applied side splashes using manufacturer's standard color-matched silicone sealant.

2. Adhere applied side splashes to countertops using manufacturer's standard color-matched silicone sealant.

3.3 REPAIR

1. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.4 CLEANING AND PROTECTION

1. Keep components clean during installation.

2. Remove adhesives, sealants and other stains.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 SITE CONDITIONS

1. Surfaces to receive waterproofing and surrounding air shall be at least 40 deg. F. (5 deg. C.) for a minimum period of 48 hours during waterproofing operations. Do not apply to frozen materials.

1.3 WARRANTY

1. The work under this Section shall have a warranty in accordance with GC 12.3 of CCDC Document 2 (2008) but for a period of two years from the date of Architect's Certificate of Substantial Completion.

1.4 DESCRIPTION OF WORK

1. Supply and install horizontal waterproofing at Mechanical Room entire floor area and up walls to height of curb (min. 200mm).

1.6 DELIVERY AND STORAGE

1. Deliver materials to the site undamaged in original sealed containers and packaged with labels and seals intact. Cover materials if left outside.

3. Store solvent based liquids away from excessive heat and open flame. Post "NO SMOKING" signs in storage area.

4. Store all materials in a dry, warm, protected area. Temperatures to be above 40°F (5°C) and not to exceed 90F (32C).°

5. Store membrane cartons on pallets.

6. Keep away from sparks and flames.

7. Completely cover when stored outside. Protect from rain.

8. Protect materials during handling and application to prevent damage or contamination.

1.7 QUALIFICATIONS

1. Waterproofing to be applied by mechanics with a minimum 5 years experience in installation of work of this Section and in accordance with manufacturer's instructions.

1.8 SUBMITTALS

1. Submit manufacturer's product data and application instructions in accordance with Section 01300 – Submittals.

1.9 ENVIRONMENTAL REQUIREMENTS

1. Product not intended for uses subject to abuse or permanent exposure to the elements.

2. Protect rolls from direct sunlight until ready for use.

3. Do not apply membrane when air or surface temperatures are below 40°F (4°C).

4. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.1 SHEET APPLIED MEMBRANE SYSTEM (adhesive applied sheets)

1. Vertical and Horizontal Waterproofing Membrane:

    1. Sealtight MEL-ROL "Protected Waterproofing Membrane" 60 mils (1.524mm) thickness by W. R. Meadows.

2. Primer:

    1. Temperatures Above 40°F (4°C): Mel-Prime Water Base Primer

    2. Temperatures Above 20°F (-7°C): Mel-Prime VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

3. Flashing and Fillets: Mel-Rol Liquid Membrane.

4. Pointing Mastic: Pointing Mastic.

5. Corner Tape: Detail Strip.

6. Termination Bar: Sealtight Termination Bar.

7. Horizontal Waterproofing Protection Course: Vibraflex Waterproofing Protection Board by W. R. Meadows where the waterproofing is not protected by below grade rigid insulation or rolled applied membrane system.

8. Approved Alternative Manufacturer: W. R. Grace, Bituthene 3000 system.

2.2 ROLL APPLIED FOUNDATION DRAINAGE SYSTEM (Bubble board roll, mechanically fastened)

1. Tile:

    1. 4" Perforated PVC pipe. Provide required elbows, connections and end caps.

2. 4" Solid Non-Perforated PVC Pipe

2. Aggregate:

   1. Clear washed 3/4" diameter crushed stone.

   3. Bedding Sand (as required).

3. Mel-Drain foundation drainage - Type 5035 Rolled Matrix Drainage System: Pre-fabricated composite soil sheet drain system by W.R. Meadows of Canada, Milton, Ontario; 1-905-878-4122.

4. Pre-fabricated Termination Bar by W.R. Meadows of Canada, Milton, Ontario; 1-905-878-4122.

5. Filter Cloth (Fabric around weeping tile): Geofab Soil Stabilization-Type 1127 by Mercantile Development, Inc., Westport, CT, or "Terrafix 270R" geotextile membrane by Terrafix filter fabrics, Rexdale, Ontario, or "Trevira Spunbound" by Spunbound Business Group, Spatanburg, SC; 1-800-8457597-thickness to match above or equal by W. R. Meadows of Canada.

PART 3 EXECUTION

3.1 PROTECTION

1. Provide and install tarpaulins and coverings for the protection of adjacent wall finishes and surfaces where materials are being hoisted or being used.

2. Provide suitable platforms, wheeling stages, and/or similar protection against damage to the membrane by moving material or equipment.

3. Backfilling should be done immediately using care and caution to avoid damaging the waterproofing application.

3.2 WORKMANSHIP

1. This contractor shall, at all times, maintain their workmanship at the highest quality in accordance with the best standard practices for this class of work. Only competent mechanics skilled in the various trades specified shall be used and all work shall be executed in accordance with the drawings, specifications and manufacturer's recommendations, to produce a waterproof system.

3.3 EXAMINATION

1. Before commencing work, examine all areas and report in writing to the Architect and General Contractor, any conditions which will adversely affect successful waterproofing. Do not begin work until these conditions have been corrected.

2. Commencement of work shall imply acceptance of prepared surfaces.

3.4 APPLICATION OF WATERPROOFING

1. Preparation:

1. Protect adjacent surfaces not designated to receive waterproofing.

2. All concrete surfaces will have been cured for a minimum of 14 days prior to application. Clean all surfaces of laitance, frost, dirt, oil, grease, curing compounds and other foreign matter detrimental to adhesion of the waterproofing membrane.

3. Voids, cracks, holes, or other damaged surfaces shall be treated in accordance with the manufacturer's directions, including priming, coating and/or fabric reinforcing as required.

4. Do not apply waterproofing to surfaces unacceptable to manufacturer.

5. Concrete surfaces must be clean, smooth and free of standing water.

3.5 VERTICAL AND HORIZONTAL MEMBRANE WATERPROOFING INSTALLATION

1. Prior to application, prime all surfaces to be covered in one working day with applicable MEL-PRIME Primer. Uncovered, primed surfaces must be reprimed the next day.

2. All inside and outside corners must be smooth, free of voids with sharp edges removed. Form fillet of MEL-ROL Liquid Membrane on all inside corners or place a MEL-ROL detail strip on inside and outside corners and run the material 6" (150 mm) on each side of the corner. Place MEL-ROL over top of the detail strip to the corner and butt edges where the terminations meet.

3. Horizontal Applications: apply MEL-ROL Membrane horizontally in lengths approximately 8' (2.4 m) long from top of curb down and over floor slab.

4. Install membrane from low to high points so laps shed water. Overlap all seams at least 2 ½" (63.5 mm). To top of all vertical surfaces of membrane install MEL-ROL Liquid Membrane at least ⅛" (3.2 mm) thick and 1" (25 mm) wide. Masonry walls must be parge coated with an asphaltic foundation coating material. Install a double thickness of MEL-ROL membrane over construction, control and expansion joints and cracks greater than 1/16" (1.6mm) wide.

5. Vertical Wall Applications: Masonry walls must be parged-coated with a cementitious material before priming and applying MEL-ROL. Apply vertically in lengths of approximately 2.4m (8') long over the top of the horizontal Detail Strips at the footing. Overlap all seams at least 63.5mm (2.5"). Tightly butt edges of membrane and apply POINTING MASTIC in corner applications.

6. Once positioned the MEL-ROL Membrane should immediately be firmly hand-rubbed into the surface, followed by a pressure-applied roll pressing of the complete surface to assure positive adhesion.

7. All protrusions should be sealed with 2 layers of MEL-ROL Membrane applied at least 6" (150 mm) in all directions. Seal all terminations with MELROL Mastic. Around drains apply 2 layers of MEL-ROL Membrane and put a bead of MEL-ROL Mastic between the membrane and put a bead of MEL-ROL Mastic between the

membrane and clamping rings and at all terminations. If desired, protrusions may be sealed with MEL-ROL Liquid Membrane applied to a 60 mil thickness and overlapped at least 2 ½" (63.5 mm) with MEL-ROL Membrane.

8. Inspect and repair immediately before covering. Tears and inadequate overlays should be covered with MEL-ROL Membrane slit fishmouths and patch. Seal patch edges with MEL-ROL Pointing Mastic.

9. Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

10. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

3.6 PROTECTION

1. Protect membrane at all horizontal applications with immediate application of Vibraflex waterproofing protection board and at vertical surfaces, if no drainage system is used, or rolled matrix drainage system. Use pointing mastic as an adhesive.

2. Backfill or install concrete topping immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is part of this Section and shall apply as if repeated here.

1.2 SITE CONDITIONS

1. Surfaces to receive waterproofing and surrounding air shall be at least 40 deg. f. (5 deg. c.) for a minimum period of 48 hours during waterproofing operations.

1.3 WARRANTY

1. The work under this section shall have a warranty in accordance with GC 12.3 of CCDC Document 2 - 2008 but for a period of two years from the date of Architect's Certificate of Substantial Completion.

1.4 QUALIFICATIONS

1. Chemical waterproofing to be applied by mechanics with a minimum of five years' experience in installation of work of this Section and in accordance with manufacturer's instructions.

1.5 QUALITY ASSURANCE

1. Subcontractor to make an allowance for Chemical Waterproofing manufacturer to carry out full inspection during the application of products. Allowance for one inspection preferably first day of waterproofing application, followed by two other inspections during application. Manufacturer to submit written reports of inspections to the Architect.

1.6 SCOPE OF WORK

1. The work of this Section includes provision of chemical waterproofing to elevator pit. Note that this elevator with deep pit is a separate price option that not included in the base bid amount.

PART 2 PRODUCTS

2.1 MANUFACTURER

1. Basis of Design:

    1. Permaquik Canada Ltd. products.

2.2 MATERIALS

1. Surface applied waterproofing compound consisting of a patented formula of

chemicals, cement and special treated quartz which dampproofs by crystalline growth through the capillary voids in the concrete substance, preventing passage of water under pressure as follows:

2. Permaquik Super 200: Applied in slurry consistency or powder application on concrete wall and floor surfaces. Approved alternative Cem-Kote CW Plus by W.R. Meadows.

3. Permaquik Mortar 300: Mix to mortar consistency for filling of form tie holes, honeycombed areas, routed out cracks and junctions of all floor and walls and around elevator cylinder and other pipe locations at elevator pit. Approved alternative Meadow-Crete OV by W.R. Meadows.

4. Permaquik 400: Mix to stiff mortar consistency for filling of reglets and forming coves.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

1. Examine concrete surfaces to be waterproofed for visible structural defects. Report unacceptable surface conditions to General Contractor. Commencement of Work shall imply acceptance for application.

2. Ensure surfaces and surrounding air temperature will not be less than 5 C for a minimum period of 48 hours before, during and after the waterproofing applications.

3. Ensure that concrete surfaces are free of foreign materials and are clean and absorbent for the treatment as specified.

3.2 HORIZONTAL CONCRETE SURFACES

1. Remove from concrete surfaces any floor hardener or curing agents prior to the application.

2. Route one minimum 3/4" (19 mm) deep all construction joints and visible cracks exceeding 0.01 inch (0.25 mm) thick. Remove laitance (cement scum), dirt, dust and thoroughly rinse with water concrete slab surfaces. Remove free laying water the day prior to the waterproofing material application. Concrete surfaces shall have damp appearance only at the time the slurry coating is applied.

3.3 VERTICAL CONCRETE SURFACES

1. Remove from scale, oil, form release agents and any other foreign materials likely to affect the bond, penetration and performance of the waterproofing. Include for steam cleaning, or light sandblasting if necessary.

2. Leave form tie holes approximately 1 inch (25 mm) back of surface.

3. Route out honeycombed pockets and faulty construction joints to sound concrete.

4. Route out ¾" (19 mm) deep construction joints and visible cracks in concrete surfaces exceeding hairline size (larger than 0.01 inch (0.25 mm)).

5. Rinse surfaces to be waterproofed thoroughly with water the day prior the application. Moisture must be present in the concrete strata to achieve maximum initial penetration of the activated waterproofing chemicals. Surfaces shall be moist only (not wet) when the coatings are applied. Check by rubbing hand over the surfaces. Hand should not become wet.

3.4 MIXING OF WATERPROOFING

1. Slurry consistency:

    1. Use separate containers for measuring by volume the powdery waterproofing materials. Use water free from mater deleterious to the materials. Add water to the waterproofing materials (not vice versa) and mix thoroughly. Measure 1 part water to 2.5 parts powder.

    2. Prepare only as much slurry mixture as can be applied within 20 - 30 minutes. Do not add more water when mixture starts to thicken. Stir mixture frequently.

2. Mortar consistency:

    1. Measure out Permaquik 300 and Super 200 4:1 and mix powder thoroughly with water to powdery mixture and work with trowel until a medium stiff consistency is reached.

    3. Prepare only as much mortar as can be applied within 10 - 15 minutes.

3. Stiff mortar at coves and reglets:

    1. Add just enough water to provide a stiff mortar consistency.

3.5 APPLICATION

1. General:

    1. Install the chemical waterproofing materials as outlined herein, and as shown on the drawings. Take special precautions to protect workers by using rubber gloves and goggles if required, during the application. Use rubber gloves when mixing waterproofing materials.

2. Apply the slurry coatings by using a special masonry short or long handled brush supplied by waterproofing manufacturer.

3. Carry out the powder applications by dry sprinkling Super 200 with a sieve (of fine mesh, holding approximately 2.27 kg of waterproofing material) on concrete surfaces as specified.

4. Install waterproofing on elevator pit floor and at walls to top of first floor level.

3.6 PROTECTION AND CURING

1. When temperatures fall below freezing, cover treated surfaces with tarpaulins, or other means and maintain surface temperature above 40 F (5 C) for a minimum period of two days after completion of application.

2. Protect the freshly treated surfaces from rain for a minimum of 24 hours.

3. Moisture cure all treated surfaces for a minimum period of two (2) days, starting with fine water fog spraying the day following completion of the application

4. During extreme hot weather, if necessary, apply light water fog spray to the freshly applied slurry application in order to prevent dehydration of the coatings.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.

1.2 SUMMARY

1. Products supplied under this section:

    1. Vapour barrier and installation accessories for installation under concrete slabs.

1.3 SUBMITTALS

1. Quality control/assurance:

    1. Summary of test results per paragraph 9.3 of ASTM E 1745.
    2. Manufacturer's samples and literature.
    3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.
    4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

1.4 JOB MOCK UP

1. Submit mock-ups in accordance with Section 01300 – Submittals.

2. Construct mock-up of sheet vapour barrier installation including one lap joint, and at one edge. Mock-up is to be part of wall specified.

3. Allow 24 hr. for inspection of mock-up by Architect before proceeding with vapour barrier work.

1.5 SPECIAL PROTECTION

1. Provide adequate protection of materials and work of this Section from damage by weather and other causes.

2. Protect the work of other Subcontractors from damage resulting from work of this Section. Make good such damage to the satisfaction of the Consultant.

1.6 REFERENCES

1. American Society for Testing and Materials (ASTM):

    1. ASTM E1745- 11Standard Specification for Plastic Water Vapour Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

2. ASTM E1643- 11Selection, Design, Installation, and Inspection of Water Vapour Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

2. Technical Reference - American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

PART 2 PRODUCTS

2.1 MATERIALS

1. Vapour barrier shall have all of the following qualities:

1. Maintain permeance of less than 0.01 Perms [grains/(ft_2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Other performance criteria:
   1. Strength: ASTM E1745 Class A.
   2. Thickness: 15 mils minimum

2. Vapour barrier products:

1. Stego Wrap Vapour Barrier 0.38,mm (15-mil) by Stego Industries LLC., (877) 464-7834. **Provide at all slab on grade areas except Gymnasium.**

2. SealTIGHT Pre-moulded membrane vapour seal with plasmatic core by WR. Meadows of Canada Ltd., tel.: 905-878-4122. **Provide at Gymnasium only**.

2.2 ACCESSORIES

1. Seams:

1. Stego Tape by Stego Industries LLC,

2. Penetrations of Vapour barrier:

1. Stego Mastic by Stego Industries LLC,
2. Stego Tape by Stego Industries LLC,

3. Perimeter/edge seal:

1. Stego Crete Claw by Stego Industries LLC,
2. Stego Tack Tape (double sided) by Stego Industries LLC,

3. Stego Term Bar by Stego Industries LLC,

4. For W.R.Meados: Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.

5. For W.R.Meados: Pipe Boots: Construct pipe boots from vapour barrier material and pressure sensitve tape per manufacturer's instuctions.

PART 3 – EXECUTION

3.1 PREPARATION

1. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

    1. Level and compact base material.

3.2 INSTALLATION

1. Install vapour barrier in accordance ASTM E1643.

    1. Unroll vapour barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

    2. Extend vapour barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.

        The perimeter seal recommendation can be addressed through various methods. When sealing to the slab, Crete-Claw is the preferred option. When sealing to an existing footing, grade beam, or stem wall, the most effective options include the use of StegoTack Tape, Stego Term Bar, or both.

    3a. Seal vapour barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.

    OR

    3b. Seal vapour barrier to footing/grade beam with StegoTack Tape, Stego Term Bar, or both.

    4. Overlap joints 6 inches and seal with manufacturer's tape.

    5. Apply tape/Crete Claw to a clean and dry vapour barrier.

    6. Seal all penetrations (including pipes) per manufacturer's instructions.

7. No penetration of the vapour barrier is allowed except for reinforcing steel and permanent utilities.

8. Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 6 inches and taping all sides with tape.

3.3 INSTALLATION AT GYMNASIUM

1. Place PMPC with polyethylene side down on compacted Granular 'A' fill.

2. Lap sides and ends of sheets 6" (150mm) using "Dutch Lap" method and seal with catalytic bonding asphalt.

3. Turn pre-moulded membrane up at perimeter edges the thickness of the floor and overlap and seal joints.

4. Polyethylene anti-stick sheet must be removed from all surfaces which will receive an adhesive coating in a lap joint or detail strip.

5. Seal junctures with foundation wall, using PM5X bonding agent or detail strip.

6. Seal protrusion such as drains or vents.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.

1.2 WORK INCLUDED

1. This section includes polyethylene vapour barrier for installation at warm side of insulation at stud wall construction, and at warm side of insulation at roof/wall transitions.

1.3 JOB MOCK-UP

1. Submit mock-ups in accordance with Section 01300 – Submittals.

2. Construct mock-up of sheet vapour barrier installation including one lap joint, and at one edge. Mock-up is to be part of wall specified.

3. Allow 24 hr. for inspection of mock-up by Architect before proceeding with vapour barrier work.

1.4 SPECIAL PROTECTION

1. Provide adequate protection of materials and work of this Section from damage by weather and other causes.

2. Protect the work of other Subcontractors from damage resulting from work of this Section. Make good such damage to the satisfaction of the Consultant.

PART 2 PRODUCTS

2.1 MATERIALS

1. Polyethylene Film Vapour Barrier: equal to CAN/CGSB-51.34. (min. 6 mil thickness) for all areas (except for below concrete slabs on grade).

2. Liquid Applied Vapour Barrier: Application to transition between different adjacent surfaces.

    1. Products W.R. Meadows Air-Shield LM
    2. Laticrete Dryteck Moisture Vapour Barrier.

2.2 ACCESSORIES

1. Staples: ½" (12 mm) minimum leg.

2. Sealant: Tremco Acoustic Caulking.
3. Tape: 3M No. Y-8086 Contractor's Sheathing Tape or duct tape as recommended by vapour barrier manufacturer, 2" (50 mm) wide at all joints, etc.

4. Moulded Box Vapour Barrier: factory moulded polyethelene box for use with recessed electrical switch and outlet boxes by Sylvanis Electric Equipment Ltd., Model No. 1004-VB and 5254-VB.

PART 3 EXECUTION

3.1 INSTALLATION

1. Place polyethylene on warm side of insulation and tight to insulation at exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous barrier.

2. Use sheets of largest practical size to minimize joints.

3. Secure vapour barrier to framing members and use sealant at joints. Lap joints 16" (400 mm) minimum and caulk complete joint with sealant over solid backing at joint, then tape all joints. Ensure joints occur over framing members.

4. Caulk with sealant where screws or staples penetrate vapour barrier. Tape seal areas where nails or staples penetrate vapour barrier and at all points of penetration.

5. Seal vapour barrier at points of penetration.

6. Inspect sheets for continuity. Patch breaks and openings in vapour barriers. Tape seal.

7. Take extreme care to ensure continuity of vapour barriers. Patch breaks and openings in vapour barriers.

8. Cut sheet vapour barrier to form openings and ensure material is lapped and sealed at frames.

9. Seal perimeter of sheet vapour barrier as follows:

    1. Apply continuous bead of sealant to substrate at perimeter of sheets.

    2. Lap sheet over sealant and press into sealant bead.

    3. Install staples through perimeter of sheets at sealant bead into wood substrate. Use tape to hold in place at metal masonry and concrete substrate.

10. Seal lap joints of sheet vapour barrier as follows:

    1. Attach first sheet to substrate.

2. Apply continuous bead of sealant over solid backing at joint.

3. Lap adjoining sheet minimum 150 mm and press into sealant bead.

4. Install staples through lapped sheets at sealant bead into wood substrate. Use tape to hold in place at metal substrate.

5. Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

11. Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

    1. For sheet-type vapour barriers, install moulded box vapour barrier wrap boxes with polyethylene film sheet providing minimum 300 mm perimeter lap flange.

    2. Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

12. Protect ceiling insulation with vapour barrier. Extend ceiling vapour barrier over all exterior and interior wallheads.

13. Attach warning labels to walls with vapour barrier.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 WORK INCLUDED

1. Materials and installation methods for self adhered sheet applied air barrier located within cavity wall construction on warm side of cavity insulation as detailed around window and door openings; at control joint and expansion joint locations; over roof parapets and curbs.

2. Materials and installation methods for air/vapour barrier located in the non-accessible part of non masonry walls, such as roof tie-in to curtain wall and tie in over parapets and roof curbs on to roof deck.

3. Materials and installation to bridge and seal openings and penetrations of window frames, fasteners, ties, roof deck, structural steel and similar leakage paths in the wall.

1.3 QUALITY ASSURANCE

1. All Air/Vapour Barrier products shall be applied by a contractor currently approved by Air/Vapour Barrier manufacturer and with mechanics with a minimum 5 years' experience with the installation of this specified system. Provide written evidence of approval.

1.4 SUBMITTALS

1. Product Data: Provide data on material characteristics, performance characteristics, limitations and independent air leakage, sustained wind load and gust wind test data.

2. Submit shop drawings indicating all details of connections to roof decks and masonry flashings.

3. Submit samples of air/vapour barrier membrane which has the factory applied identification of the manufacturer clearly marked on it.

1.5 DELIVERY AND STORAGE

1. Deliver materials in original unopened packaging with all labels intact.

2. When stored at the job site, materials shall be protected from the weather by the proper use of raised platforms and waterproof coverings. Pallets of membrane shall not be double-stacked on the job site. Materials should not be stored at continuous temperatures above 38 deg. C. (100 deg. F.). Consult precaution statements on product label before use.

1.6. MOCK-UP

1. Construct typical exterior wall sample panel 4'-0" (1200mm) long by 4'-0" (1200mm) wide, incorporating frame, insulation and junction with roof membrane, illustrating materials interface and seals.

2. Locate where directed.

3. Allow 48 hours for inspection of mock-up by Architect before proceeding with air/vapour barrier work.

1.7 PRE-INSTALLATION CONFERENCE

1. Convene two weeks prior to commencing work of this Section.

1.8 ENVIRONMENTAL REQUIREMENTS

1. Ensure application temperature and humidity recommended by material manufacturer is maintained before, during and after installation.

1.9 SEQUENCING

1. Sequence work to permit installation of materials in conjunction with related materials and seals.

1.10 COORDINATION

1. Coordinate work of this section with all sections referencing this section.

1.11 WARRANTY

1. The product manufacturer shall provide a certificate certifying the performance of his products for a period of 5 years from date of acceptance.

2. The installation contractor shall provide a certificate certifying all work shall remain in place as installed free from any membrane defect for a period of 5 years from acceptance.

PART 2 PRODUCTS

2.1 MATERIALS

1. Air/Vapour Barrier: (torch applied) Bakor "Blueskin TG" SBS modified bitumen, reinforced thermofusible membrane, with an average thickness of 100 mils. Membrane is a torch applied membrane.

2. Transition Membrane: Same as Air/Vapour barrier, Bakor Blueskin SA may be used in heat sensitive areas and if weather permits on other areas of the building. Blueskin SA is not appropriate for general use during winter conditions or wet conditions.

3. Primer for "Blueskin TG": Bakor 930-18.

4. Air barrier sealant: Bakor Air Bloc 21 or 230-21 Adhesive.

5. Air Barrier sheet membrane: Bakor Blueskin VP 160 peel and stick membrane. Approved alternate: SRP AirOutshield SA 280.

6. Substrate Cleaner: Mineral spirits or xylol.

7. Liquid Sealant (Around Openings, Pipe Penetrations Prior to Membrane Installation): Bakor Air Bloc 21.

8. End of Membrane Sealant: Bakor Air Bloc 06.

9. Alternates: Air-Shield and Air-Shield LM by WR Meadows.

PART 3 EXECUTION

3.1 EXAMINATION

1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Notify Architect in writing of any discrepancies.

2. Commencement of work or any parts thereof will imply the acceptance of the substrate by the installer.

3. Ensure that:

    1. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants.

    2. Concrete surfaces are cured and dry, smooth without large voids, spoiled areas or sharp protrusions.

    3. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.

3.2 PREPARATION

1. Remove loose or foreign matter which might impair adhesion of materials.

2. Fill any voids with mastic substrate filler.

3. Clean and prime substrate joint/connection surfaces to receive transition strip in accordance with manufacturer's instructions.

3.3 INSTALLATION OF PRIMER

1. All surfaces required by manufacturer to receive air/vapour barrier must be completely primed by lambs wool roller, brush or spray equipment.

2. Apply at a rate of 4m²/L (200ft²/gal) depending on porosity and texture of surface or as directed by manufacturer.

3. Primed surfaces not covered during the same working day must be reprimed.

3.4 INSTALLATION OF AIR/VAPOUR BARRIER AND TRANSITION MEMBRANE

1. Install membrane horizontally with the sheet starting at the bottom and work progressing up the wall in an overlapping shingle fashion.

2. Position membrane for alignment. When membrane is in place, cut for ties or projections. When membrane is in place, apply heat to the underside of the membrane by propane torch at the point of contact with the substrate. Apply sufficient heat to make the bitumen tacky and firmly press membrane onto substrate to ensure complete contact and bond for the full extent of the membrane.

3. Overlap all joints in membrane a min. 2" (51 mm) and use a heated trowel to fully seal laps.

4. All inside corners shall be double covered with initial strap of 12" (300 mm) width centred.

5. Construction and control joints, double ply covered with initial strip of 6" (150 mm) width and second strip of 18" (460 mm) width.

6. Areas around drains, piping, vents, etc. shall be liberally coated with Air Bloc 21 for radius of 6" (150 mm) around drain hub piping vents, etc.
before and after application of membrane.

7. Seal around any openings with Air-Bloc 21 with a minimum 2 ½" (64mm) overlap.

8. Seal end of membrane where is meets the substrate at the end of the days' work with Air-Bloc 21.

9. At all detail areas ensure continuity of air/vapour barrier to ensure continuous air tightness, especially at all corners, junctions, window and door locations. In corners and difficult areas, use "Vedatex Adhesive" to allow for sealing and application of reinforcing pieces of membrane.

10. Mechanical attachment must be made at windows, doors, louvres and curtain walls as per manufacturer's recommendations.

11. Install membrane down over metal through wall flashings (by Section 04200) with a min. 2" (50 mm) overlap at end joints.

12. Ensure all projections, including wall ties, are properly sealed by using a heated trowel to butter compound at the interface.

3.5 PRECAUTIONS

1. Do not leave membrane exposed for more than 6 weeks. Install insulation as soon as possible to protect the membrane from damage by other trades.

2. Provide support for air/vapour barrier system on back and/or bottom side where it crossed over gaps such as masonry wall cavities, etc. Use copper flashing to support air/vapour barrier at gaps.

3.6 JOB COMPLETION

1. The contractor shall inspect the completed membrane and correct all defects to meet the specification.

2. Clean up all debris, excess materials and equipment and remove from site.

3. Any drippage or spills of coating sealant, mastic or primers shall be cleaned.

4. The General Contractor shall restrict construction traffic and equipment movement near the completed air barrier to only essential related trades. For trades continuing to work near the completed air barrier, appropriate protection shall be provided.

END OF SECTION

PART 1 GENERAL

1. 1 GENERAL REQUIREMENTS

1. Division One, General Requirements is part of this Section and shall apply as if repeated here.

1.2 SCOPE OF WORK

1. Supply and install rigid insulation at top and side of roof parapets; roof curbs and foundation upturn, and high wall/low roof conditions below through wall flashing; below grade insulation at perimeter walls; below interior floor slabs at exterior entrance concrete slabs, and elsewhere where indicated on drawings.

1.3 SUBMITTALS

1. Submit shop drawings and samples in accordance with CCDC Document 2-2008 for items 2 below.

PART 2 PRODUCTS

1.1 INSULATION

1. Below Grade foundation Locations: To conform to CAN/ULC S701 Type 4, ship lapped / square edged – buttered with waterproofing membrane backup, extruded polystyrene rigid insulation to be "Styrofoam SM" with RSI 0.87 (R-5.0) minimum thermal resistance values per inch by Dow or equal.

2. Below Grade Cavity Wall Locations: Shipped lapped / square edged – buttered with waterproofing / air/vapour barrier retarder backup, ultra extruded polystyrene rigid insulation to be "Styrofoam Cavitymate Ultra" (Grey) with RSI 0.97 (R-5.6) minimum thermal resistance value per inch by Dow or equal.

3. Below Grade, Slab on Grade, Frost Slab, Door Threshold Locations: To conform to CAN/ULC S701 Type 4, square edge, extruded polystyrene rigid insulation to be "Styrofoam SM" with RSI 0.87 (R-5.0) minimum thermal resistance values per inch by Dow or equal.

4. Above Grade Cavity Wall Locations (over masonry or concrete substrates where all the insulation is on the exterior side of the wall substrate) and parapets: Ship lapped / square edged – buttered or air retarder backup, ultra extruded polystyrene rigid insulation to be "Styrofoam Cavitymate Ultra" (Grey) with RSI 0.97 (R-5.6) or "Styrofoam SM" with RSI 0.87 (R-5.0) minimum thermal resistance values per inch by Dow or equal – less than 1 permeance.

5. Above Grade Cavity Wall Locations (over exterior sheathing, on framed substrate systems where mineral wool insulation fills the framed substrate cavity void): Ship lapped / square edged – buttered, extruded polystyrene rigid insulation to be "Styrofoam Cladmate" with RSI 0.88 (R5.0) minimum thermal resistance values per inch by Dow or equal – greater than 1 permeance - this

insulation is to be breathable and only an air barrier on the exterior side of the wall substrate sheathing.

6. Foam Insulation: Sprayed polyurethane foam to flame spread rating of less than 500, min. RSI 1.05 (R 6/1") at density of 32.8 kg/cu.m (2lb/cu.ft). Spray foam at voids and broken areas in the rigid insulation. Spray foam is for repairs only.

1.2 ADHESIVE

1. Cavity wall insulation board perimeter buttered edges: "Air-Bloc 21" by Bakor (air/vapour retarder, both)

Note: Over exterior sheathing, on framed substrate systems where there is mineral wool insulation filling the voids with an continuous air/vapour barrier sealed on the interior side of the framing members, the exterior rigid insulation is not to be sealed around perimeters when the contractor does not install Cladmate as specified for breathability.

2. Adhesive for perimeter insulation below grade: to be CGSB 71-GP-24m equal to Bakor 230-3J.

PART 3. EXECUTION

3.1 WORKMANSHIP

1. Work shall include rigid insulation in cavity walls, clear storey walls; roof parapets, roof curbs, below grade foundation perimeter and below concrete entrance slabs.

2. Surfaces to receive rigid insulation shall be clean, free of grease and oil, and reasonably smooth with no mortar or concrete pin projections.

3. Install insulation after building substrate materials are dry.

4. Prime surfaces before using asphaltic type adhesives.

5. Install all materials using adhesive or fasteners in strict accordance with manufacturer's installation instructions unless otherwise specified herein.

6. Ensure a uniform, continuous thermal barrier effect. Where insulation is to be provided under other Sections, co-ordinate the work such that the thermal barrier continuity is achieved.

7. Install insulation to maintain continuity of thermal protection to building elements and spaces.

8. Fit insulation closely around electrical boxes, plumbing and heating pipes and ducts, and other protrusions.

9. Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from damaged or broken edges. Use longest possible lengths to reduce number of joints. Keep insulation minimum 3" (75 mm)

from heat emitting devices such as recessed light fixtures, and a minimum 2" (50 mm) from sidewalls of CAN4-S604 Type "A" chimneys and CAN1-B149.1 and CAN1-B149.2 Type "B" and "L" vents.

10. In multiple layer applications offset both vertical and horizontal joints.

11. Do not enclose insulation until it has been inspected.

3.2 BELOW GRADE FOUNDATION WALL LOCATIONS – WITH BELOW GRADE FLOOR LEVEL / BASEMENT

1. Install 75mm (3") minimum rigid insulation using below grade adhesive (fasteners not to be used as this will puncture the waterproofing membrane already adhered to the concrete foundation system) dabbed on as required to hold insulation in place prior to installing waterproofing drainage bubble board over. Backfill gently at below grade perimeter foundation locations.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.3 BELOW GRADE CAVITY WALL LOCATIONS

1. Install 75mm (3") minimum rigid insulation using below grade adhesive (fasteners not to be used as this will puncture the waterproofing membrane already adhered to the concrete foundation system) dabbed on as required to hold insulation in place prior to installing solid masonry over.

2. This is typically two courses below floor level datum without a below grade floor level / basement, or 4 courses below floor level datum with below grade floor level / basement overlapping below grade exterior foundation wall insulation by two courses – 4x overlapping.

3. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.4. BELOW GRADE – EXTERIOR HARD SURFACE LOCATIONS

1. Install 100mm (4") for 1220mm (4') minimum rigid insulation out below / underside all hard surface materials from building perimeters.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.5 BELOW SLAB ON GRADE – INTERIOR HEATED SLABS

1. Zone 6

    1. Install 75mm (2") x 915mm (36") vertical (on inside of foundation) and 50mm (2")continuous horizontal (underside slab on grade) minimum rigid insulation around building perimeters where more stringent insulation is not indicated / detailed on drawings.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.6 BELOW SLAB ON GRADE – INTERIOR NON-HEATED SLABS

1. Zone 6

    1. Install 50mm (2") x 610mm (24") vertical (on inside of foundation) and 75mm (3") x 1220mm (48") horizontal (underside slab on grade) minimum rigid insulation around building perimeters where more stringent insulation is not indicated / detailed on drawings – this is typically Zone 5.

    2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.7 BELOW GRADE FROST SLAB LOCATIONS

1. Install 100mm (4") thick for 1220mm (4') horizontal out from all exterior frost slab foundation systems, then 50mm (2") for 1220mm (4') out from 4" thick insulation horizontal at all hard surface locations. Coordinate with typical frost slab plan detail.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.8 BELOW GRADE INSULATION AT DOOR THRESHOLDS

1. Install 50mm (2") x 200mm (8") minimum vertical rigid insulation below door thresholds between interior slab on grade and exterior frost slabs at every door threshold location.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.9 ABOVE GRADE CAVITY WALL LOCATIONS

1. Install 75mm (3") minimum rigid insulation using above grade adhesive dabbed on as required to hold insulation in place prior to installing fasteners with enlarged plastic washer heads for final anchorage / fastening (there is no air/vapour barrier membrane adhered / fastened to the wall substrate system to puncture, only an air barrier as the wall substrate cavity has more insulation to fill the void along with an air/vapour barrier on the interior side.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

3.10 ABOVE GRADE ROOF PARAPETS AND CURBS

1. Cut and fit 75mm (3") minimum rigid insulation at tops and sides of roof parapets and curbs as detailed on drawings.

2. Repair all open joints and damaged edges with foam spray insulation to fill voids.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements is part of this Section and shall apply as if repeated here.

PART2 PRODUCTS

2.1 INSULATION

.1 Batt and Blanket Mineral Fibre Insulation (Exterior Wall -Stud Cavity):

1. Rockwool ComfortBatt mineral wool semi-rigid batt insulation with flexible edge. Thickness is to fill wall cavity solid unless specified / shown otherwise on wall types.

Typical thicknesses of 92mm – R14.5 and 140mm - R22.5
(provide minimum value of R13 as required to comply with OBC SB-10)

.2 Batt insulation at cavity wall:
1. Rockwool Cavityrock DD rockwool insulation board. 92mm
(provide minimum value of R15 continuous insulation as required to comply with OBC SB-10)

.3 Acoustic Sound Batt Insulation (Interior Wall Systems (Stud Cavity) & Sound Proofing Above Ceilings):

1. Rockwooll Acoustical Fire Batt (AFB) mineral wool insulation for fire rated assemblies and Rockwool Safe 'n' Sound for non-fire-rated assemblies. Thickness is to fill wall cavity solid unless specified / shown otherwise on wall types.

2. Rockboard 60 with foil face (facing upward into plenum) at sound rated ceiling systems where ceiling spaces are used for plenums.

.4 Curtain Wall Insulated Panel:
Rockwool Curtain Rock mineral fibre insulation with 'R' value of 4.2 / inch.
152 curtain wall framing to receive 114mm (4.5") thick insulation,
190mm curtain wall framing to receive 152mm (6") thick insulation.
Other conditions (different size back mullions which create different size sealed metal backpans) to receive insulation to fill entire void of sealed metal backpan from back side of exterior veneer sealed in curtain wall caps to face of back panel infill typical.

.5 Floor Slab Edges / Termination:
Rockwool Safe mineral fibre insulation to be installed at edge of floor slab / slab termination to back side of vertical curtain plane to fill the remaining installation / deflection void to maintain fire resistance rating of the floor system. Install finish floor cap over & under to hold in place.

.6 Requests for approved alternative products must include technical information and be submitted not later than 7 days prior to tender closing.

2.2 ACCESSORIES

.1 Staples: ½" (13 mm) minimum leg.

PART 3 EXECUTION

3.1 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces. Insulation to be friction fit between studs, joists or furring members.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Do not install insulation in any part of the building where protection against inclement weather has not yet been provided and where the insulation could thereby be wet or damaged.

.5 Provide and install supports as required to keep insulation in place at soffits with floor above and around ducts in attic space.

.6 Keep insulation a min. 3" (75 mm) from heat emitting devices such as recessed light fixtures.

3.2 LOOSE FIBRE INSULATION

.1 Pack loose mineral wool insulation in crevices around lintels, frames, beams, around ducts at holes and other places where shown or required to minimize air infiltration.

.2 Pack loose mineral wool into voids around mechanical and electrical pipes and ducts where they pass through non-fire rated wall, floors and ceilings.

3.3 FIRE RATED MINERAL WOOL INSULATION

.1 Supply and install mineral wool at fire separations and where indicated on drawings.

.2 Refer to Section 07270 - Firestopping and Smoke Seals for mineral wool work by that Section.

3.4 SOUND INSULATION

.1 Fill all cavities full of mineral wool sound insulation where sound insulation is indicated on drawings.

.2 Sound insulation above acoustic tile ceilings supplied and installed by Section 09500 – Acoustical Treatment as per this Section.

3.5 BATT INSULATION

.1 Install mineral wool batt insulation at exterior or air/vapour barrier walls, ceiling spaces, between floor joists at perimeter wall locations and all other locations shown on drawings.

.2 Place batts in close contact with vapour barrier or air/vapour barrier facing the interior.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENT

1. Conform to Sections of Division 1 as applicable.

2. This section includes closed-cell medium density spray applied polyurethane foam insulation, air barrier and vapour barrier.

1.2 REFERENCED STANDARDS

1. ASTM E-96 Standard Test Methods for Water Vapor Transmission of Materials.

1. CAN/ULC S705.1-15: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density.

2. CAN/ULC S705.2-05 (R2016): Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

3. CAN/ULC-S710.1:2019 Standard for Bead Applied One-Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

4. CCMC 13588-L– Evaluation of BASF WALLTITE ® v.3 as an insulation and air barrier material.

5. Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13659-R. Walltite Eco v.3 Air Barrier System

6. CCMC's Technical Guide, Air Barrier Systems for Exterior Walls of Low-Rise Buildings, MasterFormat Number 07272 (07 21 19.02).

7. Canadian Construction Materials Centre (CCMC) Technical Guide, Air Barrier Systems for Exterior Walls of Low-Rise Buildings, MasterFormat Number 07 27 09.01.

8. BASF Canada Installer Quality & Training Program – Raising Performance to New Heights, June 2005. BASF Canada Installer Training Manual, June 2005 or CUFCA - Quality assurance installation standards for application by certified contractors approved by CUFCA.

9. Do elastomeric membrane installation in accordance with manufacturers printed application instructions, except where specified otherwise.

1.3 SUBMITTALS

1. Product Data: Provide data on material characteristics, performance criteria, and limitations.

2. Installer Qualifications: Submit proof confirming the installing contractor is licensed by the BASF Canada Quality and Training Program-Raising Performance to New Heights and certified by Morrison Hershfield to perform the installation of the product or system specified or an application certified contractor approved by CUFCA.

3. Licensing of the installer is required by CAN/ULC S705.2-05 Installation Standard.

4. Manufacturer's Installation Instructions: Indicate preparation, installation requirements and techniques, product storage and handling criteria.

5. Submit samples of all materials in accordance with Section 01300.

6. Submit duplicate 12" x 12" samples of sheet membrane material.

1.4 PRODUCT, DELIVERY, STORAGE AND HANDLING

1. Deliver materials in original unopened containers.

2. Label containers with brand name, installation instructions and identification of various items.

3. Store materials except membrane between 15°C and 27°C. If exposed to lower temperature restore to acceptable level before using.

4. Store materials except membrane in dry area and protect.

1.5 QUALITY ASSURANCE

1. Contractor performing work under this section must be licensed under the BASF Canada Quality and Training Program-Raising Performance to New Heights and certified by Morrison Hershfield or by CUFCA. The contractor is required by the CAN/ULC S705.2-05 to purchase and install, for this project, only material that conforms to the requirements of CAN/ULC S705.1-01 Material standard.

2. Applicators shall have their photo-identification certification cards in their possession and available on the project site, for inspection upon request

3. Maintain one copy of installation manual on site.

4. The Licensed Installer shall conduct the on-site daily testing as required by the CAN/ULC S705.2-05 Installation Standard. The Licensed Installer shall complete the Daily Work Report as required by the CAN/ULC S705.2-05 Installation Standard. Upon request submit copy of all completed forms to Consultant prior to making application for payment.

5. Membrane: applied by applicator trained and approved by manufacturer for application of its products.

6. Applicators: minimum 5 years proven experience.

7. Membrane manufacturer's representative:
    1. Inspect substrate prior to commencement of work, during application of membrane and upon completion of work.

    2. Provide technical assistance to applicator and assist where required in correct installation of membrane.

1.6 QUALIFICATIONS

1. Installer to be a Qualified Applicator of the products from the manufacturer/distributor. Submit proof of status upon request.

2. Material manufacturer/distributor must have an on-site quality assurance program. Submit three copies of quality assurance program upon request.

3. Approved applicators:

    1. Quinte Urethane 613-395-4032
    2. G & R Insulation 613-969-7403
    3. Interprovincial Insulation 613-546-2835
    4. Great Northern Insulation, Woodstock 1-800-265-1914
    5. Insta-Insulation, Brantford 1-800-688-0311
    6. K-Seal, Kitchener 1-877-644-1414
    7. ThermalPro Insulation, 866-376-8875
    8. Or other installers that are listed by BASF as FoamMasters

1.7 MOCK-UP

1. Provide mock-up of air-vapour barrier materials.

2. Construct typical exterior sample wall in conjunction with Section 04200 incorporating window frame head jamb and sill insulation, building corner condition junction with roof air barrier illustrating materials interface and seals.

3. Locate where directed by Architect.

4. Mock-up will not remain as part of the Work.

1.8 SCOPE/LOCATION

1. At all exterior cavity wall locations and any other locations, as noted on drawings.

1.9 PRE-INSTALLATION CONFERENCE

1. Convene with Architect, Inspection and Testing Company and General Contractor one week prior to commencing work of this section to review application procedure and detailing of openings and other areas.

1.10 ENVIRONMENTAL REQUIREMENTS

1. Maintain temperature and humidity recommended by the materials manufacturer before, during and after installation.

1.11 CO-ORDINATION

1. Co-ordinate the work of this section with all sections referencing this section.

2. Provide sprayed foam insulation/air-vapour barrier at masonry cavity wall locations, at curtain wall systems where spray foam is shown at cavity wall locations, and at all metal wall cladding cavity wall locations.

1.12 WARRANTY

1. Warrant work of this section against defects or deficiencies for a period of two years from date Work is certified as substantially performed in accordance with General Condition of the Contract.

2. Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period.

3. Obtain from the manufacturer a material guarantee stating that the membrane shall be free of manufacturing defects and premature deterioration for a period of ten years from date of final Certification of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

1. WALLTITE ® v.3 by BASF The Chemical Company as represented by Building Resource Inc. (1.416.410.4055).

2. Other acceptable product: Polarfoam PF 7300, HeatLok Soya by Demilic Canada (1.866.437.0223).

3. Insulation/ Air Barrier Material and Air barrier System: Closed cell, spray applied polyurethane foam, medium density, ccSPF meeting the requirements of CAN / ULC-S705.1 and the CCMC's Technical Guide, Air Barrier Systems for Exterior Walls of Low-Rise Buildings, MasterFormat Number 07272 (07 21 19.02). Certified by EcoLogo as containing a minimum of 5% recycled content by mass of finished product. GREENGUARD Indoor Air Quality Certified by the GREENGUARD Environmental Institute under the GREENGUARD for Children & Schools product certification program. Product to utilize Zero ODS (Ozone Depleting Substance) blowing agent.

    1. Density (ASTM D1622) = 28.9 kg/m^3 (1.8 lb/$ft.^3$), minimum.

    2. Long Term Thermal Resistance (LTTR) in accordance with CAN/ULC-S770-03 as per CAN/ULC-S705.1.

Thickness mm (inches)	RSI / (R Value)
50.8mm (2")	2.17 (12.4)
63.5mm (2.5")	2.78 (15.8)
76.2mm (3")	3.38 (19.2)
88.9mm (3.5")	4.00 (22.7)
102 mm (4")	4.62 (26.2)
127mm (5")	5.82 (33)
152.4mm (6")	7.11 (40.3)
177.8 (7")	8.42 (47.7)
203.2 (8")	9.69 (55)

3. Flame Spread Classification as per CAN / ULC-S102, including S127, Flame Spread <500.

4. Compressive strength as per ASTM D1621, 201 kPa(29.2 psi)

5. Tensile strength as per ASTM D1623, 325kPa (47.1psi)

6. Open cell content as per ASTM D2856, 6%.

7. Water absorption as per ASTM D2842, 0.6% by volume.

8. Water Vapour Permeance as per ASTM96,

    1. 25mm sample: 51 ng/Pa•s•m^2 (0.85 Perms).
    2. 50mm sample: 41 ng/Pa•s•m^2 (0.68 Perms).

9. VOC emissions - below the detectable limit after 24 hrs.

10. Colour: Initial colour is purple; exposure to UV (sunlight) will cause it to change to grey or rusty brown and eventually yellow. Colour may vary depending on thickness of application.

11. Modify spray foam to suit temperature application as per manufacturer's recommendations. Spray foam shall not have any CFC or HCFC or any depletion substance affecting the ozone layer.

2.2 PRIMERS

1. As per manufacturer's recommendations and CAN/ULC-S705.2 for surface conditions, for oily steel surface like Z-Bar, steel deck roof or curtain wall pan, aluminum tube, PVC pipes, applied ADBOND 8388-1 adhesive primer, colour: red before spraying polyurethane foam.

2.3 AIR/VAPOUR BARRIER

1. Elastomeric Sheet Membrane Air/Vapour Barrier:

    1. To be used in all areas required by the Walltite ® v.3 Air Barrier System installation guide including all control joints over parapet wall at roof locations down onto roof air barrier, and between all junctions of dissimilar materials. Install prior to the application of the insulation. Install in widths of min. 12" (300mm)with 6" (150mm) cover to each side of joints or onto dissimilar products; and at base wall flashing membrane with min. 8" (200 mm) upturn and extended out over concrete foundation wall and extended a min. ¼" beyond. Once the curing time required by the membrane manufacturer has elapsed, a test must be conducted to verify adhesion between the membrane and the substrate. All adhesion tests must be performed using COM-TEN INDUSTRIES Series 301N1M equipment or an equivalent. If adhesion is lower than the required minimum of 100 kPa (15 psi), the membrane must be mechanically fastened.

2. Acceptable Products:

1. Blueskin TG air/vapour membrane and "Blueskin SA" air/vapour membrane (at all heat temperature sensitive locations) complete with end of membrane and termination sealer "Air Block 06". Manufactured by Monsey Bakor or PW 100/40 BH by Protectowrap, or equal by W. R. Meadows.

3. Upon Architect's approval, products that function better in cold weather to be used at no additional cost to the Owner.

2.3 APPLICATORS

1. Installers of spray polyurethane foam shall be trained by BASF in accordance with CAN/ULC S705.2 and certified by certified by Morrison Hershfield to install the system specified or by CUFCA.

2.4 COMPATIBILITY

1. Ensure that all materials used are compatible.

2. Provide proof of compatibility.

PART 3 EXECUTION

3.1 EXAMINATION

1. Verify that surfaces and conditions are ready to accept the Work of this section. Application of Work of this section shall be deemed acceptance of existing work and existing conditions. Report in writing defects in substrate which may adversely affect the performance of the foam insulation/air barrier.

2. Examine joints before sealing to ensure configuration, surfaces and widths are suitable for vapour barrier. Report in writing the locations of joints which are deemed unacceptable for the application of vapour barrier and/or air barrier.

3.2 PREPARATION

1. Surfaces to receive foam insulation/air-vapour barrier shall be free of frost, loose or foreign matter which might impair adhesion of materials.

2. Prepare surface by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, millscale and other contaminants which will affect adhesion and integrity of the foam insulation/air barrier system. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the foam insulation. Ensure surfaces are dry before proceeding.

3. Prepare joints to receive foam air barrier sealant by brushing, scrubbing, wiping, scraping or grinding to remove loose mortar, dust, oil, grease, solvents, oxidation, mill scale and other contaminants which will affect adhesion and integrity of foam sealant.

4. Where joints between sheathing boards exceeds 6 mm apply air-vapour barrier membrane to lap onto each sheathing board a 3" (75mm) for a min. total width of 6" (150 mm).

3.3 APPLICATION

1. Apply sheet membrane air-vapour barrier and foam insulation/air-vapour barrier membrane materials over clean and dry surfaces.

2. Installation shall be in accordance with CAN/ULC S705.2-05 , sheet membrane air vapour barrier and foam insulation air-vapour barrier membrane manufacturer's recommendations for this application overlapping all joints of sheet membrane with minimum 4" (100 mm) laps. Seal all laps and termination joints with "Air Bloc 06".

3. Masonry contractor will ensure that the surface is prepared to meet the requirements specified by spray foam insulation / air-vapour barrier manufacturer.
4. Before commencing work, the contractor will ensure that environmental and site conditions are suitable for installation of materials in accordance with each manufacturer's recommendations and notify architect in writing of unsuitable surfaces and conditions.

5. Commencement of work shall imply acceptance of surfaces and conditions.

6. Apply foam insulation/air-vapour barrier in strict accordance with manufacturer's written instructions, specifications or recommendations.

7. Apply foam insulation/air-vapour barrier only when surfaces and ambient temperatures are within limits prescribed by the material manufacturer.

8. Fill joints with foam sealant making allowances for post expansion of foam.

9. Finish joints shall be free from air pockets and imbedded foreign materials. Cut back excess foam sealant after cutting flush with surrounding surfaces unless otherwise directed and/or detailed.

10. Apply foam insulation/air-vapour barrier to a minimum 80 mm (3 1/4") thickness with a minimum two passes (min. 15mm, max. 50mm and allowing foam to cure between passes) to within the following tolerances: +6.4 mm (1/4"); - 0" (0 mm) thickness at all locations where cavity wall insulation/air barrier is shown on drawings and to provide a minimum R 18. Take particular care at base of wall and transition membrane flashing locations. First pass to create thin coat. 3 passes may be required at these critical areas.

11. Finished sprayed foam insulation/air barrier shall be free of voids and imbedded foreign materials.

12. Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.

13. Remove over-spray and masking materials immediately after foam has cured to hard surface film.

14. Clean and make good surfaces soiled or damaged by work of this section. Consult with section of work soiled before cleaning to ensure methods used will not damage their work.

15. Do not permit adjacent work to damage work of this section. Damage to work of this section caused by other sections shall be made good by this section at the expense of the section which caused the damage.

3.4 FIELD QUALITY CONTROL

1. Site Tests:

    1. The Licensed Installer shall conduct daily visual inspection, adhesion/cohesion testing and density measurements as outlined by the CAN/ULC S705.2-05 Installation standard.

    2. The Licensed Installer shall complete the Daily Work Record and record all information required including the results of the testing. The Daily Work Record shall be kept on site for routine inspection. Copies of the Daily Work Record shall be forwarded to the owner or owner's representative upon request.

    3. Copies of the Daily Work Record or monthly summaries shall be sent to the BASF Quality Assurance Program office on a monthly basis as required by BASF or to CUFCA as required by Demilic.

    4. The costs incurred for daily testing and inspection by the Licensed Installer and the completion of the Daily Work Record shall be borne by the Licensed Contractor.

2. Inspection:

    1. Arrange for third party site-inspection by qualified inspection company/engineer. The cost of inspections shall be included in the bid provided by the Licensed Contractor.
    2. Arrange for third party site-inspection as outlined in the BASF Canada Quality and Training Program-Raising Performance to New Heights or CUFCA. The number of inspections is to be in accordance with the following schedule and is based on the area covered by spray foam insulation air vapour barrier system.

    3. For area insulation/air barrier system:

        1. 0-25,000 ft^2 – 1 inspection

        2. 25,001 – 50,000 ft^2 – 2 inspections

        3. 50,001 – 75,000 $ft.^2$ – 3 inspections

        4. 75,001 $ft.^2$ + - 4 inspections

    4. The 3rd party site-inspection shall verify conformance with the manufacturer's instructions, the CAN/ULC S705.2-05 Installation

standard, the CCMC technical guide for Air Barrier Systems and this section of the project specification.

5. If the inspection reveals any defects, the Licensed Contractor shall immediately rectify all such defects at his cost.

3.5 CLEAN UP

1. Clean up and remove all debris from site.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 DELIVERY

1. Packaging of insulation shall indicate manufacturer, type, density, and insulation value.

1.3 SAMPLES

1. Submit samples in accordance with Section 01300 – Submittals.

2. Install sample installation min. 1'-0" (300 mm) long for each material proposed for project.

3. Submit material safety data sheets for materials of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

1. Sprayed-On Insulation: Foam insulation equal to Froth-Pak 2 Component Polyurethane Foam by DOW with a min. R value of 5.5 per inch.

2. Sprayed Applied Fire Resistive Insulation: (at locations where insulation will remain exposed to the interior i.e. bottom steel framing that penetrates roof insulation for steel support structure that does not have insulation on the warm interior side) equal to Heat-Shield Sprayed-On Thermal Insulation by Cafco Industries Ltd.

3. Use of structural steel and steel deck at first floor level to provide min. R5.

PART 3 EXECUTION

3.1 WORKMANSHIP

1. Insulation shall be applied by skilled workers, in accordance with best trade practices and manufacturer's printed instructions.

2. Do not install insulation in any part of the building where roof protection against inclement weather has not yet been provided and where the insulation could thereby be wet or damaged.

3. Examine joints before sealing to ensure that configuration, surfaces, and widths are suitable for spray-on insulation and service and that execution of sealing and performance of spray-on insulation will not be adversely affected. Defective work

resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this Section.

4. Proceed with spray-on insulation only when air, substrate and surfaces in contact with spray-on insulation are completely dry.

5. Prepare joints by brushing, scrubbing, scraping or grinding inner surfaces top remove loose mortar, dust, oil, grease, oxidation, mill scale, and other materials which will affect adhesion and integrity of spray-on insulation and dry with clean cloths. Ensure that surfaces have not been coated with releasing agents, coating or other treatments, or that they are entirely removed.

6. Finished joints to be free of air pockets, imbedded foreign materials and cut back after curing to be flush with surrounding materials and recessed to sufficient depth for caulking.

7. Where spray-on insulation is to be applied at edges of insulation or at air/vapour barrier ensure that spray-on insulation is located to form seal at warm side of insulation and/or to form continuation of air/vapour barrier.

8. Protect all finished surfaces with appropriate covering during installation.

9. Install Sprayed-On Insulation and Sprayed Applied Fire Resistive Insulation as per manufacturer's recommendations.

3.2 LOCATIONS

1. Sprayed-On Insulation: Seal all joints where air leakage can occur, including at joist shoes, under base plates, between door and window frames and rough openings, around electrical and plumbing boxes and conduits that penetrate vapour barriers, around ceiling fixtures that penetrate roof deck. All other locations as specified and indicated on drawings, with foam spray-applied insulation where required to prevent movement or infiltration of air. Do also voids under window sills.

2. Sprayed Applied Fire Resistive Insulation: Install at all roof wall locations at structural penetrations through roof insulation at roof metal deck locations as per drawings with a min. thickness of 4" (100 mm) with an R value of 16. Apply insulation a min. 8" (200 mm) from roof deck down onto block walls and a min. 6" (150 mm) from block wall across onto metal deck. Apply insulation a min. 8" (200 mm) beyond each side of structural element penetrating through roof insulation (i.e. roof screen support). Fill all voids at these areas. Install this insulation at all areas where spray

4. applied insulation will remain exposed to the interior (including above acoustic tile and drywall ceiling locations).

5. Minimum 1" on steel floor deck and structural steel at first floor level. R5 insulation level required for in-floor heating.

3.3 CLEANING

1. Remove from surfaces of other work sealant smears, droppings and masking tape immediately after sealant has cured to a hard surface film.

2. Clean surfaces soiled by work of this Section. Do not use cleaning methods that will damage surrounding surfaces. Make good work cleaning has damaged under work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements is part of this Section and shall apply as if repeated here.

1.2 PRODUCT HANDLING

1. Deliver materials in original unopened packages bearing the name of the manufacturer, the brand and proper Underwriters Laboratories of Canada cUL/ULI labels for fire hazard and fire resistance classifications.

2. Keep materials under cover and free from dampness. All bags that have been exposed to water before use shall be discarded. Material is to be used before its expiration date.

1.3 SUBMITTALS

1. Comply with pertinent provisions of Section 01300 – Submittals.

2. Submit the additional following data:

3. Materials list of items proposed to be provided under this Section;

4. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

5. It is the responsibility of the fireproofing contractor/applicator to submit specific ULC cUL/ULI design numbers and to provide in writing confirmation that the Building Inspection Department accepts the submitted ULC design system to achieve the required 1 hr. fire-resistance rating for all first floor steel columns and floor assemblies.

1.4 PRIOR TO APPLICATION OF FIREPROOFING MATERIAL

1. An inspection shall be made by this Contractor to see that all steel and other surfaces are acceptable to receive fireproofing.

2. Such inspection shall be made to see that all surfaces to be fireproof be free of oil, grease, dirt, scale, or any other substance that may impair proper adhesion.

3. If surface conditions are not satisfactory, it is the responsibility of this Contractor to notify the General Contractor of said conditions.

4. Where this Contractor proceeds with the work of this Section constitutes the acceptance of responsibility of said surfaces by this Contractor.

1.5 SCOPE OF WORK

1. Locations Include:

    1. Fireproofing of exposed spray in place insulation. Fireproofing of structural steel beams, steel columns, steel joists, roof deck at "cold spots" where indicated on drawings.

PART 2 PRODUCTS

2.1 MATERIALS

1. Water: clean, fresh and suitable for domestic consumption and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material.

2. Sprayed Fireproofing:

    1. Sprayed Fireproofing for exposed steel beams and joists, the ULC design shall be equal to:

    1. Cementitious mixture AD Type 5GP (5MD where product is in contact or could be in contact to be more durable) by A/D Fire Protection U.L.C. design shall be equal to: a 1 hour ULC design type as required to suit the steel beams to meet ULC Design F906.

    2. Approved Alternative manufacturers are fireproofing by CAFCO Industries Ltd. and design shall be cUL Design F902 by CAFCO Industries, or Grace Construction Products Monokote MK-6 ULC Design F905.

3. Fireproofing Sprayed on Sealer: equal to TC-55 by A/D Fire Protection Ltd.

4. Sprayed Applied Fire Resistive Thermal Insulation (at locations where insulation will remain exposed to the interior): Monoglass Spray-On Insulation by Monoglass Inc. or Heat-Shield Sprayed-On Thermal Insulation by Cafco Industries Ltd.

5. Sprayed Applied Fireproofing to cover spray in place Insulation (at locations where spray in place insulation cannot remain exposed to the interior): Monokote Z-3306 Thermal Barrier by GCP Canada Inc., or Southwest Type 7TB by Carboline.

2.2 PERFORMANCE CRITERIA

1. The sprayed fireproofing shall have been tested by Underwriters Laboratories or other certified testing agency in accordance with the procedures of ASTM E119. (U.L.C. CAN 4-S101-M)

2. The sprayed-on fireproofing shall be Asbestos free, cementitious mineral fibre type. Approved performance criteria shall be:
    1. Material shall not crack or delaminate when the backing to which it is applied is subjected to a downward deflection of 1/20th of the span.

2. The fireproofing subject to impact tests on a sample of the completed floor assembly shall not crack or delaminate from the surface to which it is applied. The test shall consist of 60 lb. (27 kg.) sand bag dropped from a height of 4'0" (1200 mm) onto the test specimen per ASTM E-760.

3. The sprayed on fireproofing applied over uncoated and galvanized steel shall have a minimum bond strength of 295 lbs. per cubic foot (18.6 kPa), 360 Blaze II, when set and dry per ASTM E-736.

4. The fireproofing material shall not be subject to losses from the finished application by sifting, flaking, or dusting.

5. As a measure of the fireproofing material's ability to resist deformation, a sample of the material applied to a 6" x 24" (150 mm x 600 mm) galvanized steel sheet shall be subjected to a compressive load of 1,000 lbs. (454 kg.). The deformation of the material under these conditions shall be less than 10%.

6. Bare, shop-coated and galvanized steel sheets with the fireproofing applied shall be kept at 90±3 degrees F. (30 degrees C. - 34 degrees C.) and 70±3% RH for a duration of 240 hours without evidence of corrosion of the steel.

7. The fireproofing material shall have been subjected to abrading forces in accordance with ASTM Proposed Test Methods for Fire Resistive Materials. The abrasion when tested in accordance with this method shall be no more than 1.22 in. (31 mm).

8. The fireproofing material shall have been subjected to impact penetration tests in accordance with test procedures per ASTM E760 Proposed Test Methods for Sprayed Fire Resistive Material. Samples of the material when subjected to impact forces shall not show an impact loss greater than .31 cubic in. (50.8 cubic mm).

    1. The fireproofing density shall conform to ASTM E-605 a minimum 13 pcf (208kg/m3).

3. The sprayed on fireproofing shall be compatible to provide the proper adhesion with the red primer installed on the steel columns, beams and bridging by the Steel Trade Contractor.

PART 3 EXECUTION

3.1 GENERAL

1. All clips, hanger supports, sleeves and other attachments to the fireproofing bases, as covered under other sections of the specifications, are to be placed by others, prior to the application of the fireproofing material, where these attachments can be anticipated in advance.

2. Ducts, piping, conduit or other suspended equipment that interfere with the uniform application of the fireproofing material shall be positioned after the application of the sprayed fireproofing.

3.2 APPLICATION

1. Application of sprayed fireproofing shall be installed by experienced craftsperson.

2. Temperature and enclosure conditions shall be as required by the fireproofing manufacturer.

    1. An air and substrate temperature of 40 degrees F. (4 degrees C.) shall be maintained for 24 hours before and after application of the fireproofing.

    2. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation air circulation and ventilation is to be provided.

3. Patching and repairing of sprayed fireproofing damaged by other trades, shall be performed under this Section and paid for by the trade(s) causing the damage.

4. Sprayed Applied Fire Resistive Insulation: Install at all roof wall locations and at structural penetrations through roof insulation at roof metal deck locations as per drawings with a in. thickness of 3" (75 mm) with an R value of 3.3 per 25mm. Apply insulation a min. 8" (200 mm) from roof deck down onto block walls and a min. 6" (150 mm) from block wall across onto metal deck. Apply insulation a min. 32" (800 mm) beyond each side of structural element penetrating through roof or wall insulation. Fill all voids at these areas. Install this insulation at all areas where spray applied insulation will remain exposed to the interior (including above acoustic tile and drywall ceiling locations).

3.3 CLEAN-UP

1. After completion of the fireproofing work, equipment shall be removed, and all exposed wall and floor areas shall be cleaned of deposits of sprayed fireproofing materials.

END OF SECTION

PART 1 GENERAL

1. 1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 WORK INCLUDED

1. Firestopping and smoke seals at wall to above grade floors and roof assemblies at all corridors and all other vertical fire separations, at fire rated walls (including 0 hr. rated walls), mechanical rooms, janitor rooms, washroom, servery, Library, changerooms, gym, etc., at both drywall and masonry walls. Mechanical/Electrical Sections of firestopping and smoke seals shall be by Mechanical and Electrical Contractors where their equipment and materials penetrated rated walls. See Project Information Sheet A0.2 and A0.3 for exact location of smoke/fire rated walls including '0' hour rated walls.

1.3 SAMPLES

1. Submit samples in accordance with Section 01300 – Submittals.

2. Submit 1'-0" (300 mm) x 1'-0" (300 mm) sample of each actual firestop material proposed for project.

1.4 QUALITY ASSURANCE

1. Applicator shall be licensed by the manufacturer of fireproofing materials with minimum three years documented experience for installing firestopping and smoke seal systems.

2. Submit manufacturer's certification that materials meet or exceed specified requirements.

3. Product manufactured under ULC Follow-up Program. Each container or package shall bear ULC label or listing mark.

1.5 SHOP DRAWINGS

1. Submit shop drawings and product data in accordance with Section 01300 – Submittals.

2. Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

3. Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.6 SEQUENCING AND SCHEDULING

1. Sequence work to permit installation of firestopping and smoke seal materials to be installed after adjacent work is complete and before closure of spaces.

1.7 MUNICIPAL AUTHORITY APPROVAL

1. Discuss firestopping and smoke seal requirements with municipal building inspector to obtain their approval prior to installation. Determine which products and/or procedures will be required to obtain final approval.

2. Submit in writing, prior to commencing installation, full detailed descriptions of materials and methods to be employed for firestopping work to achieve full final approval of authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

1. Firestopping and smoke seal systems: A/D FIREBARRIER Firestop Systems by A/D Fire Protection Systems Inc., capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115-M85, and not to exceed opening sizes for which they are intended. Other manufacturers shall not be used unless approved in writing (5) days prior to tender closing. Approved Alternate Manufacturer: Tremco Ltd., Fire Stopping Systems.

2. Mineral Wool Backing Insulation: ULC Labelled, preformed non-combustible material A/D FIREBARRIER Mineral Wool by A/D Fire Protection Systems Inc.

3. Firestopping Sealant: ULC labelled, single component silicone based, A/D Silicone FIREBARRIER Sealant by A/D Fire Protection Systems Inc.

4. Firestopping Seal: ULC labelled, single component water-based seal, A/D FIREBARRIER Seal by A/D Fire Protection Systems Inc.

5. Spray-On Firestopping Sealant: ULC labelled, high performance single component, water-based, elastomeric acrylic firestop sealant, "TREMstop Acrylic SP" (sprayable grade) by Tremco Ltd.

6. Fire resistance rating of installed firestopping assembly not less than the fire resistance rating of surrounding floor and wall assembly as indicated on the drawings.

7. Firestopping system at openings around penetrations for pipes, ductwork, conduit and other mechanical and electrical items requiring sound and vibration control; elastomeric sealant type with mineral wool; do not use a cementitious or rigid seal at such location.

8. Primers: to manufacturer's recommendation for specific material, substrate, and end use.

9. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

10. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

11. Sealants for vertical joints: non-sagging.

12. Firestopping mortar is not acceptable for this project.

PART 3 EXECUTION

3.1 EXAMINATION

1. Examine existing conditions to receive this work prior to submitting shop drawings.

2. Examine surfaces to receive work of this Section and report any defects which may affect the Work of this Section.

3. Verify that openings are ready to receive the Work of this Section.

4. Confirm compatibility of surfaces to receive firestopping and smoke seal materials.

5. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

1. Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are dry and frost free.

2. Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.

3. Maintain insulation around pipes and ducts penetrating fire separation.

4. Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

1. Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

2. Seal holes or voids made through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained. For vertical sections, sealant is required only on the top side of the mineral wool. It is required on both sides for horizontal sections except only one side on ‘0’ hour rated walls.

3. Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

4. Tool or trowel exposed surfaces to a neat finish.

5. Remove excess compound promptly as work progresses and upon completion.

6. Install firestopping with smoke seal sealant on both sides of all fire rated walls except for '0' hour rated walls where sealants is required continuously only one side of mineral wool backing insulation.

3.4 INSPECTION

1. Notify architect when ready for inspection and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies.

2. Arrange for final inspection of the work of this Section by firestopping manufacturer and municipal building inspector prior to concealing or enclosing work. Make corrections required.

3.5 SCHEDULE

1. Fire and smoke seal at all areas where work is indicated on drawings (corridors, mechanical rooms, ceilings, janitor's room, washrooms, changerooms, servery, Library, gymnasium, etc. fire separations), and at locations as follows:

2. Generally, all locations required by code.

3. Penetrations through fire resistance rated (including 0 hour rated fire separations) masonry and concrete walls (except mechanical and electrical penetrations which will be firestopped by the mechanical and electrical contractors).

4. Top of fire resistance rated masonry and gypsum rated partitions and walls (Includes corridors noted as 0 hr. fire rating)

   NOTE: Refer to Architectural drawings for locations of vertical fire separations.

5. Intersection of fire resistance rated masonry.

6. Control and sway joints in fire resistant rated masonry.

7. Penetrations through all floor slabs and fire rated ceilings (except mechanical and electrical penetrations which will be firestopped by the mechanical and electrical contractors).

8. Openings and sleeves installed for future use through fire resistant rated separations.

3.6 CLEAN-UP

1. Remove excess materials and debris and clean adjacent surfaces immediately after application.

2. Remove temporary dams after initial set of firestopping and smoke seal materials.

3.7 CERTIFICATION

1. The manufacturer of the firestopping and smoke seal products shall inspect each application on site and certify in writing its fire rating.

2. Costs for manufacturer's site inspection of firestopping and smoke seals application and certification shall be included in this Contractor's Section base bid.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section, and shall apply as if repeated here.

1.2 DESCRIPTION

1. Description of Work:

    1. The work of this section shall be comprised of the fabrication, supply and installation of pre-fabricated Aluminum Architectural panel system as indicated on drawings and as specified herein. The specifications and drawings pertaining to this section's work are to portray the general design and particular building requirements. The Contractor will be responsible to ensure that the finished insulated metal wall system product meets or exceeds the general design requirements and finished usage of the building as specified herein.

2. The Contractor in conjunction with the Aluminum Architectural panel system Manufacturer will be required to ensure that the Aluminum wall cladding and their components are designed, engineered, adapted as required to satisfy the general design as indicated herein without significantly altering details, measurements, clearances, etc., while allowing for the proper installation of work of all other sections.

    1. Work Included:

        1. Preformed Aluminum Architectural Panel System cladding, fascia, closures, flashings, miscellaneous trim

        2. All subgirts (singular and bi-directional), support framing back to structure, spacers, clips, and fasteners.

        3. Sealants.

1.3 SUBMITTALS

1. Shop Drawings:

    1. Submit shop drawings in accordance with GC 3.11 of the General Conditions as per CCDC 2 2020 .

    2. Indicate dimensions of panel system, attachment methods, details of subgirts, anchorage details , framed openings, accessories, schedule of wall elevations, trim and closure pieces, loadings, fasteners, and related work.

    3. Indicate arrangement of panel system including joints, types and location

of supports, fasteners, and any special shapes. Provide engineered support system where required.

4. Fully detail membrane air/vapour barrier, thermal barrier, insulation, corner details, flashings at top and bottom of walls, and all other components in the system.

5. Indicate detailed description of mechanical, electrical, and other systems in work.

6. Describe requirements of other systems of components related to this work but provided by others. Obtain necessary information required to detail this work including methods of integration and securing

7. Design loading and accommodation for thermal expansion.

8. Each shop drawing shall be stamped by a Professional Engineer licenced in the Province of Ontario.

2. Samples:

1. Submit samples according to Section 01300 and as follows:

2. Submit preliminary 8" x 12" (200mm x 300mm) or larger colour sample of each prefinished aluminum panel.

3. Submit interlocking panel assembly approximately 3'-0" x 3'-0" (900 mm x 900 mm) in size of all fabricated materials forming a part of the panel system. Show weatherproof sealed exterior and interior joints.
1.

4. Mock-Up

1. Provide a 1200mm x 2400m (4'-0" x 8'-0") mock-up indicating panel colour, finish, joints, end conditions, connections, fastening, corner conditions and openings' conditions.

1.4 STANDARDS, DESIGN AND PERFORMANCE REQUIREMENTS

1. Design and test cladding system in accordance with the current edition of :

1. ASTM E283 "Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Door Under Specified Pressure Differences Across the Specimen".

2. ASTM E330 "Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference"

3. ASTM E331 "Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure

Difference".

4. CAN3 S157 "Strength Design in Aluminum"

5. Canadian Steel Sheet Building Institute (CSSBI) recognized member.

6. CSA S136-94 "Cold Formed Steel Structural Members".

7. National Building Code of Canada

8. Deflection of the individual panels is not to exceed 1/180th of the span for the specified wind forces acting on it.

9.. Design panels as a floating system to accommodate thermal movement caused by ambient temperature range without causing deterioration of the cladding.

10. Design expansion joints to accommodate movements in cladding and between cladding and structure to prevent permanent distortion or damage to the cladding.

11. Design wall system as pressure equalized open "Rain Screen System". The panel system shall have internal drainage paths to collect moisture and direct it via weep holes or openings to the exterior.

12. All fasteners on typical joints to be hidden from view where possible. Where fasteners must be exposed, heads must be countersunk.

13. Design wall system to maintain the following erection tolerances:

14. Maximum variation from plane or location shown on shop drawings 20mm/10m.

15. Maximum offset from true alignment between two adjacent members abutting end to end in line: 1.0mm minimum normal thickness of 6mm.

1.5 QUALITY ASSURANCE

1. Qualification of Manufacturer

1. Standard for appearance and performance of rainscreen cladding system as per "System R4-300 Dry Joint Pressure Equalized Rainscreen" by Riverside Group.

1. Contact Information:
www.riversidegroup.net
7675 Tranby Avenue
Windsor, ON N8S 2B7
519.945.1321

2. Manufacturer of cladding system and installer shall demonstrate at least

five (5) year's experience in projects similar in scope.

3. This section establishes the standard of quality required for the cladding system. Proposed substitutions must meet this standard and will be considered as follows:

    1. A written request for approval of a substitution is received at least ten (10) days prior to tender closing.

    2. The request includes a complete item-by item description comparing the proposed substitution to the specified system, together with manufacturer's literature, samples, test data, engineering standards and performance evaluation indicating comparable standards to those specified.

2. Requirements of Regulatory Agencies

    1. In addition to requirements of authorities having jurisdiction, carry out insulated metal wall system work in accordance with the latest edition of the following specific applicable requirements of following:

        1. Latest edition of Ontario Building Code, as currently amended

        2. CAN 3-S157 strength design in Aluminum

        3. CAN 3-136 Cold formed Steel Structural Members

        4. ASTM E330; E283 and E331

1.6 WARRANTY

1. Warrant work of this section against defects or deficiencies for a period of five (5) years from date work is certified as substantially performed in accordance with GC 24 of General Conditions of the contract.

2. The Contractor hereby warrants for twenty (20) years from substantial performance that system is covered against failure of factory applied finish, colour, that the panel system enclosure will be water and weather tight, structurally sound and free from distortion; that the exterior finish will not craze, peel, corrode or discolour; that the exterior cladding will not develop excessive fading or non-uniformity of colour, and will be free from blemishes or distortion due to thermal movement of the wall or normal movements of the building structure; that the gaskets, tape and sealants will be free from deterioration from sunlight, weather or oxidation and from permanent deformation and free from leaks under load.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

1. Provide necessary crating or bundling for shipment of components to site including protection against weather.

2. Mark and identify parts of panel system before shipping.

3. Protect prefinished panel system during fabrication, transportation, site storage and installation.

4. Store materials in accordance with manufacturer's recommendations and protected from the elements at Site under protection to prevent staining from the ground or from collection of water on material, or both; and secure against wind damage. Provide air circulation around finished metal surfaces.

5. Handle and protect galvanized materials from damage to zinc coating.

1.8 TESTING

1. Reports to cover tests described below shall be submitted. All test shall be conducted or witnessed by an independent agency without any financial or business interests in the wall system supplier. Testing on reasonable similar systems will be considered acceptable.

2. The largest typical panel size shall be tested in both pressure and suction based on procedures shown in ASTM E330, procedure "B". The support system for the panel shall mimic the intended use for the project. Panel defection under design load shall not exceed L/90. Panel ultimate strength shall be a minimum of two times the design load.

3. Air leakage of the air barrier shall be tested based on ASTM E283. The air barrier shall have penetrating fasteners to match the highest typical density to be used on the project. Air leakage should not exceed 0.02 L/(s • m^2) @ 75 Pa (0.004 cfm/ft. @ 1.57 lb./$ft.^2$)

PART 2 PRODUCTS

2.1 MATERIALS

1. Plate Aluminum Panels

1. Fabricated panels from aluminum alloy 3105-H14 or 3003-H14 with minimum nominal thickness of 6mm factory formed.

1. Note: an alternate price has bee asked for to provide 4 mm aluminum composite panels in lieu of 6 mm solid aluminum panels (If solid aluminum panels are used, colour selection is to incorporate custom colours).

2.2 BASIS-OF-DESIGN

1. Subject to compliance with requirements, provide the specified products and/or materials from indicated manufacturers. Other comparable products may be submitted as substitution requests eight (8) days prior to bid for Architect and/or Owner's review and approval.

2. Requests for substitutions will be considered in accordance with provisions of

Section 01500 - Substitutions.

3. Manufacturer: Kanalco Ltd. with PPG Color Coating Dry Joint System.

    1. Aluminum Composite Panels Color Coating:

    2. Duranar Coating (2-coat system). Base Colour Selection:

        1. Wood Look - Design Line to be selected from complete range
           Solid colour - Colorweld 500 to be selected from complete range

        3. Colours to be confirmed prior to ordering of any material

4. Approved Alternative:

    1. Dri-Design Wall panel System

    2. Emburite

    3. Kanalco. Ltd.

    3. Alpolic

    4. Vic-West

5. Finishes: All to be EcoClean

6. Colour to be selected / confirmed by architect from the manufacturer's full range / wood / solid / designs and colours. Thickness as recommended by manufacturer after factory forming of panels.

    1. Sheets are to be formed into a pan like profile complete with welded corners excluding 1.905mm aluminum panel which are stiffened by in clips and sealed. Welded corners are to be suitably ground to allow a smooth finish for painting.

    2. Panels are to be stiffened with z-shaped aluminum stiffeners with a maximum spacing of 610mm.

7. Extrusions: Fabricated from aluminum alloy 6063, temper T54 with minimum thickness of 2mm (0.080") or as required for structural adequacy.

8. Subgirts, Clips, Spacers: minimum 1.2 mm (0.048") thick formed galvanized steel; ASTM 653M Grade 230 with Z275 coating.

9. Supporting Girts for Aluminum Composite Panel System: aluminum extrusions of manufacturer's proprietary design, shaped, and sized to suit panel sizes and location of supporting substructure.

10. Fastening Systems:

1. Fasteners connection aluminum components to aluminum or galvanized steel be 304 stainless steel.

2. Other fasteners to be stainless steel.

3. Insulation: Vapour Barrier and sprayed foam insulation/air barrier at back up block by Section 04200 masonry contractor supplied and installed as per section 07214.

4. Closures: Flashing and Trim: Fabricate to profiles indicated on shop drawings or as required to meet performance requirements. Material to match panels in exposed locations, galvanized material in concealed locations.

5. Bituminous Paint: Best grade, quick drying, non-staining alkali resistant asphalt utility enamel

11. Sealants:

1. Concealed Locations: tape or compound, non-skinning, non-drying, butyl rubber.

2. Exposed Locations: one part silicone to CGSB CAN 2-19.13.

3. Primer: as recommended by sealant manufacturer.

2.3 FABRICATION

1. Spacer of Girt System: galvanized steel girt anchor or clip system designed to meet performance requirements specified. Design system to minimize direct heat transfer; avoid direct metal to metal contact wherever possible.

2. Fabricate wall components to comply with dimensions, thickness and details as shown on the shop drawings, including fascia and soffit panels and all companion flashing.

3. Fabricate all components of the system in the factory, ready for field installation.

4. Tolerances of the finished panels shall meet the following limitations.

1. Maximum variation from specified length and width of panel measure at perimeter:

2. +/-0.8mm up to 1219mm
3. +/-1.6mm up to 3048mm

5. Maximum variation from theoretical diagonal of finished panel is 5mm.

6. Maximum out of flatness (bow) of finished panel surface is 1/360 times longest dimension up to a maximum of 6.4mm for panels up to 3 square meters and 12.7mm for panels up to 9 square meters.

5. Flashings, Trim, Closures: fabricated to profiles indicated and as required to meet design and performance requirements. Use preformed corner pieces only. Use same material as exterior skin where exposed. Use galvanized sheet steel in concealed locations. Double back exposed edges.

PART 3 EXECUTION

3.1 PREPARATION

2. Prior to start of erection, examine existing work and report to Architect any unsatisfactory conditions.

3. Provide secondary steel framing for support of panel system, where such framing is required but not provided by structural steel Section. Install secondary framing in accordance with applicable requirements of CAN3-S16. 1 and CAN3-S136.

3.2 ERECTION

4. Install panel system in accordance with manufacturer's directions and as detailed on drawings.

5. Prior to installing subgirts/spacers to support work, Spray-on insulation/air vapour barrier Contractor to install air barrier membranes. (by Sections 07214 and 04200)

6. Fasten subgirts/spacers to supporting work. Provide additional framing at terminations, openings and penetrations.

7. Allow Spray foam insulation/air vapour barrier Contractor to install spray foam insulation/air vapour barrier prior to installing exterior skin.

8. Install exterior wall panel system with vertical and horizontal joints accurately aligned and tight fitting to conform with system tolerances.

9. Provide sealants, flashings, closures, covers and trim as indicated and as required to render work complete and finished in accordance with specified requirements. Install sealants in accordance with Section 07900, Sealants.

10. Coordinate installation of panel system with all other Trade Contractors working in the surrounding area.

3.4 TOUCH-UP AND CLEANING

1. Touch-up minor paint abrasions with matching touch-up paint.

2. Installer shall clean panel surfaces by dry wiping in the course of product installation.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section, and shall apply as if repeated here.

1.2 DESCRIPTION

1. Description of Work

    1. The Work of this Section shall be comprised of the fabrication, supply and installation of pre-fabricated metal wall system as indicated on drawings and as specified herein. The specifications and drawings pertaining to this section's work are to portray the general design and particular building requirements. The Contractor will be responsible to ensure that the finished insulated metal wall system product meets or exceeds the general design requirements and finished usage of the building as specified herein.

    2. The Contractor in conjunction with the metal wall system Manufacturer will be required to ensure that the metal wall cladding and their components are designed, engineered, adapted as required to satisfy the general design as indicated herein without significantly altering details, measurements, clearances, etc., while allowing for the proper installation of work of all other sections.

3. Work Included

    1. Preformed Metal wall cladding, caps, fascia, closures, flashings, miscellaneous trim

    2. All subgirts (singular and bi-directional), support framing back to structure, spacers, clips, and fasteners.

    3. Sealants.

1.3 RELATED SECTIONS

1. Unit Masonry - Section 04200
2. Rough Carpentry - Section 06100
3. Air/Vapour Barrier - Section 07195
4. Rigid Insulation - Section 07211
5. Built Up Asphalt Roofing - Section 07513
6. Caulking of Insulated Metal Wall System by this Section as per Section 07900
7. Refer to Mechanical Sections
8. Refer to Electrical Sections

1.4 SUBMITTALS

1. Shop Drawings

    1. Submit shop drawings in accordance with GC 3.11 of the General Conditions and Section 01300 – Submittals.

    2. Indicate dimensions, siding and soffit profiles, attachment methods, anchorage details for preformed insulated metal wall system, framed openings, accessories, reveals and control joints, schedule of wall elevations, trim and closure pieces, loadings, fasteners and related work.

    3. Indicate arrangement of prefinished metal cladding sheets including joints, types and location of supports, fasteners, and any special shapes.

    4. Fully detail membrane air/vapour barrier, thermal barrier, insulation, corner details, flashings at top and bottom of walls, and all other components in the system.

    5. Indicate detailed description of mechanical, electrical and other systems in work.

    6. Describe requirements of other systems of components related to this work but provided by others. Obtain necessary information required to detail this work including methods of integration and securing.

    7. Design Connections and material gauge to be submitted and signed by Professional engineer for applicable OBC loads.

2. Samples

    1. Submit samples according to Section 01300 and as follows:

        1. Submit preliminary 8" x 12" (200mm x 300mm) or larger colour sample of each prefinished metal panel.

        2. Submit interlocking panel assembly approximately 3'-0" x 3'-0" (900 mm x 900 mm) in size of all fabricated materials forming a part of the insulated metal wall system. Show weatherproof sealed exterior and interior joints.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

1. Appearance: exposed fasteners approved by the Architect; exposed surfaces free of distortion, twist, waves, and buckles.

2. Structural Loads: resist positive and negative wind pressures expected in this geographical area with a maximum allowable deflection of 1/180 of span. Components shall not vibrate when subjected to the effects of wind.
3. Moisture Control: prevent infiltration of water and snow into siding system. Provide means of draining space between insulation and exterior skin, in accordance with NRC Rain Screen Principles and drawing details.

4. Thermal Movement: accommodate expansion and contraction of component parts without causing buckling, failure of joints seals, undue stress on fasteners and other detrimental effects.

5. Structural Movement: accommodate movement between siding system and building structure caused by structural movement, without permanent distortion, racking of joints, breakage of seals or water penetration.

1.6 QUALITY ASSURANCE

1. Qualification of Manufacturer

1. Preformed metal shall be installed by manufacturer's construction forces or by an accredited erector under direct control and responsibility of manufacturer.

2. Requirements of Regulatory Agencies

1. In addition to requirements of authorities having jurisdiction carry out insulated metal wall system work in accordance with the latest edition of the following specific applicable requirements of following:

1. Latest Ontario Building Code, as currently amended,

2. CAN 3-S136

3. Applicable publications by Canadian Sheet Steel Building Institute.

1.7 WARRANTY

1. Warrant work of this section against defects or deficiencies for a period of five (5) years from date work is certified as substantially performed in accordance with GC 24 of General Conditions of the contract.

2. The Contractor hereby warrants that the metal wall system enclosure will be water and weathertight, structurally sound and free from distortion; that the exterior finish will not craze, peel, corrode or discolour; that the exterior cladding will not develop excessive fading or non-uniformity of colour, and will be free from blemishes or distortion due to thermal movement of the wall or normal movements of the building structure; that the gaskets, tape and sealants will be free from deterioration from sunlight, weather or oxidation and from permanent deformation and free from leaks under load.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

1. Provide necessary crating or bundling for shipment of components to site including protection against weather.

2. Mark and identify parts of metal roofing before shipping.

3. Protect prefinished steel sheet during fabrication, transportation, site storage and installation in accordance with CSSBI Sheet Steel Fact #3, January 2017.

4. Store materials flat at Site under protection to prevent staining from the ground or from collection of water on material, or both; and secure against wind damage. Provide air circulation around finished metal surfaces. Store insulation and adhesives in dry areas, heated as required to prevent damage to adhesives.
5. Handle and protect galvanized materials from damage to zinc coating.

PART 2 PRODUCTS

2.1 MATERIALS

1. Prepainted Sheet Steel:

    1. Base metal: hot dipped zinc coated (galvanized) sheet steel meeting requirements of ASTM A653.

    2. Manufacturer to be Vicwest or Agway Metal Products . Colors to be selected by Architect from maniufacturer's range prior to ordering material. Provide samples as requested for verification.

    3. Siding Profiles:
    1. equal to Vicwest AD300R
    To be installed vertically or horizontally as shown on the drawings.
    4. Colours: Allow 5 colours to be confirmed prior to ordering material:
    75% Stone Grey, 15% Bone White 5% Huron Blue, Burgundy & Antique Linin.
    Accent colours shall be randomly placed as per the drawings.

    5. Subgirts, Clips, Spacers: minimum 1.2 mm thick formed galvanized steel; ASTM 446 Grade A, zinc coating designation Z275.

    6. Fastening Devices: stainless or cadmium plated; colour match exposed fasteners with metal on which they occur.

    7. Closures: as recommended by manufacturer at all exposed locations.

    8. Bituminous Paint: Best grade, quick drying, non-staining alkali resistant asphalt utility enamel.

    9. Sealants:

        1. Concealed Locations: tape or compound, non-skinning, non-drying, butyl rubber.

        2. Exposed Locations: Spectrem 1 by Tremco or approved equal one part silicone sealant to CGSB 19.13-M87.

        3. Primer: as recommended by sealant manufacturer.

2.2 FABRICATION

1. Unless otherwise indicated use minimum 0.030" (0.76mm) core thickness sheet metal, tension levelled.

2. Spacer of Girt System: galvanized steel girt anchor or clip system designed to meet performance requirements specified. Design system to minimize direct heat transfer; avoid direct metal to metal contact wherever possible.

3. Wall Cladding Profiles: Profile for siding to be corrugated AD300R and AD200R by Vicwest, Agway Metal Products or approved alternate.

4. Finished exposed surfaces shall be prepainted steel, smooth and plain.

5. Flashings, Trim, Closures: fabricated to profiles indicated and as required to meet design and performance requirements. Use preformed corner pieces only. Use same material as exterior skin where exposed. Use galvanized sheet steel in concealed locations. Double back exposed edges.

PART 3 EXECUTION

3.1 PREPARATION

1. Prior to start of erection, examine existing work and report to Architect any unsatisfactory conditions.

2. Provide secondary steel framing for support of metal siding and soffit system, where such framing is required but not provided by structural steel Section. Install secondary framing in accordance with applicable requirements of CAN3-S16. 1 and CAN3-S136.

3.2 ERECTION

1. Install siding system in accordance with manufacturer's directions and as detailed on drawings.

2 Prior to installing subgirts/spacers to support work Spray-on insulation/air barrier Contractor to install vapour barrier and air barrier membranes. (by Sections 07214 and 04200)

3. Fasten subgirts/spacers and suspended metal soffit furring to supporting work. Provide additional framing at terminations, openings and penetrations.

4. Allow Rigid Insulation Contractor to install rigid insulation prior to installing exterior skin.

5. Install exterior wall and soffit skin with all joints accurately aligned and tight fitting.

6. Provide sealants, flashings, closures, covers and trim as indicated and as required to render work complete and finished in accordance with specified requirements. Install sealants in accordance with Section 07900, Sealants.

7. Coordinate installation of metal siding and soffit with all other Trade Contractors working in the surrounding area.

8. Leave metal siding and soffit systems in clean and neat condition.

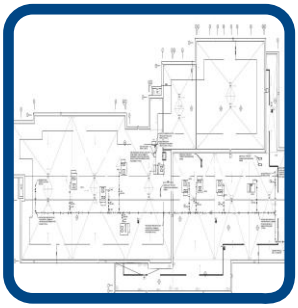
3.3 TOUCH-UP AND CLEANING

1. Touch-up minor paint abrasions with matching touch-up paint.

END OF SECTION

Consulting Engineers | Working Together, Better

New Port Elgin School Flat Roof Installation



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March 10, 2026
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EXISTING CONDITIONS AND OBJECTIVES

The objective of this project is the installation of the new SEBS hot-applied built-up-roof (BUR) on all roof areas (Stipulated Price), or 2-Ply Modified Bitumen (MB) (Alternate Price) at New Port Elgin School. The building features as shown in Figure 1 Roof Plan below and detailed in the scope of work.

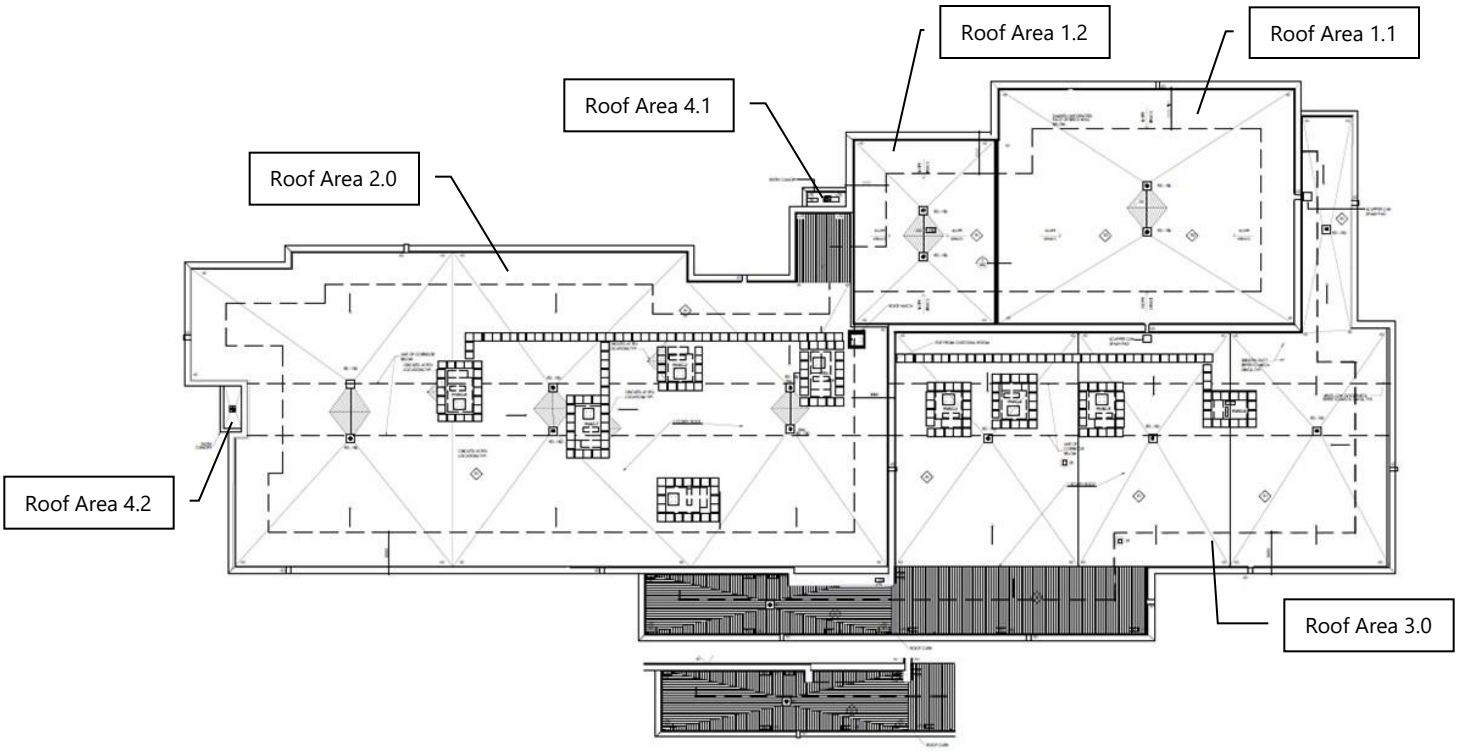

Figure 1: Roof Plan – New Port Elgin School.

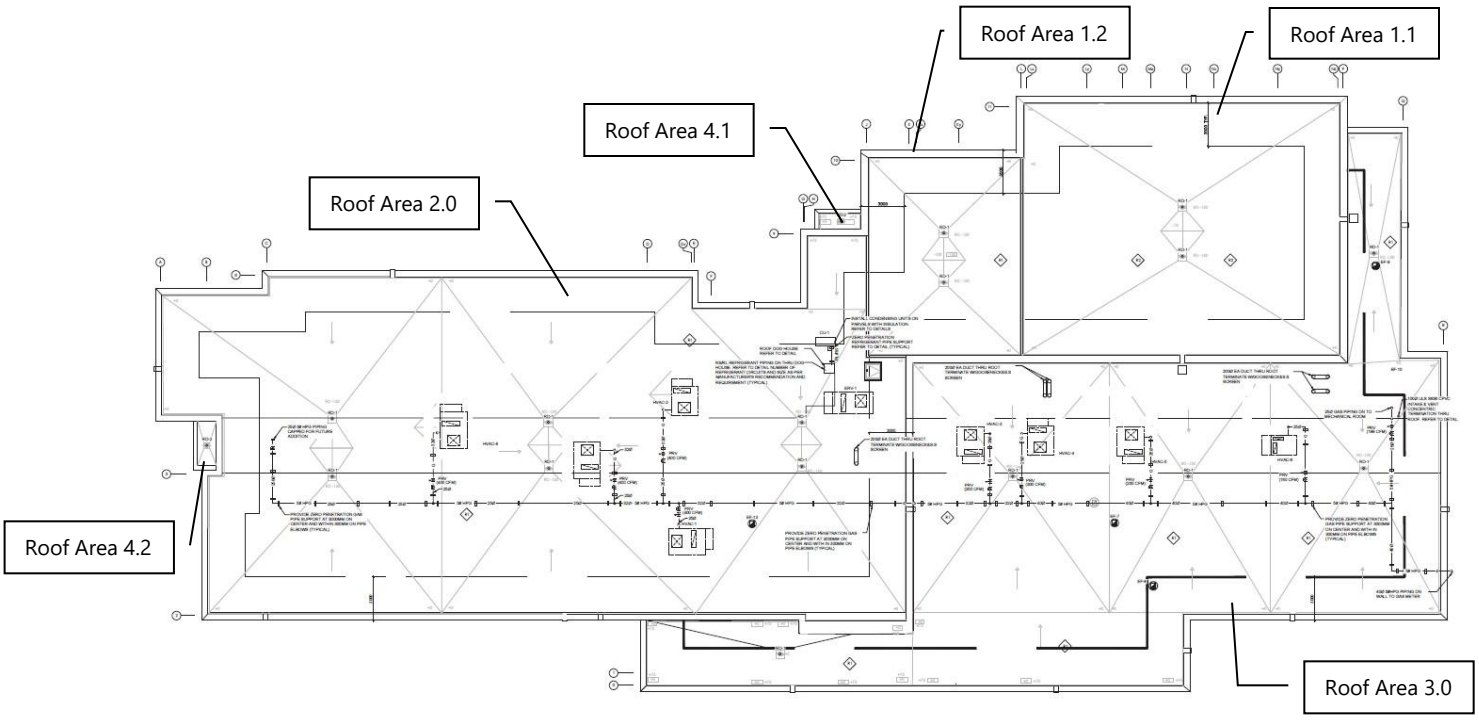

Figure 2: Roof Plan – New Port Elgin School.

STIPULATED AND UNIT PRICE ITEMS

Items outlined below coincide with the Stipulated Price or Alternate Price items listed on the Bid Form and are to include all materials, labour and equipment necessary to perform the work, to the full extent of the Specifications, including but not limited to the following:

.1 Contractor and staff must be certified by the membrane manufacturer and provide verification letter prior to tender.

.2 Upon award of the contract, Contractor to submit the following:

.1 Completed Manufacturer's project warranty application to the warranty provider advising them of the project and all relevant project related details. A two (2) year Contractor Warranty and twenty (20) year Manufacturer's Labour, Material and Workmanship System Warranty is required.

.2 Completed Manufacturer's material Technical Data Sheet (TDS) are to be included with bid submission to allow for review by Consultant.

.3 Review existing roof deck for any defects that may impact its structural integrity or the integrity of the new roof assembly and report deficiencies to Consultant. All areas that are damaged, deteriorated or otherwise deficient shall be repaired to the satisfaction of the Consultant. Contractor to track and submit invoices, documentation listing location and size of deck repairs. Unless otherwise directed, no deck repairs are to be carried out until the Consultant has been contacted for review and approval. Payment for this work will be from the contingency based on the tendered unit rate.

.4 Building Occupants will occupy premises during the entire construction period for execution of normal operations. Cooperate with Building personnel in scheduling operations to minimize conflict and to facilitate building usage.

.5 It is expected that the Contractor will ensure the safety and proper routing of the public. Maintain fire routes and exits and if they are affected as part of the work, include hoarding / overhead protection within the work area. No areas of access to or around the building are to be restricted without the approval of Building Management.

.6 Prior to commencement of the Work, record condition and take photographs of existing building and landscaping components. Provide daily and final cleanup to restore building and site landscaping (grassed areas, shrubs, and hard surfaces) to pre-construction conditions. During the completion of the Work, every attempt to minimize damage to landscaping shall be exercised, including the control of debris.

1.0 General

.1 **Mobilization, Access and Protection (Item 1.1):**

.1 Building Occupants will occupy premises during entire construction period for execution of normal operations. Cooperate with Building personnel in scheduling operations to minimize conflict and to facilitate building usage.

.2 It is expected that the Contractor will ensure the safety and proper routing of the public. Maintain fire routes and exits and if they are affected as part of the work, include for hoarding / overhead protection within the work area. No areas of access to or around the building are to be restricted without the approval of Building Management.

.3 Prior to commencement of the Work, record condition and take photographs of existing building and landscaping components. Provide daily and final cleanup to restore building and site landscaping (grassed areas, shrubs, and hard surfaces) to pre-construction conditions. During the completion of the Work, every attempt to minimize damage to landscaping shall be exercised, including the control of debris.

.4 Provide access to the work area as required to facilitate review by the Consultant as described herein.

.5 Install temporary protection for all building components, i.e., parging, masonry, siding and/or concrete to ensure safe, clean, and orderly removal and replacement work. All spatter or staining on existing elements as the result of the roofing work shall be removed at the Contractor's cost. Contractor shall assume responsibility of existing elements and new roofing assembly where solvents are required to remove spatter and staining which will adversely affect the elements to be cleaned.

.6 Weather protection and enclosures as required are to be included in this item and will not be considered as an additional cost after award of the project. Provide weather protection for building components exposed during demolition / removals and/or winter protection and heat as required to perform the work and as specified.

.7 Protect moisture sensitive materials being stored outside from inclement weather using 8oz vinyl tarpaulins adequately secured to prevent blow off. All temperature sensitive materials shall be stored in a heated location with a minimum temperature of 5°C (40°F) and removed only as needed. Under no circumstances shall temperature sensitive materials be allowed to freeze.

.8 All materials shall be delivered and stored in their original packaging bearing the manufacturers label, grade, and product weight, including all other related standards, specifications, and the like. All materials in a rolled configuration shall be stored on end a top a skid to protect bottom surface from foreign debris and moisture.

.9 Conventional Roof Protection (insulation under waterproofing membrane): Provide rigid insulation, polyethylene sheeting and plywood sheathing below access rigging and where equipment or materials are stored on the roof**.**

.10 Coordination of trades will be the responsibility of the Contractor to ensure the work is completed as soon as possible.

.11 For work completed by a subcontractor, a representative of the general contractor must be present on site at all times.

.12 **A copy of the specification and details must be on site always for reference purposes.**

2.0 Flat Roof Installation

The following information is for reference purposes only, and the Roofing Contractor is responsible for confirming roof assembly and square footage information prior to bid submission.

Roof assembly information is presented with components listed in order, from top to bottom:

New Roof Assembly: SEBS Hot-Applied Low-Slope Built-Up-Roof (BUR) System

	Roof Areas 1.1, 1.2, 2.0, 3.0, 4.1 and 4.2
Ballast	Pea-stone gravel embedded in SEBS modified asphalt flood coat (Refer to Section 07 51 13 for Options); over
Membrane	1-Ply Composite Ply and 2-Ply Type IV Fiberglass in SEBS Hot Applied Asphalt (Refer to Section 07 51 13); over
Overlay Insulation	½" (13 mm) HD Coated Fiberboard Insulation Refer to Section 07 51 13 for Options in SEBS Hot Applied Asphalt; over
Base Insulation	2-Layers of 3" (75mm) ISO Insulation Mechanically Fastened; over
Vapour Retarder	Self-Adhered Membrane
Thermal Barrier	Existing ½" (13 mm) Gypsum Board
Deck	Lightweight Fluted Steel
Deck	Non-Cellular Acoustical Steel

Roof Assembly and Related, New Port Elgin School Roof Areas 1.1, 1.2, 2.0, 3.0, 4.1 and 4.2 (Items 2.1 through 2.6): Supply all materials, labour and equipment required to complete roof replacements in accordance with Section 07 51 13, 07 62 00, 07 92 00 including, but not limited to the following:

.1 All mechanical, electrical, and internal plumbing work to be completed by others.

.2 Sweep and vacuum roof deck surface to remove all stones, debris, and particulate. Carefully inspect the condition of the roof deck for defects and discrepancies and report them to the Owner/Consultant in writing. Do not proceed with work until surfaces are satisfactory.

.3 Provision and installation of new wood blocking as required to ensure the following are above the completed roof assembly, and on vertical surfaces.

.1 Curbs are to be a minimum of 8" (200 mm).

.2 Perimeters and expansion joints are to be a minimum 6" (150 mm) providing a 10% slope into the roof.

.3 Walls are to be a minimum 12" (300 mm).

.4 Fill in all voids around the roof perimeter and all penetrations using expanding spray polyurethane foam insulation. Use batt insulation around void to prevent foam from dripping into the building.

.5 Provision and installation of fiberglass trapezoidal shaped infill that matches the existing acoustical steel deck profile.

.6 Provision and installation of new ½" (13mm) gypsum board tight together without damaged. Stagger boards a minimum 2' (600mm) adhered in low-rise foam adhesive.

.7 Provision and installation of new specified self-adhered vapour retarder membrane over primed roof deck and extending up the vertical surface a minimum of 3" (75 mm) above the cant strip along the roof perimeter, curbs, and penetration locations.

.8 Submit shop drawings for tapered insulation layout to the Consultant for review prior to fabrication.

.1 Base Insulation

.1 Provision and installation of new 2-layers of 3" x 4' x 4' ISO (inorganic facer) insulation mechanically secured with five (5) fasteners per board. Stagger boards a minimum 1' (300mm) to prevent thermal bridging.

.2 Tapered Insulation

.1 Provision and installation of new 2% tapered insulation saddles between all roof drain locations, and cricket at all mechanical curb locations where water butts against from sloped roof area (Refer to Figure 1 Roof Plan).

.3 Overlay Insulation

.1 Provision and installation of new ½" x 4' x 4' HD coated fiberboard overlay insulation or 3/16" x 4' x 8' mineral-reinforced asphaltic board (Refer to Section 07 51 13 for Options) adhered in hot applied asphalt. Stagger boards a minimum 1' (300mm) to prevent thermal bridging.

.9 Provision and installation of fully adhered wood fiber cant strip at the base of perimeters and curbs adhered in hot-applied SEBS modified asphalt.

.10 Provision and installation of new specified 1+2 ply (BUR) membrane fully adhered with hot-applied SEBS modified asphalt (Refer to Section 07 51 13).

.11 Provision and installation of new specified flashing membrane fully adhered with hot-applied SEBS modified asphalt (Refer to Section 07 51 13).

.1 For the new specified 2-ply SBS modified bitumen flashing membrane, install gussets and heat-weld using a hot-air welder at all end and side laps for all layers of SBS modified bitumen membrane flashings.

OR

.2 1-ply EPDM/SBR flashing membrane corners and side laps to be reinforced with mesh and rubberized mastic. Leading edge reinforcement using reinforcement mesh and hot-applied SEBS modified asphalt.

.12 Plumbing Vent

.1 Provision and installation of new wood blocking and vandal-proof plumbing vent and electrical flashings with new spun-aluminum stack jackets; extend or cut existing plumbing vent pipes, as necessary to suit height of new flashing a minimum 12" (300 mm) higher than the completed roof assembly. Insulate between plumbing pipe and flashing and apply specified silicone sealant (tooled) around top of penetration. Install vandal-proof cap mechanically fastened with two stainless screw per cap.

.13 Roof Drain

.1 Provision and installation of new wood blocking and new copper roof drains with flat flange and hard connections and 2% tapered roof drain sump a minimum 16' x 16'.

.1 Ensure that the completed drain and scupper installation is lower than the completed roof surface in the field-of-roof.

.14 Perimeter Roof Drain Scupper Downspouts

.1 Provision and installation of new wood blocking and fully soldered 20oz. copper roof drain scupper with a 6" wide box and 4" outlet/leader with 2% tapered roof drain scupper sump a minimum 8' x 16' at all locations. Brazed scuppers will not be accepted.

.1 Ensure that the completed scupper installation is lower than the completed roof surface in the field-of-roof.

.2 Install new 4" x 4" open-face prefinished metal with all associated accessories with a 2" offset from top to bottom to allow water to continually flow within (Photographs 22 and 23). Colour to be chosen by Owner.

.2 Secure downspout using stainless steel self-tapping screws. Sealant at laps and ends with specified sealant.

.3 New open-faced downspouts are to be installed connected to the scuppers.

.15 If during the roof replacement a pitch pan is required, provision, and installation of new 16oz. - 6" x 6" copper pitch pan with fully soldered joints filled with quick dry patching mortar and ChemLink 1-Part pourable penetrating sealant and M-1 structural adhesive/sealant. Size may vary (Unit Price). Brazed scuppers will not be accepted.

.16 Provision and installation of new weatherstripping at the ventilation curbs.

.17 Provision and installation of new 2" x 2' x 2' (25 mm x 600 mm x 600 mm) concrete pavers, supported on 1" (25 mm) extruded polystyrene (XPS) insulation at all HVAC condensates drainpipes (2 per location) (Photograph 23) and roof access ladders (2 per location). Refer to Roof Plan A2.3.

.18 Provision and installation of SEBS modified hot melt adhesive flood coat and clean ⅜" (10 mm) nominal size pea-stone gravel, over completed built-up-roof (BUR) membrane. **Double pour all prevailing wind corners (NW corners) in an L-shape, 10' x 10',**

.19 Gas Lines

.1 Wire brush and repaint all gas lines with two (2) coats of bright yellow rust inhibiting paint using rollers. **Paint cans will not be permitted**.

.20 Temporary tie-in (night-seal) shall be achieved by extending membrane of the new roof membrane onto the existing roof system a minimum distance of 24" (600 mm). Membrane shall be fully adhered using compatible materials as per manufacturer's recommendations.

.21 Metal flashing installation is to be completed as per 07 62 00 - Sheet Metal Flashing and Trim.

.1 Metal flashing colour to be chosen by Owner.

.22 Sealant application is to be completed as per 07 92 00 – Sealant.

.1 All sealants must be tooled. Untooled sealant will not be accepted.

.2 Clear sealant will not be accepted.

.23 Warranty

.1 Manufacturer's technical representative to perform periodic site visits and provide work-in-progress observation reports to Consultant.

.1 Contractor and Manufacturer Warranties refer to Sections 07 51 13 and 07 52 16.

ALTERNATIVE PRICES

Items outlined below coincide with the Alternative Price to complete 2-ply Self-Adhered Modified Bitumen (MB) assembly replacement in accordance with Sections 07 52 16, 07 62 00, 07 92 00 items listed on the Bid Form and are to include all costs associated.

QUALIFICATIONS

.1 The above is to be considered a general description of the work to be completed and must not be construed as limiting the scope of work.

.2 All quantities / measurements to be confirmed by Contractor from on-site take-offs.

END OF SECTION – 01 11 50

PART 1 - GENERAL

1.1 General Requirements

.1 All conditions of the contract and Division 1, General Requirements apply to this section.

.2 All materials and equipment must be set up in a position satisfactory to the Owner's representative.

.3 Scheduling of the work shall be discussed with and be subject to the approval of the Owner.

.4 Provide a minimum 24-hour notice to the Consultant and the Owner prior to proceeding with any work that may disrupt building access or services.

1.2 References

.1 Comply with requirements of the following documents, latest edition:

.1 Canadian Standards Association CSA S350, Code of Practice for Safety in Demolition of Structures.

.2 Occupational Health and Safety Act and regulations for Construction Projects

.3 National Building Code of Canada, Part 8, "Safety Measures at Construction and Demolition Sites", and Provincial requirements.

1.3 Quality Assurance

.1 Notify the Consultant for review and confirmation of the following items:

.1 final repair review.

1.4 Asbestos and Designated Substances

.1 The Contractor shall request if a Designated Substance Survey has been performed by the Owner in the work area for this project. Where/if designated substances have been identified, the material(s) must be removed by a qualified Hazardous Material Abatement Contractor which is approved by the client and outlined per the Designated Substance Survey Report, which is prepared and made available by the Owner's Environmental Consultant.

PART 2 - PRODUCTS

.1 Not Used.

PART 3 - EXECUTION

3.1 General Protection

.1 Minimize noise, dust, and inconvenience to occupants.

.2 Protect existing building systems, services and equipment.

.3 Provide temporary dust screens, covers, railings, supports and other protection as required.

.4 Provide required signage, barricades, hoarding, overhead protection and temporary egress in accordance with Occupational Health and Safety Act and Section 01 56 00 – Temporary Barriers and Enclosures.

.5 Support affected structure or building components and if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures and then cease operations and notify Consultant immediately.

.6 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater, and wildlife, or contribute to excess air and noise pollution.

.7 Do not dispose of waste or volatile materials such as: mineral spirits, oil, petroleum-based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

.8 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

.9 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

.10 Protect trees, plants and foliage on site and adjacent properties where indicated.

.11 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.

.12 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

3.2 Demolition Salvage and Disposal

.1 Remove parts of existing structure to permit repairs or new construction. Sort materials into appropriate piles for recycling and or reuse.

.2 Refer to demolition drawings and specifications for items to be salvaged for reuse if applicable.

.3 Remove items to be reused, store in a protected location, and reinstall under appropriate section of specification.

.4 Trim edges of partially demolished building elements to suit future use.

.5 Include for the disposal of removed materials to appropriate Landfill and/or recycling facilities, except where specified otherwise, in accordance with authority having jurisdiction.

.6 Dispose of debris on a continuous basis. Do not stockpile debris in a manner which would overload the structure or impede access around the site. Use approved safe method(s) of conveying materials to and from grade level as follows:

.1 Under no circumstances shall material be dropped from one roof level to another. Use hoists and other similar equipment.

.2 Method(s) of conveying materials shall not damage existing building elements and surfaces to remain, and steps must be taken to protect and ensure safety of same during demolition and until construction is complete.

END OF SECTION – 02 41 19

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PART 1 - GENERAL

1.1 General Requirements

.1 All conditions of the contract and Division 1, General Requirements apply to this section.

.2 All materials and equipment must be set up in a position satisfactory to the Owner's representative.

.3 All materials shall be new and in perfect condition, free from defects which may impair strength, durability, or appearance.

.4 Scheduling of the work shall be discussed with and be subject to the approval of the Owner.

1.2 References

.1 Comply with requirements of the following documents, latest edition:

.1 ASTM D1761, Standard Test Methods for Mechanical Fasteners in Wood.

.2 ASTM D5456, Standard Specification for Evaluation of Structural Composite Lumber Products.

.3 CAN/CGSB-11.3, Hardboard.

.4 CAN/CGSB-71.26, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.5 CSA B111, Wire Nails, Spikes and Staples.

.6 CSA O112, CSA Standards for Wood Adhesives.

.7 CSA O121, Douglas Fir Plywood.

.8 CAN/CSA O122, Structural Glued-Laminated Timber.

.9 CSA O141, Softwood Lumber.

.10 CSA O151, Canadian Softwood Plywood.

.11 CSA O153, Poplar Plywood.

.12 CSA O325, Construction Sheathing.

.13 CSA O437, Standards on OSB and Waferboard.

.14 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.

.15 FSC-STD-20-002, Structure and Content of Forest Stewardship Standards V2-1

.16 FSC Accredited Certified Bodies.

.17 NLGA Standard Grading Rules for Canadian Lumber [2007].

.18 Ontario Building Code.

1.3 Quality Assurance

.1 All carpentry work to comply with best practices of trade and by skilled carpenters.

.2 Provide carpentry alterations and comply with best practices of the trade.

.3 Make adjustments to specified procedures caused by weather and site conditions only with the Owner's approval.

1.4 Delivery, Storage and Handling

.1 All materials shall be delivered and stored in their original packaging bearing the manufacturers label, grade and product weight, including all other related standards, specifications, and the like.

.2 All materials shall be adequately protected from inclement weather conditions and stored in a dry, well ventilated and weather protected location.

.3 All materials shall be stored to protect bottom surface from moisture.

.4 Handle and store products in a manner to prevent damage and deterioration.

.5 Remove and replace damaged materials at own expense and to the satisfaction of the Consultant.

1.5 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with applicable local, provincial, and national regulations. Include for tipping fees associated with landfills and recycling depots.

1.6 Environmental Requirements

.1 Weather dry.

.2 Imminent weather forecast, dry.

.3 Use only dry materials and apply only during weather that will not introduce moisture into the system.

.4 All new and temporary construction at higher elevations, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off.

PART 2 - PRODUCTS

2.1 Materials

.1 Lumber to be identified by grade stamp of an agency certified by the Canadian Lumber Standards Administration Board (N.L.G.A.).

.2 Blocking and Rough Framing

.1 Grade No. 2, Northern Softwood in accordance with the "Standard Grading Rules for Canadian Lumber" as issued by the National Lumber Grades Authority (N.L.G.A.).

.2 Spruce, #1 Softwood, conforming to CSA 0151.

.3 Wood Cants: 89 x 89mm (4 x 4").

.3 Plywood Sheathing

.1 Exterior, Spruce #1, conforming to CSA 0151 or O121, exterior grade, G1S. Thickness of 13mm (1/2") and/or 19mm (3/4") as noted on drawings.

.4 Nails

.1 Ardox spiral, to CSA Standard B111, length to give 38mm (1.5") minimum penetration into materials being fastened.

.5 Screws

.1 Fasteners for wood: Galvanized steel wood screws with countersunk heads of size and length to provide minimum 38mm (1-½ in.) penetration into underlying member.

.2 Fasteners for steel substrates: Flat head, self-tapping steel screw with galvanized finish as supplied by Fastening House, or Approved Alternate. Length: to suit penetrate through member a minimum of 19mm (3/4").

.3 Fasteners for masonry and concrete substrates: Tapcon fasteners with "Climaseal" corrosion resistant finish, as manufactured by Buildex/Red Head, or Approved Alternate. Screw to be of sufficient length to penetrate into substrate a minimum of 38 mm.

.4 Bolts, Washers and Nuts: to ASTM A307. Size as indicated on Drawings. Hot dipped galvanized or approved equivalent corrosion resistant finish.

PART 3 - EXECUTION

3.1 Examination

.1 Examine the drawings and specifications to determine the extent of the work involved, together with other data affecting the work, as in no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the extent of such work shown, herein described or implied.

.2 Ensure that existing wood blocking to be incorporated with the work is in good condition and permanently and properly secure to existing surfaces.

.3 Inform Consultant of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Installation

.1 Cut, align, plumb, and secure wood to conform to the full intent of the details. Shim new wood assembly where required in order to obtain true to line levels.

.2 Construct continuous members from pieces of longest practical length. Treat all saw cuts with wood preservative.

.3 Countersink bolts where necessary to provide clearance for other work.

.4 Replace all damaged material and reseal masonry anchors as required to conform to design intent herein described.

.5 Install spanning members with "crown-edge" up.

.6 Install cant strips and blocking as indicated on drawings, secured permanently to structure trimmed and levelled to accommodate chamfers and slopes. Install to accommodate insulation, roofing and flashing materials.

.7 Install continuous plywood sheathing, wood blockings, cants, studs, nailers and continuous shims where required and detailed on Drawings and Details. Shims to be of sufficient height to ensure a minimum two (2%) percent positive slope on all parapet, perimeter and dividing walls.

.8 Install roof sheathing in accordance with requirements of NBC.

.9 Install furring and blocking as required to space-out and support facings, fascia, soffit, siding, and other work as required.

.10 Install furring to support siding applied vertically where sheathing is not suitable for direct nailing.

.11 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.12 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.13 Use nailing disks for soft sheathing as recommended by sheathing manufacturer

.14 Provide new exhaust fan and duct penetration curbs. Width and length of curbs to match the existing. Curbs shall be a minimum of 600mm (24") above the height of the roofing membrane.

.15 Fabricate sleepers, expansion joints, perimeters, and walls as detailed. Maintain a minimum height of 300mm (12") above the finished roof surface for sleepers and curbs and where permitted at walls.

.16 Securely anchor wood blocking, cant strips, nailers and shims in place at 300mm (12") on centre in a staggered pattern. Fasten studs to top and bottom plates with two screw fasteners. Fasten wood blocking, wood cant strips, nailers and shims to the existing substrate with the appropriate screw fasteners. Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping fasteners in from edges.

.17 Fasten plywood along supported edges at a minimum of 150mm (6") on centre. Fasten to framing members within the field of the plywood panel at a maximum of 450mm (16") on centre. Fasten plywood to framing and existing substrate with appropriate fasteners. Place plywood so that the surface grain is perpendicular to the framing members. Provide minimum 2mm wide gaps between edges of plywood to allow for material expansion.

.18 Re-fasten loose existing wood blocking, cants, shims and plywood with screw fasteners where permitted to remain as part of the finished work and to the satisfaction of the Consultant.

.19 Coordinate work to keep cutting and remedial work to a minimum. Fasteners shall be of size and spacing required to assure secure anchorage. The fastener spacing of wood blocking to the substrate and to each other shall not exceed 300mm (12") o.c. unless otherwise accepted in writing by the Consultant.

.20 Protect installed products and components from damage during construction.

.21 Repair damage to adjacent materials caused by rough carpentry installation.

3.3 Cleaning

.1 Maintain project free of accumulated waste and rubbish and remove from the Owner's premises on a daily basis.

.2 As the work progresses remove smears and droppings resulting from work of this section before it has time to set. Use recommended cleaners, as required.

END OF SECTION – 06 10 00

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PART 1 - GENERAL

1.1 General Requirements

.1 All conditions of the contract and Division 1, General Requirements apply to this section.

.2 All materials and equipment must be set up in a position satisfactory to the Owner's representative.

.3 All materials shall be new and in perfect condition, free from defects which may impair strength, durability, or appearance.

.4 Scheduling of the work shall be discussed with and be subject to the approval of the Owner.

.5 All work shall meet contract O.B.C., CRCA, NRCA, SMACNA requirements and good roofing installation practices.

.6 Work shall be executed to the highest standards of workmanship in the industry, by fully trained roofers and siding installers.

1.2 References

.1 Comply with requirements of the following documents, latest edition:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D 1079 "Terminology Relating to Roofing and Waterproofing.

.2 ASTM C1325 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.3 ASTM C578: Rigid, Cellular Polystyrene Thermal Insulation.

.4 ASTM D41: Asphalt Primer Used in Roofing, Damp-proofing, and Waterproofing.

.5 ASTM D312: Asphalt Used in Roofing.

.6 ASTM D2822: Asphalt Roof Cement.

.7 ASTM D4601, Type II: Standard for Asphalt Coated Glass Fibre Base Sheet Used in Roofing.

.8 ASTM D6162: SBS Mod. Bit. Sheets Using Polyester & Glass Fiber Reinforcements.

.9 ASTM D6163: SBS Mod. Bit. Sheets Using Glass Fiber Reinforcements.

.10 ASTM D6164: SBS Mod. Bit. Sheets Using Polyester Reinforcements.

.11 ASTM D2178-97a: Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

.12 ASTM D6162-00: Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

.13 ASTM D6163-00: Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

.14 ASTM D6152-99: Standard specification for SEBS-Modified Mopping Asphalt Used in Roofing

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 37.29M: Rubber-Asphalt Sealing Compound.

.2 CAN/CGSB 37-GP-9M: Primer, Asphalt, unfilled, for Asphalt Roofing and Waterproofing.

.3 CAN/CGSB 37-GP-15M: Application of Asphalt Primer for Asphalt Roofing & Waterproofing.

.4 CAN/CGSB 37-GP-56M: Membrane, Bituminous, Prefabricated and Reinforced for Roofing.

.5 CAN/CGSB 51.26M: Thermal Insulation, Urethane and Isocyanurate, Boards, Faced.

.6 CAN/CGSB 51.33M: Vapour Barrier Sheet, Excluding Polyethylene, for use in Construction.

.7 CAN/ULC S701: Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.8 CAN/ULC S704 and CAN/ULC-S770: Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Fixed.

.9 CAN/ULC-S107-10: Standard Methods of Fire Tests or Roof Coverings.

.10 CGSB 37 GP 9Ma: Primer, Asphalt, Unfilled, for Asphalt Roofing, Damp¬proofing and Waterproofing.

.11 CGSB 37-GP-52M: Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric.

.12 ASTM D6152-99: Standard specification for SEBS-Modified Mopping Asphalt Used in Roofing.

.13 CAN/CGSB 51.33 M89: Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction

.3 Canadian Standards Association (CSA)

.1 CSA A231.2-14 Precast Concrete Paving Slabs.

.2 CSA A123.21-04 - Dynamic Wind Uplift Resistance of Roof Assemblies.

.3 CSA B111 - Wire Nails, Spikes and Staples.

.4 CAN/CSA A123.2: Asphalt Coated Roofing Sheets.

.5 CAN/CSA A123.3: Asphalt Saturated Organic Roofing Felt.

.6 CAN/CSA A123.16: Asphalt Coated Glass Base Sheets.

.7 CAN/CSA A231.1: Precast Concrete Paving Slabs.

.8 CAN/CSA 0121M: Douglas Fir Plywood.

.9 CAN/CSA 0151M: Canadian Softwood Plywood.

.4 Underwriter Laboratories

.1 Wind Uplift Resistance of Roof Assemblies - UL 580, UL 1817.

.5 Sheet Metal & Air Conditioning Contractors' National Association (SMACNA) Manual (Latest Edition).

.6 NRCA (National Roofing Contractors Association) and CRCA (Canadian Roofing Contractors Association) – Roofing and Waterproofing Manual.

.7 Ontario Building Code (OBC) 5.2.2.2. Determination of Wind Load – Membrane.

.8 Conform to National Plumbing Codes and requirements of Provincial and Municipal Authorities. Most stringent requirements shall govern where in conflict.

1.3 Quality Assurance

.1 Contractor and his staff must be pre-approved and licensed by the membrane manufacturer, Owner, and Consultant prior to tender.

.2 Field review of roofing application will be carried out by Consultant. Contractor to make site available for inspection at Consultant's request. Any work not accepted by the Consultants shall be corrected by the Contractor to meet the requirements of the specifications, manufacturer's recommendations and/or good construction practices.

.3 The Contractor shall arrange for a technical representative of the manufacturer to review the installed roof system wherever a System Warranty has been specified.

.4 Manufacturer's representative to visit site a minimum twice weekly (or more if warranty requirements dictate), to review work in progress. Written reports shall be issued to all parties. A final review shall be made upon completion of the project in conjunction with Owner and Consultant.

.5 Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise designer of any discrepancies prior to commencement of the Work.

.6 Maintain one copy of the specification and manufacturer's literature on site throughout the execution of the Work.

.7 At the beginning of the Work and at all times during the execution of the Work, allow access to site by the Consultant and roofing membrane manufacturer's representative.

1.4 Submittals

.1 Submit to the Consultant a list of materials intended for use, before they are ordered, after award of contract.

.2 Provide initial schedule within five (5) working days after Contract award, showing anticipated progress stages and final completion of work. Work shall not commence before work schedule is provided.

.3 Shop Drawings

.1 Submit Shop Drawings before proceeding with fabrication, including but not limited to the following:

.1 Tapered Insulation layout.

.4 Submit product data, including MSDS sheets, indicating membrane and bitumen materials and base flashing materials.

.5 Submit manufacturer's installation instructions.

.6 Provide a copy of the system manufacturer's warranty with the tender submission.

1.5 Mock-Ups

.1 When the requirement for a mock-up is requested in individual Sections or shown on the Drawings, erect mock-ups at locations acceptable to the Consultant for approval.

.2 Reviewed and accepted mock ups will become standards of quality of Work and material against which installed Work will be verified.

.3 Failure to prepare a mock-up in a timely manner is insufficient reason for an extension of Contract time.

.4 Verify all dimensions and conditions and provide alterations required to adapt Work to specific site conditions without additional cost.

.5 Allow 24-hours for review of the mock-up.

.6 All colours to be approved by the Owner.

.7 The mock-up, if acceptable to the Consultant, may form part of the finished Work.

1.6 Delivery, Storage and Handling

.1 All work to be conducted from the exterior using, hoist, etc.

.2 Site storage is limited. Location of storage to be coordinated with Owner.

.3 All materials shall be delivered and stored in their original packaging bearing the manufacturers label, grade and product weight, including all other related standards, specifications, and the like.

.4 All materials shall be adequately protected from inclement weather conditions. Only materials to be installed on the same day shall be removed from the protected location to the work site.

.5 Protect moisture sensitive materials being stored outside from inclement weather using 8oz vinyl tarpaulins adequately secured to prevent blow off. Provide openings in manufacturer's packaging as recommend by manufacturer to prevent the formation of condensation prior to tarping.

.6 All temperature sensitive materials shall be stored in a heated location with a minimum temperature of 5°C (40°F) and removed only as needed. Under no circumstances shall temperature sensitive materials be allowed to freeze.

.7 All materials in a rolled configuration shall be stored on end a top a skid to protect bottom surface from foreign debris and moisture.

.8 When possible, the Contractor should restrict stock piling of material in one location on the roof surface to prevent exceeding the specified deck live load capacity.

.9 Handle and store products in a manner to prevent damage and deterioration.

.10 Remove and replace damaged products at own expense and to the satisfaction of the Consultant.

.11 Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks, and excessive heat.

1.7 Waste Management and Disposal

.1 All roofing, insulation, flashings, and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable Municipal, Provincial, and Federal requirements.

.2 All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Contractor and properly transported to a legal dumping area authorized to receive such material.

1.8 Environmental Requirements

.1 Weather dry.

.2 Imminent weather forecast, dry.

.3 Install roofing on dry deck, free of water, moisture, snow, frost, and ice. Use only dry materials and apply only during weather that will not introduce moisture into roofing system.

.4 Only as much of the new roofing as can be made weather-tight each day, including all flashing and detail work, shall be installed.

.5 Comply with manufacturer's recommendations for minimum and maximum temperatures and humidity during application.

.6 Do not install roofing membrane when temperature remains below 5°C for self-adhesive installations, or as stated in manufacturer's written specifications. Apply materials in accordance with the manufacturers' written recommendations.

.7 All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

1.9 Safety and Protection

.1 General:

.1 The Contractor shall follow all safety regulations as required by OHS (Occupational Health and Safety) and any other applicable authority having jurisdiction.

.2 All rooftop contamination that is anticipated or that is occurring shall be reported to the manufacturer to determine the corrective steps to be taken.

.3 The Contractor shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense.

.4 Protect surrounding surfaces from work in progress by covering walls.

.5 Protect finished roofing at work areas or access to work areas with plywood underplayed with extruded polystyrene insulation.

.6 Work boots shall not be worn through the building. All scuffs, marks and stains on carpets, walls, and other surfaces that are as a consequence of re-roofing work, as determined by the Owner and Consultant, shall be cleaned at no cost to the Owner. If stains, marks, etc. are not removed to the satisfaction of the Owner, then the cost of replacement/refinishing of marred component shall be borne by the Contractor.

.2 Solvents, Adhesives and Membranes:

.1 Store only enough solvents and adhesives on the roof for the same day's use, do not leave adhesives on roof overnight. Manufacturer supplied adhesives to be stored in their overnight containers. Minimum temperature for solvent-based adhesive and primers is -5°C.

.2 Do not install roofing membrane when temperature remains below -18°C for torch application, or 5°C for self-adhesive installations. Apply materials in accordance with the manufacturers' recommendations.

.3 Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odours could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odour while ventilating the building. Keep lids on unused cans at all times.

.4 Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

1.10 Warranty

.1 Reviews by the System Manufacturer's representative shall only take place upon approval of the Consultant. Request for such site visits shall be provided to the Consultant at least 48-hours prior to requested site visit.

.2 All roofing work is to meet or exceed CRCA standards as well as roof system Manufacturer's requirements.

.3 Contractor's Warranty

.1 Contractor shall supply the Owner with a two (2) year Contractor Warranty for workmanship.

.2 In the event any work related to materials installed is found to be within the Contractor warranty term, defective or otherwise not in accordance with the Contract Documents, the Contractor shall repair that defect at no cost to the Owner within 48 hours of receipt of notification. The Contractor shall also pay for all damages resulting from aforementioned defects.

.3 The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.

.4 Warranty shall be issued on the corporate letterhead and signed by an authorized signing officer.

.5 Nothing contained in this article shall be construed as in any way restricting or limiting the liability in common law and statutory liability of the Contractor.

.4 Manufacturer's Warranty

.1 Provide a sample copy of the system manufacturer's warranty with tender submission.

.2 Manufacturer's Extended Warranty: The Manufacturer shall issue a non-prorated warranty for a period of Twenty Years (20-years) at no cost to the Owner. All components including the vapour retarder, insulation, cover board, membrane, flood coat, perimeter flashings including metal shall be covered under this warranty. Wind uplift warranty shall cover wind velocity up to a maximum wind speed of not greater than 117 km/h (73 mph).

.3 Documentation shall be provided that the Manufacturer has personnel to carry out above noted warranty requirements and has a history of providing these for a minimum of 5 years.

.4 Record noted deficiencies and arrange for their proper repair under warranty.

.5 Should leaks occur in any area of the Manufacturer's product roof assembly during the warranty period, Manufacturer warrants that it will furnish, no-charge, sufficient material, and labour to correct the affected area(s). Any repair required under the warranty will be carried out in accordance with the specifications at no cost to the Owner.

.6 The warranty may be transferable subject to review and approval of Manufacturer.

.7 Nothing contained in this article shall be construed as in any way restricting or limiting the liability in common law and statutory liability of the Manufacturer.

.8 Under the terms of the warranty, the Roofing Contractor shall provide: A list of all necessary materials/procedures - as required by the Manufacturer to qualify for the warranty (and install such materials to the acceptance of the Consultant and Manufacturer).

PART 2 - PRODUCTS

2.1 List of Proposed Materials

.1 The use of materials other than those specified herein must be approved prior to award of the Contract. If substitute materials are proposed, then the list of materials must be included as part of the Tender Form. This submittal shall include product name, number and data sheets and manufacturer's specifications and installation instructions.

.2 Materials listed below are to be used on the project. Under no circumstances will substitute materials be used unless approval is first received from the Owner. Use of substitute materials without prior approval can result in the removal and replacement of these materials at no cost to the Owner.

.3 Note: all materials are to be supplied by one manufacturer meeting manufacturer's respective material compatibility requirements to achieve the required System Warranty. Acceptable membrane manufacturers for this project are:

.4 Components to be used that are other than those supplied or manufactured by the membrane manufacturer may be submitted for review and acceptance by the membrane manufacturer.

.5 The membrane manufacturer's acceptance of any other product is only for a determination of compatibility with the products and not for inclusion in the manufacturer's warranty.

.6 The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with the membrane manufacturer's products.

2.2 Acoustic Insulation

.1 Fiberglass, 17.5 kg/m^3 density profiled to suit deck flute profile.

2.3 High-Temperature Self-Adhered Membrane Adhesive

.1 Rubber based adhesive for self-adhered membrane.

2.4 High-Temperature Self-Adhered Membrane

.1 Self-adhered 40-mil composite high softening point SBS membrane with Service Temperature -40 °F to 260 °F.

2.5 Spray Applied Polyurethane Foam

.1 Non-shrinking, low expansion, closed cell, non-CFC, single component foam to CAN/ULC-S711.1, as manufactured by Handi-Foam, Abisko Enerfoam, Froth-Pak or an approved equivalent.

2.6 Wood/Fiber Cant Strips

.1 Factory fabricated from rigid wood fiber roof insulation board cut to provide a true 45° angle between horizontal and vertical surfaces. All cant strips with sloped side to measure 3", 4", 5" and 5 ¾" (75 mm, 100 mm, 125 mm and 144 mm) x 4' (1200 mm) nominal sizes. Wood fiber cant strips to be dry and true before use.

2.7 Asphalt Primer

.1 Low odor, asbestos free formulation from refined select asphalt to produce an effective priming base CGSB 37-GP-9.

2.8 Thermal Barrier

.1 Fibreglass mat faced panel with a specially treated gypsum core that resists moisture, surface primed. Panel size to be 1220mm x 2440mm (4' x 8') with minimum thickness of 13mm (½").

2.9 Vapour Retarder Adhesive

.1 A rapid-curing adhesive primer to meet Manufacturer's warranty requirements.

2.10 Vapour Retarder Membrane

.1 Self-adhered air and vapour control membrane consisting of a self-adhering SEBS rubberized asphalt laminated to a tough slip resistant cross laminated polyethylene surface film.

2.11 Insulation Adhesive

.1 Thermal Barrier: Low-rise polyurethane adhesive, compatible with asphalt surfaces and fiber faced insulation to meet Manufacturer's warranty requirements.

.2 Overlay Insulation: SEBS (Styrene-Ethylene-Butylene-Styrene) modified roofing interply adhesive and waterproofing asphalt, meets ASTM D 36, ASTM D412, ASTM D 3111, ASTM D 6511.

2.12 Insulation Fasteners

.1 #15 Philips high load fastener with corrosion resistant plate conforming to ASTM D4470. Must penetrate the roof deck a minimum of ¾" (19 mm). Approved Products: Dekfast by SFS intec, or approved equivalent.

2.13 Base, Tapered, Overlay and Sumped Insulation

.1 Base Insulation: Polyisocyanurate closed cell foam rigid roof insulation board, pentane blown, HCFC free, Type II, Class 2, Grade 2 (inorganic facer) minimum, manufactured with HC blowing agent bonded to glass fiber reinforced facers on top and bottom surfaces during the manufacturing process, meeting the requirements of CAN/ULC-S126-14 (R2024), CAN/ULC-S107, conforming to CAN/ULC-S704 for Long Term Thermal Resistance (LTTR) R-values of R-5.7 R per inch, for Class 1-90 windstorm classification & meeting FM4450 approval requirements for Class 1 Fire as a component in roof deck construction.

Board size 3" x 4' x 4' (75 mm x 1200 mm x 1200 mm).

.2 Tapered Insulation Crickets

.1 Rigid high thermal insulation board and crickets composed of closed cell polyisocyanurate foam core manufactured with fiberglass reinforced facers. Physical properties of insulation meet or exceed CAN/CGSB-51.26-M86. Insulation compressive strength to meet or exceed 20 kpa (138 psi) using test method ASTM D 1621. Insulation dimensional stability change must not exceed 2% when tested using ASTM D 2126. Insulation must be ULC approved.

Tapered Insulation and Crickets 2%.

.3 Overlay Insulation:

.1 Install asphalt coated high density fiberboard roof insulation impregnated with a water-repellant petroleum paraffin emulsion that imparts a high moisture resistance to the product. Board Density to be minimum 15.40 lbs/ft3 with CAN ULC-S706 Type II Class I and ASTM C-208 Type II Grade I Standards, R-Value of 1.3.

Board size to be ½" x 2' x 4' (13 mm x 600 mm x 1200 mm).

Or,

.2 Expanded perlite mineral aggregate board; 60 psi (414 kPa) at 10% Consolidation, square edges Meeting ASTM C 728.

Board size to be ½" x 2' x 4' (13 mm x 600 mm x 1200 mm).

.4 Tapered Drain Sump

.1 Fiberboard: High density, asphalt coated and/or impregnated fiberboard or perlite insulation conforming to standards described in ASTM C208 or ASTM C728. Drain sump to be created for a distance of 16' x 16' (4800 mm 4800 mm) and 2% slope.

2.14 Built-Up Roof (BUR) Membrane (1+2)

.1 Base Ply Membrane:

.1 1-Ply of Composite ply membrane with glass/polyester reinforcement and SBS modified bitumen membrane with a minimum thickness of 2.5 mm to ASTM D6162, CAN/CGSB 37.56-M, 9th draft.

.2 1-Ply of Composite ply membrane with polyester/glass reinforcement coated with waterproofing asphalt. To meet or exceed ASTM D4601, Type II, or ASTM D 6162, Type I, Grade S.

.2 Built-Up-Roof (BUR) Membrane: 2-Plies Type IV non-woven glass fiber mat impregnated with asphalt, to meet or exceed ASTM D-2178 Type 6, CAN/CSA A123.17.

Approved Products to meet Manufacturer's warranty requirements.

2.15 Membrane Flashing (BUR 1+2)

.1 2-Ply of composite ply membrane with glass/polyester reinforcement and SBS modified bitumen membrane with a minimum thickness of 2.5 mm to ASTM D6162, CAN/CGSB 37.56-M, 9th draft.

.2 1-Ply of polymer reinforced sheet membrane flashing with EPDM and SBR elastomers, conforming to ASTM D751 (min. thickness 45-mil).

2.16 Membrane Flashing Lap Reinforcement Mastic

.1 Single-component, asbestos free roof elastomer formulated from polymers, plasticizers, and selected additives, used as a base for setting metal flanges, lap adhesive.

2.17 Membrane Flashing Lap Reinforcement Membrane

.1 6" vinyl coated fiberglass mesh.

2.18 Roof Membrane, Overlay, Flashing and Flood Coat Aggregate/Gravel Adhesive

.1 SEBS (Styrene-Ethylene-Butylene-Styrene) modified roofing interply adhesive and waterproofing asphalt, meets ASTM D 36, ASTM D412, ASTM D 3111, ASTM D 6511.

2.19 Surfacing Aggregate

.1 Clean, washed pea-stone gravel ⅜" (10 mm) nominal size. Not more than 10% of the aggregate may be out of size. No fines are permitted. Gravel to meet or exceed ASTM D1863.

2.20 Roof Drain (Supplied by Others)

.1 New Roof Drain Clamping Ring: No-hub cast iron roof drain with steel flange, clamping ring with water dam and screen, by Watts, Zurn or approved alternate.

.2 New Copper Roof Drains: New 24oz./.05" (1.2mm) roofing grade T-2 copper roof drain to be complete with flat flange, brass stabilizing ring, cast aluminum strainer dome with integrated or separate clamping ring, stainless-steel underdeck clamp and new MJ Clamp or Fernco coupler for hard internal connections.

2.21 Roof Drain Scuppers

.1 Refer to SECTION 07 62 00 - Sheet Metal Flashing and Trim.

2.22 Pitch Pans and Filler

.1 Refer to SECTION 07 51 13 – Sheet Metal Flashing and Trim

2.23 Penetration Flashing (Supplied by Others)

.1 Insulated aluminum sleeves and collars with vandal proof cap fabricated from 0.051" pre-spun aluminum of size to suit supplied by (wire):

.1 MEFA-V2 by Altra Metal Specialties

.2 Flash-Tite by Lexcor Canada

.3 Copper Hercules by OMG Roofing Products

.4 SJ-26 by Thaler Metal Industries

.5 or approved alternate.

.6 Flanges to be primed both sides as per manufacturer requirements.

.2 To be manufactured with matching vandal-proof caps or collars (plumbing vent). All sleeves to have foamed in place closed cell urethane foam insulation sprayed into the unit at the plant under controlled conditions. Flanges to be primed both sides as per manufactures requirements. Plumbing stack flashings prefabricated from heavy gauge spun aluminum, complete with wide base flange, telescoping cap and pre-insulated. Minimum 450mm (18") above roof surface.

.1 AVS-1 Series by Altra Metal Specialties

.2 Flash-Tite VB/VC Series by Lexcor Canada

.3 PVP-3 Series with cap by National Roofing Supply

.4 SJ-27 Series by Thaler Metal Industries

2.24 Roof Accessories

.1 Batt Insulation: Mineral wool batt insulation by Roxul: or approved equivalent.

.2 Rubberized Mastic to meet Manufacturer's warranty requirements.

.3 Precast Concrete Pavers: 2" x 24" x 24" (50 mm x 600 mm x 600 mm) precast concrete pavers to meet CSA 231.1-1972 or CAN3-A231.2-M85. Standard diamond texture surface with natural colour. Brooklin Roof Ballast Slab by Brooklin Concrete Inc.

.4 Insulation Pads for Concrete Pavers: 1" x 22" x 22" (25 mm x 550 mm x 550 mm) Type IV extruded polystyrene insulation. Roofmate by Dow Chemical Canada Ltd., or approved equivalent.

.5 Butyl Sealant formulated from a blend of butyl rubber and polyisobutylene.

.6 Cap Nails: 1" (25 mm) square or round head, ring shanked or Ardox galvanized or non-ferrous type with 1" disk, length as required to suit application.

.7 Termination Bar: Light-weight flexible aluminum 6063 T-5 grade and corrosion resistant. Pre-drilled every 8" (150 mm) and in 10' lengths with a ⅛" (3 mm) lip sealant edge for secure seal.

.8 Backer rod where required to fill applicable gap.

2.25 Fasteners and Fastener Accessories:

.1 Wood to steel, wood to wood or steel to steel:

1. Tru-Fast Ultra Solid Stainless-Steel fastener to penetrate substrate by minimum 19mm (3/4").

.2 Wood/steel to concrete or concrete block:

1. Perma-Grip Tap Grip H.D. Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 32mm (1 1/4").

2. Tru-Fast Tap Grip H.D. Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 32mm (1 1/4").

3. Tru-Fast DP with Trucote PC-3 corrosion protection fastener c/w EPDM galvanized steel sealing washers to penetrate substrate by 19mm (3/4").

.3 Termination Lip Bar for Membrane:

1. Light-weight flexible aluminum 6063 T-5 grade and corrosion resistant. Pre-drilled every 8" (150 mm) and in 10' lengths with a ⅛" (3 mm) lip sealant edge for secure seal.

2. Add fasteners where contact is not firm between fasteners.

.4 Termination bar fastener for wood, steel, or aluminum:

1. Tru-Fast Ultra Solid Stainless-Steel fastener to penetrate substrate by 19mm (3/4") c/w EPDM galvanized steel sealing washers or Construction Fasteners Inc. Woodgrip #14 screw complete with Sentri coating on threads, Chromagard colour match head and EPDM washer.

.5 Termination bar fastener for concrete or masonry:

1. Tru-Fast Tap Grip Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 32mm (1 1/4") c/w EPDM galvanized steel sealing washers.

.6 Prepainted metal flashing to steel or wood:

1. Construction Fasteners Inc. Woodgrip #14 screw complete with Sentri coating on threads, Chromagard colour match head and EPDM washer or approved equal. Fastener to penetrate substrate by minimum 19mm (3/4").

.7 Membrane to wood:

1. Galvanized round top nails with minimum 25mm (1") diameter heads to penetrate the substrate a minimum 32mm (1 1/4").

.8 All fasteners and plates to meet the requirements of Factory Mutual 4470 Standard for wind uplift and corrosion resistance.

.9 All fasteners used with pressure treated lumber to be stainless steel or hot dipped galvanized, minimum G185 in accordance with ASTM A653-03.

2.26 Sheet Metal Flashings and Trim

.1 Refer to SECTION 07 62 00.

2.27 Sealant

.1 Refer to SECTION 07 92 00. Exterior grade silicone sealant. Clear silicone is not acceptable, and all sealants must be tooled.

PART 3 - EXECUTION

3.1 Examination

.1 Inspect existing conditions and substrates upon which work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the work.

.2 Defective work resulting from application to unsatisfactory substrate conditions will be considered the responsibility of those performing the work of this section.

.3 Prior to the removal of any roof components all existing openings (drains, vents, air intakes, etc.) shall be covered or plugged to prevent any debris or contaminate from entering the building below. All such coverings are to be removed at the end of each working day and reinstalled prior to the next days start up.

3.2 Workmanship

.1 Execute roofing work which is not specifically covered by these Specifications in accordance with applicable standards in Canadian Roofing Contractors Association (CRCA) and the National Roofing Contractors Association Roofing Specification Manual, in accordance with the Canadian Modified Bitumen Manufacturer's Association's recommendations, in accordance with the manufacturer's preprinted and published specifications and to ULC Design No. S-107, to FM 1-28 and 1.49 criteria, compliance with local fire insurance requirements and/or local building codes, except where specified otherwise.

.2 Do not install any material when it is raining or snowing, on wet/humid surfaces and/or outside of the application temperature allowed by the manufacturer.

.3 Do priming for asphalt roofing in accordance with CAN/CGSB 37-GP-15M and as recommended by membrane manufacturer.

.4 Procedures for application of materials should be in accordance with manufacturer's recommendations; otherwise, the Consultant should be notified if any conflict with this Specification arises.

.5 All work shall be carried out in accordance with drawings, specifications, and contract documents.

.6 Adhesives or sealants and liquid primers will not be applied until surfaces are dry.

.7 Inspect the underside of roof deck when installing fasteners, where possible, to avoid accidental damage.

.8 While work is in progress, all steps must be taken to safeguard the building from damage due to the elements.

.9 Advise the Consultant of adjustments to specified roofing procedures recommended by the Manufacturer or due to site conditions. Written approval is needed to make any adjustments to the specified procedures.

.10 Lay out Work to avoid working over newly installed membranes. If any foreign material is inadvertently incorporated into the membrane, remove the material immediately and repair to restore membrane to its original integrity.

.11 Maintain equipment in good working order to ensure control of roofing operations and protection of Work. Types of roofing equipment and laying techniques to be employed are to meet the approval of the Consultant.

.12 Do not penetrate roof deck with any fastening devices that would do damage or impair the function of the roof assembly.

.13 Unless otherwise specified, complete entire roofing operation up to the line of termination of each day's Work to meet the design intent in order to safeguard and protect the Work and building from damage and weather.

3.3 Preparation

.1 **A copy of this specification shall be kept on site at all times for reference purposes.**

.2 Use warning signs and barriers. Maintain in good order until completion of work.

.3 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.

.4 Contractor is to take care to not damage any previously performed work, any closely located buildings and all grounds in the vicinity during roofing operations. Garbage chutes are to be located as to minimize their exposure to the building and its occupants. Protect walls by means of tarpaulins where garbage chutes and hoisting equipment is located. Cover dumpsters and bins so that debris does not blow away.

.5 Before work commences, ensure all air in-take air exchangers, drains, down venting and similar, are protected from the intrusion of dust and debris.

.6 Roof access is to be unobstructed. Doorways and fire routes are to be kept clear of any obstacles.

.7 Protect surrounding surfaces from work in progress by covering walls.

.8 Examine all site conditions to ensure that they are in satisfactory condition for the commencement of the work of this section.

.9 Examine work of other trades for defects and discrepancies and report them to the owner/consultant in writing. Do not proceed with work until surfaces are satisfactory.

.10 Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

.11 The Contractor shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Contractor shall report any such blockages in writing to the Owner's Representative for corrective action prior to the installation of the roof system.

.12 Prior to the removal of any roof components, all existing openings (drains, vents, air intakes, etc.) shall be covered or plugged to prevent any debris or contaminate from entering the building below. All such coverings are to be removed at the end of each working day and reinstalled prior to the next day's start up.

.13 The existing metal flashings and roof membrane shall be removed and associated debris to expose the existing overlay board and vertical substrates ensuring proper and adequate adhesion of the new roof assembly.

.14 Once the existing roofing materials are removed, the substrates shall be reviewed by the Contractor and Consultant. The entire roof area is to be reviewed in order to satisfy warranty requirements of the manufacturer of the new roof system. The Consultant is to be notified 48 hours prior to testing.

.15 All unused and abandoned pitch pockets, vents, curbs, sleepers, projections, etc. are to be removed from the designated areas and disposed of. Obtain verification and authorization from the Owner before removing any suspected unused or abandoned projections. New decking is to be installed as required to close off any openings prior to the installation of the new roofing system.

.16 Ensure roof drains have been installed at proper elevations relative to finished roof surface in order to allow for sufficient drainage of the roof surface.

.17 Disconnect Electrical Services as required.

.18 Disconnect Mechanical Equipment as required.

.19 Ensure that projections and any equipment (electrical conduit, gas lines etc.) are correctly secured to the decking where applicable. If any inadequate securement is found, the Consultant is to be informed and work around that area is to be halted until the situation has been rectified.

.20 Prior to application of membranes, examine substrate and ensure any defect of level or construction is correct before proceeding with the work.

.21 Inspect wood blocking, cants and the like. Do not install roofing unless such items are adequately installed to withstand stresses imposed by thermal movement of the roof components.

3.4 Surface Preparation

.1 Thoroughly sweep and vacuum deck free of all stones and debris and remove any irregularities in the deck to provide a smooth, even, dry surface over which to apply vapour retarder. Remove all grease, residual asphalt, dirt, oil, debris, diesel fuel, water, and all other foreign matter from the top surface and within the roof deck flutes.

.2 Report any deck damage or deterioration to the Consultant. No deck repair or replacement may be performed without the previous written consent of the Consultant/Owner. Costs for such repair or replacement shall be performed in accordance with the unit rates. All additional billing shall be delivered to the Owner with a copy submitted to the Consultant, accompanied with an itemized breakdown of costs incurred.

3.5 Carpentry

.1 Add new wood blocking as necessary to maintain minimum heights at perimeters and curbs. The minimum height above the finished roof at curb locations and at wall bases is to be 200mm (8"). The minimum height at parapets is to be 150mm (6") above the finished roof.

.2 Replace any seriously damaged or deteriorated wood at perimeters and projections with new construction grade spruce wood blocking or exterior grade, good one side plywood to match existing. Determination of the suitability to re-use or replace existing wood to be at the sole discretion of the Consultant.

.3 Ensure existing wood blocking remaining at perimeters and curbs is securely fastened to existing substrate before installing any new blocking.

.4 Install wood blocking as required to ensure that all curbs and sleepers for H.V.A.C. and mechanical equipment are level.

.5 All wood blocking and plywood is to be considered part of the roof, and to be made watertight by the end of each working day to eliminate moisture infiltration into the roof system.

.6 All fasteners to be flush or slightly sunk with surface of wood blocking being secured where possible.

.7 As indicated on drawings, install blocking and cant strips to accommodate slopes and insulation, roofing and sheet metal.

.8 Carpentry alterations will be performed to accepted trade practice.

.9 Before proceeding, installation of vapour retarders is to be in place.

.10 Wood to wood, wood to metal, wood to masonry or concrete to be secured at 300mm (12”) on center staggered.

3.6 Spray Applied Polyurethane Foam

.1 At openings and gaps along perimeter, curbs, and penetrations, install non-shrinking, low expansion, closed cell, non-CFC, single component foam to CAN/ULC-S710.1, as manufactured by Handi-Foam, Abisko Enerfoam, Froth-Pak or an approved equivalent.

.2 Other (larger applications): non-shrinking, medium-high expansion, closed cell, non-CFC, two component foam to CAN/ULC-S711.1, as manufactured by Handi-Foam, Abisko Enerfoam, Froth-Pak or an approved equivalent.

.3 Use batt insulation around voids to prevent foam from dripping into the building.

3.7 Asphalt Primer

.1 Apply primer in accordance with manufacturer's directions to clean and dry surfaces.

.2 Ensure all substrates are fully covered with primer leaving no areas bare.

.3 Avoid pools and heavy areas and allow primer to dry a minimum 30 minutes or until staining does not occur to the touch and surface becomes tacky.

3.8 Acoustic Insulation

.1 Install fiberglass in every flute butt tightly together.

3.9 Thermal Barrier

.1 Where required, install in parallel rows and with joints staggered from boards below by half a board width and all ends staggered and in firm contact with one another.

.2 Ensure insulation is installed in a staggered butt joint configuration and is offset a minimum of 12" (300 mm).

.3 Fill gaps between insulation boards greater than ¼" (6 mm).

.4 Install ISO insulation low-rise foam adhesive in accordance with Manufacturer's instructions. Apply ¼" – ½" wide adhesive ribbons spaced 12" on center. Install insulation boards immediately into wet adhesive. Do not allow adhesive beads to skin over before placing the boards. Walk on board to fully press them into the wet adhesive in accordance with insulation manufacturer's application techniques and rates, using approved applicator. Check adhesion of insulation boards frequently. Spots compressed should be approximately 1 ½" (38 mm) to 2" (25 mm) diameter. Apply boards using pressure at several points to adhere maximum contact throughout all field areas.

3.10 Vapour Retarder

.1 Lay out the new vapour retarder to run parallel to the deck flutes, atop the primed surface, fold the membrane in half lengthwise. Apply primer if required, allow to dry, and remove the release paper and press one corner of the membrane into place.

.2 Lift the free end of the membrane and pull until taught, then bond to the deck. Push the remaining membrane in place, ensuring there are no voids or wrinkles. Terminate all end laps atop the high side of the deck flutes. Sides shall be overlapped a minimum of 3" (75 mm) with end-laps primed and covered a minimum of 6" (150 mm).

.3 Extend membrane up and along the perimeter wall and curbs a minimum 3" (75 mm) above the top of the cant strip to ensure a continuous air-vapour barrier.

.4 Seal roof deck penetrations such as pipes, roof anchors, skylights, roof hatches, joints at roof/wall details, etc. first by applying the primer, then pressing pre-cut pieces of the vapour barrier snugly into place, ensuring no gaps or voids in coverage (use vapour barrier tape if so desired).

.5 At perimeters and large penetrations, such as curbs, a 6" (150 mm) envelope will be constructed to encapsulate the insulation, serving as a water cut-off membrane.

.6 Pack voids between deck and penetrations such as at plumbing vents, hot exhaust stacks, etc. using mineral wool insulation.

.7 Seal vapour retarder around all deck openings and penetrations, except hot vents.

.8 Seal perimeter of vapour retarder as follows: Fully envelope insulation with vapour retarder at walls, perimeters, curbs, etc., 6" (150 mm) minimum and adhere vapour retarder to top of insulation at enveloped areas; apply primer to the top of the insulation, fold the envelope on top and press the membrane into place, ensuing the envelope extends a minimum of 6" (150 mm) onto the horizontal surface. In torch applications, envelope the vapour retarder over the first layer of prime insulation prior to installing the overlay board.

3.11 High-Temperature Self-Adhered Membrane and Adhesive

.1 Prime surfaces with primer using a roller to achieve membrane to surface adhesion at (200-250 ft2 /gal) or (5-6 m2 /L) and allow to dry. It is important to avoid over-application of primer and allow drying for at least 30 minutes prior to covering. Not allowing the primer/adhesive to dry fully prior to covering may result in failed laps and/or failed adhesion to the substrate.

.2 Seal inside and outside corners of sheathing boards with a strip of membrane extending a minimum of 5" (13 cm) on either side of the corner detail. Prime surfaces where appropriate to achieve surface adhesion as per manufacturer's instructions and allow to dry.

.3 Install membrane in shingle fashion and press firmly into place, overlap minimum 5" (13cm) overlap at all ends (vertical) and 2" (5cm) side laps (horizontal). Promptly roll all laps and membrane to ensure the seal.

3.12 Base, Tapered and Overlay Insulation

.1 Install insulation boards with edges in moderate contact, without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

1. Install in parallel rows and with joints staggered from boards below by half a board width and all ends staggered and in firm contact with one another.

2. Ensure insulation is installed in a staggered butt joint configuration and is offset a minimum of 12" (300 mm).

3. Fill gaps between insulation boards greater than ¼" (6 mm) with the same insulation.

4. Off-set fiberboard insulation layer from polyisocyanurate insulation layer a minimum of 12" (300 mm).

.2 Base Insulation – Mechanically Fastened

.1 Mechanically attach extruded polyisocyanurate (ISO) base layer with five (5) fasteners per 4' x 4' board penetrating the roof deck a minimum of ¾" (19 mm).

.3 Overlay Insulation – Hot-Applied Modified Asphalt

.1 Fully adhere the overlay insulation boards in hot-applied modified asphalt to achieve good adhesion. Fully adhere insulation in hot-applied modified asphalt, applied at a rate of 25 lbs/100 ft2 (1.25 kg/m2), and applied in a full, continuous and uniform coating to achieve good adhesion. Check adhesion of insulation boards frequently. Step boards into place to maximize adhesion.

.2 Install insulation boards with edges in moderate contact, without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

1. Ensure insulation is installed in a staggered butt joint configuration and is offset a minimum of 12" (300 mm).

2. Fill gaps between insulation boards greater than ¼" (6 mm) with the same insulation.

3. Off-set fiberboard insulation layer from polyisocyanurate insulation layer a minimum of 12" (300 mm).

.3 Install in parallel rows and with joints staggered from boards below by half a board width and all ends staggered and in firm contact with one another.

3.13 Roof Penetrations

.1 Coordinate installation of roof drains and other related flashings.

.2 Prime all metal flanges and allow solvents to flash off prior to installation.

.3 Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

.4 Install metal plumbing stack flashings and roof drains in accordance with manufacturer's recommendations.

.5 Coordinate installation of roof drains and related flashings.

.6 Install 1-ply or 2-ply flashing membrane centered on drain, and to extend a minimum 4" (100 mm) and 6" (150 mm) (2-ply), or 6" x 6" (150 x 150 mm) (1-ply) beyond the flange onto the field-of-roof in specified modified bitumen adhesive.

.7 Reinforce leading edge laps of 1-ply EPDM/SBR flashing membrane with 6" (150 mm) BURmesh set in SEBS modified mopping asphalt followed by a flood coat and gravel.

.8 Reinforce leading edge laps of membrane flashing with reinforcement mesh and hot asphalt as recommended by Manufacturer for 1-ply EPDM/SBR elastomeric membrane only.

.9 Apply silicone sealant tooled around top of plumbing vent and install vandal-proof cap mechanically fastened using two (2) stainless-steel screws.

3.14 General Guidelines

.1 Sufficient adhesive should be applied at the laps to result in a visible bead of adhesive at the completed lap edge.

.2 Unroll membrane and allow to relax on a clean surface prior to installation. Time required for relaxation will vary with weather conditions in accordance with Manufacturer's requirements. Once relaxed sufficiently, re-roll the membrane, and begin application.

.3 Surface Inspection: Modified Bitumen membranes can be applied over wood, metal, gypsum board and steel decks which must be clean, smooth, free of snow, ice, moisture, and debris.

.4 Application of Primer: Priming is required for all substrates prior to the installation of a modified bitumen membrane. The primer is to be applied as per the manufacture's recommendations with a roller or sprayer. Contractor is to allow primer to dry prior to mopping to the prepared substrate. Drying time will vary according to the deck and weather conditions.

.5 Alignment of Rolls: The first roll to be completely unrolled and aligned with the edge of the roof. Where required, the membranes are to be unrolled and allowed to relax for the required time. The membrane is to be re-rolled from both ends to the centre and then applied as per specifications.

.6 Staggering of Sheets: End laps between base and cap sheets to be staggered in accordance with Manufacturer's requirements and guidelines.

.7 End lap and side lap sealing at areas of potential moisture infiltration at voids created by overlapping rolls of membrane, **heat-weld using a hot-air welded all end and side laps, gussets and inside and outside corners for the modified bitumen field and flashing membrane layers**.

.8 Membrane must be applied without voids, wrinkles, buckles, fish mouths or any evidence of lack of full adhesion. Deficiencies must be repaired to the satisfaction of the Consultant. Cut out fish mouths at field areas and side laps which are not completely sealed and repair to meet manufacturer's recommendations. Replace all membrane which is not fully and continuously bonded.

.9 At the end of each day's work, all laps must be inspected.

3.15 1+2 Built-Up-Roof Membrane (BUR)

.1 Starting at the low point of the roof or at the drain, unroll a layer of the composite modified bitumen base ply, align and re-roll. Install base ply into hot asphalt at the nominal uniform rate of 25 lbs. per square (1.22 kg/m2) over the entire surface. Install each ply so that it shall be firmly and uniformly set, without voids, wrinkles, blisters or fishmouths. Side laps are to be a minimum of 3" (75 mm) and end laps are to be a minimum of 6" (150 mm). Extend the base ply to the top of wood fiber cant strips.

.2 Starting at the low point of the roof or at the drain apply one ply Type IV felt, 18" (457 mm) wide, then over that one a 36" (914 mm) wide, set-in hot asphalt. The remainder of the felts are to be applied full width, overlapping each felt 24 2/3" (627 mm), giving a minimum of 2-plies over the hybrid base ply in all locations. Install each felt so that it shall be firmly and uniformly set, without voids, into the hot asphalt (within 25°F (14°C) of the EVT) applied just before the felt at a nominal uniform rate of 25 lbs. per square (1.22 kg/m^2) over the entire surface. Felts can be installed by hand mopping, mini mopper. Avoid traffic on newly installed membrane in order to minimize asphalt displacement.

.3 Equiviscous Temperature at Point of Application: No more than 25°F (14°C) from bitumen rating indicated on bitumen container label.

.4 Apply felts smooth and ensure felts are "broomed in or squeegeed in" so as to set the felt and avoid air pockets, wrinkles, fishmouths, lap joints, or tears.

.5 Apply felts smooth, free from air pockets, wrinkles, fishmouths, lap joints, or tears.

.6 Extend membrane felts to the top of wood fiber cant strips.

.7 Install 1-ply base sheet and bitumen glaze coat for cut-off at end of day's operation. Remove watertight cut-off before resuming roofing.

3.16 Installation of Reinforced Gussets

.1 Install gussets at every angle, on inside and outside corners.

.2 Heat-weld using a hot air welder, the gussets in place after installing the base sheet membrane, and prior to the cap sheet membrane.

3.17 Membrane Flashing

.1 Flashing membrane is to extend over the parapet and a minimum 25mm (1") and beyond the exterior masonry brick.

.2 2-Ply Membrane Flashing SEBS Modified Hot Asphalt:

.1 Align the base and cap ply flashing membranes in 3' (1 m) wide strips extending over perimeters as shown on detail drawings.

.2 Install the base ply membrane flashing a minimum of 4" (100 mm) beyond to toe of the cant, and cap ply membrane flashing a minimum 6" (150 mm) beyond to toe of the cant. Ensure that both membranes are fully bonded into modified mopping asphalt at the rate of 25 lbs./square (1.22 kg/m2) and onto the roof surface. Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles with termination bar and fasteners or with round top nails as indicated on drawings. Leave a salvage edge at membrane flashing end laps to allow for heat-welding using a hot-air welded.

.3 Secure the top of the flashing sheets with round top nails or with a termination bar. Cover with metal flashing as required.

.3 1-Ply Membrane Flashing SEBS Modified Hot Asphalt:

.1 Install new 1-ply EPDM/SBR elastomeric membrane along parapet, curbs and penetrations set into specified membrane flashing adhesive, applied at the rate of 25 lbs./square (1.22 kg/m2) and onto the roof surface and covering the entire surface of materials to receive flexible membrane flashing.

.2 New elastomeric membrane flashing to terminate 150mm (6") past the cant strip, onto field membrane.

.3 Reinforce leading edge all laps and corners of membrane flashing with reinforcement mesh and modified mopping asphalt as recommended by manufacturer.

.4 Brush or rub membrane flashing into place ensuring a full bond. Side laps to be a minimum of 100mm (4"), end laps to be a minimum 150mm (6"). Reinforce corners and all laps with three-course modified asphalt and 150mm (6") reinforcement mesh over all side and end laps. Stripping shall extend 75mm (3") on either side of the lap edge.

.5 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles with terminations as indicated on drawings and details.

3.18 Roof Penetrations

.1 Coordinate installation of roof drains and other related flashings.

.2 Prime all metal flanges and allow solvents to flash off prior to installation.

.3 Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

.4 Install roof drains, support flashings and other roof penetration flashings and seal with membrane in accordance with the manufacturer's recommendations and as indicated on detail drawings.

.5 Install metal stack flashings and roof drains in accordance with manufacturer's recommendations.

.6 Coordinate installation of roof drains and related flashings.

.7 Mop in and seal flashings and flanges of items penetrating membrane.

.8 Install 1-ply or 2-ply flashing membrane centered on drain, and to extend a minimum 4" (100 mm) and 6" (150 mm) (2-ply), or 6" x 6" (150 x 150 mm) (1-ply) beyond the flange onto the field-of-roof.

.9 Reinforce leading edge laps of 1-ply EPDM/SBR flashing membrane with 6" (150 mm) BURmesh set in SEBS modified mopping asphalt followed by a flood coat and gravel.

.10 Reinforce leading edge laps of membrane flashing with reinforcement mesh and hot asphalt as recommended by Manufacturer for 1-ply EPDM/SBR elastomeric membrane only.

3.19 Roof Drainage

1. General Practices

.1 Install new scuppers at locations shown on the drawings and as per the details and specifications.

.2 Remove and discard existing drains and pipe fittings that are no longer required.

.3 Restore openings and other components damaged or removed during the new installations.

.4 **No roof area shall be left overnight without adequate provision for drainage at the existing roof scupper drain locations.**

2. At existing drain locations re-use existing precast drain bowl with new clamping ring and stainless-steel bolts and nuts, if retrofit drainpipe diameter 2" (50 mm) or less hard connect drains.

3. Otherwise, install new drain insert and drain seal in accordance with Drawings and manufacturer's instructions. Make joints watertight.

4. Prior to the installation of the insulation and the membrane ensure that the drains are clean and free flowing. The beginning of the installation will indicate that no problems exist with the existing drainage.

5. Adjust roof drain height to match new roof insulation thickness.

6. Prime all metal flanges and allow solvents to flash off prior to installation.

7. Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

8. Install 1-ply or 2-ply flashing membrane centered on drain, and to extend a minimum 4" (100 mm) and 6" (150 mm) (2-ply), or 6" x 6" (150 x 150 mm) (1-ply) beyond the flange onto the field-of-roof.

9. Reinforce leading edge laps of 1-ply EPDM/SBR flashing membrane with 6" (150 mm) BURmesh set in SEBS modified mopping asphalt followed by a flood coat and gravel.

3.20 Roof Drain Scuppers

1. Install flashing membrane into scupper opening in a full bed of rubberized mastic prior to copper scupper installation.

2. Install new metal open-top scuppers as shown on the roof plans unless otherwise directed by the Consultant. The new scuppers are to be custom-fabricated complete with canted edge on three sides.

3. Set pre-primed flanges in a full bed of rubberized mastic. Face of scupper to be encapsulated with prefinished metal cover.

4. Install flashing membrane and reinforcement where required in accordance with manufacturer's recommendations. Installation to be per the specifications and Detail Drawings.

3.21 Flood Coat and Aggregate

.1 Upon approval from the Consultant, apply a uniform flood coat of SEBS modified asphalt at rate of 60 lbs./square (2.9 kg/m^2) at EVT and evenly distribute aggregate and ensure bond with flood coat so that no flood coat is visible. Extend aggregate to bottom edge of wood fiber cant strips, stack flashings and drain rings. Immediately broadcast and evenly distribute dry and clean roofing aggregate over the entire roof surface, at the rate of minimum 400lbs/100ft^2 (19.5kg/m^2) with a minimum of 50% embedment ensure bond.

.2 Double pour corners at prevailing wind corner and as shown in the scope of work and drawings.

1. Sweep loose gravel back from the perimeter of the roof at prevailing wind corners for a distance of 10' x 10' and apply a second application of hot asphalt at the rate of 200lbs/100ft2 (10kg/m2) for a total aggregate pour of 600lbs/100ft2 (30 kg/m2).

.3 Ensure that the gravel is evenly spread over the entire roof surface so that no asphalt is visible. Apply additional gravel where required and redistribute gravel by hand where necessary to fully cover all asphalt.

3.22 Termination Bars

.1 Install butyl sealant between new and old membrane and new termination bar where required.

.2 Ensure all metalwork and / or terminations are installed within 72 hours of completed membrane applications.

.3 Install 1" (25 mm), 14-gauge termination bar ⅛" (3 mm) below the top of the flashings and secure to the masonry wall using 1 ½" 'Tapcon' fasteners every 8" o/c.

.4 Seal the top of the termination bar with specified silicone sealant.

3.23 Temporary Water cut-offs

.1 Temporary waterproof seals will be placed on daily work. Only areas which can be made watertight in the same day will be removed to ensure protection of the interior. Temporary seals will be removed before proceeding with the remaining work.

.2 All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses.

.3 All temporary water-stops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation.

.4 The new membrane shall be carried into the water-stop. The water-stop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing.

.5 The edge of the membrane shall be sealed in a continuous heavy application of sealant.

.6 When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of offsite. None of these materials shall be used in the new work.

.7 If inclement weather occurs while a temporary water-stop is in place, the Contractor shall provide the labour necessary to monitor the situation to maintain a watertight condition.

.8 If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Contractor's expense.

3.24 Cleaning

.1 Clean off drips and smears of bituminous material immediately as they occur.

.2 Clean up and remove from job site on a daily basis, all rubbish and surplus materials resulting from this work.

END OF SECTION – 07 51 13

PART 1 - GENERAL

1.1 General Requirements

.1 All conditions of the contract and Division 1, General Requirements apply to this section.

.2 All materials and equipment must be set up in a position satisfactory to the Owner's representative.

.3 All materials shall be new and in perfect condition, free from defects which may impair strength, durability, or appearance.

.4 Scheduling of the work shall be discussed with and be subject to the approval of the Owner.

.5 All work shall meet contract O.B.C., CRCA, NRCA, SMACNA requirements and good roofing installation practices.

.6 Work shall be executed to the highest standards of workmanship in the industry, by fully trained roofers and siding installers.

1.2 References

.1 Comply with requirements of the following documents, latest edition:

.1 American Society for Testing and Materials

.1 ASTM C578: Rigid, Cellular Polystyrene Thermal Insulation.

.2 ASTM D41: Asphalt Primer Used in Roofing, Damp-proofing, and Waterproofing.

.3 ASTM D312: Asphalt Used in Roofing.

.4 ASTM D2822: Asphalt Roof Cement.

.5 ASTM D4601: Standard for Asphalt Coated Glass Fibre Base Sheet Used in Roofing.

.6 ASTM D6162: SBS Mod. Bit. Sheets Using Polyester & Glass Fiber Reinforcements.

.7 ASTM D6163: SBS Mod. Bit. Sheets Using Glass Fiber Reinforcements.

.8 ASTM D6164: SBS Mod. Bit. Sheets Using Polyester Reinforcements.

.2 Canadian General Standards Board

.1 CAN/CGSB 37.29M, Rubber-Asphalt Sealing Compound.

.2 CAN/CGSB 37-GP-9M, Primer, Asphalt, unfilled, for Asphalt Roofing and Waterproofing.

.3 CAN/CGSB 37-GP-15M: Application of Asphalt Primer for Asphalt Roofing & Waterproofing.

.4 CAN/CGSB 37-GP-56M: Membrane, Bituminous, Prefabricated and Reinforced for Roofing.

.5 CAN/CGSB 51.26M: Thermal Insulation, Urethane and Isocyanurate, Boards, Faced.

.6 CAN/CGSB 51.33M: Vapour Barrier Sheet, Excluding Polyethylene, for use in Construction.

.3 Canadian Standards Association

.1 CAN/CSA 8.1, Elastomeric Composite Hose and Hose Couplings for Conducting Propane and Natural Gas.

.2 CAN/CSA A123.2: Asphalt Coated Roofing Sheets.

.3 CAN/CSA A123.3: Asphalt Saturated Organic Roofing Felt.

.4 CAN/CSA A123.16: Asphalt Coated Glass Base Sheets.

.5 CAN/CSA A231.1: Precast Concrete Paving Slabs.

.6 CAN/CSA 0121M: Douglas Fir Plywood.

.7 CAN/CSA 0151M: Canadian Softwood Plywood.

.4 Underwriters Laboratories of Canada

.1 CAN/ULC S701: Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC S704: Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Fixed.

.5 Ontario Roofing Contractors Association – Roofing Specifications Manual.

.6 NRCA (National Roofing Contractors Association) – Roofing and Waterproofing Manual.

.7 ULC (Underwriters Laboratories of Canada) – List of Equipment and Materials for Building Materials, Fire Resistance, and Fire-stop Systems and Components.

.8 Conform to National Plumbing Codes and requirements of Provincial and Municipal Authorities. Most stringent requirements shall govern where in conflict.

.9 Ontario Building Code.

1.3 Quality Assurance

.1 Contractor and his staff must be pre-approved and licensed by the membrane manufacturer, Owner, and Consultant prior to tender.

.2 Field review of roofing application will be carried out by Consultant. Contractor to make site available for inspection at Consultant's request. Any work not accepted by the Consultants shall be corrected by the Contractor to meet the requirements of the specifications, manufacturer's recommendations and/or good construction practices.

.3 The Contractor shall arrange for a technical representative of the manufacturer to review the installed roof system wherever a System Warranty has been specified.

.4 Manufacturer's representative to visit site a minimum twice weekly (or more if warranty requirements dictate), to review work in progress. Written reports shall be issued to all parties. A final review shall be made upon completion of the project in conjunction with Owner and Consultant.

.5 Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise designer of any discrepancies prior to commencement of the Work.

.6 Maintain one copy of the specification and manufacturer's literature on site throughout the execution of the Work.

.7 At the beginning of the Work and at all times during the execution of the Work, allow access to site by the Consultant and roofing membrane manufacturer's representative.

1.4 Submittals

.1 Submit to the Consultant a list of materials intended for use, before they are ordered, after award of contract.

.2 Provide initial schedule within five (5) working days after Contract award, showing anticipated progress stages and final completion of work. Work shall not commence before work schedule is provided.

.3 Prior to final completion, submit a letter from the Manufacturer stating that the Work has been inspected and installed in conformity to their requirements.

.4 Shop Drawings

.1 Submit Shop Drawings before proceeding with fabrication, including but not limited to the following:

.1 Tapered Insulation layout.

.5 Submit product data, including MSDS sheets, indicating membrane and bitumen materials and base flashing materials.

.6 Submit manufacturer's installation instructions.

.7 Provide a copy of the system manufacturer's warranty with the tender submission.

1.5 Mock-Ups

.1 When the requirement for a mock-up is requested in individual Sections or shown on the Drawings, erect mock-ups at locations acceptable to the Consultant for approval.

.2 Reviewed and accepted mock ups will become standards of quality of Work and material against which installed Work will be verified.

.3 Failure to prepare a mock-up in a timely manner is insufficient reason for an extension of Contract time.

.4 Verify all dimensions and conditions and provide alterations required to adapt Work to specific site conditions without additional cost.

.5 Allow 24-hours for review of the mock-up.

.6 All colours to be approved by the Owner.

.7 The mock-up, if acceptable to the Consultant, may form part of the finished Work.

1.6 Delivery, Storage and Handling

.1 All work to be conducted from the exterior using, hoist, etc.

.2 Location of site storage to be coordinated with Owner.

.3 All materials shall be delivered and stored in their original packaging bearing the manufacturers label, grade and product weight, including all other related standards, specifications, and the like.

.4 All materials shall be adequately protected from inclement weather conditions. Only materials to be installed on the same day shall be removed from the protected location to the work site.

.5 Protect moisture sensitive materials being stored outside from inclement weather using 8oz vinyl tarpaulins adequately secured to prevent blow off. Provide openings in manufacturer's packaging as recommend by manufacturer to prevent the formation of condensation prior to tarping.

.6 All temperature sensitive materials shall be stored in a heated location with a minimum temperature of 5°C (40°F) and removed only as needed. Under no circumstances shall temperature sensitive materials be allowed to freeze.

.7 All materials in a rolled configuration shall be stored on end with selvage end up atop a skid to protect bottom surface from foreign debris and moisture.

.8 The Contractor is to restrict stock piling of material in one location on the roof surface to prevent exceeding the specified deck live load capacity.

.9 Handle and store products in a manner to prevent damage and deterioration.

.10 Remove and replace damaged products at own expense and to the satisfaction of the Consultant.

.11 Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks, and excessive heat. Storage of flammable materials in interior occupied areas (stairwells, corridors, etc.) is not permitted.

1.7 Waste Management and Disposal

.1 All roofing, insulation, flashings, and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable Municipal, Provincial, and Federal requirements.

.2 All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Contractor and properly transported to a legal dumping area authorized to receive such material.

1.8 Environmental Requirements

.1 Weather, dry.

.2 Imminent weather forecast, dry.

.3 Install roofing on dry deck, free of water, moisture, snow, frost, and ice. Use only dry materials and apply only during weather that will not introduce moisture into roofing system.

.4 Only as much of the new roofing as can be made weather-tight each day, including all flashing and detail work, shall be installed. All seams shall be heat welded before leaving the job site that day.

.5 Comply with manufacturer's recommendations for minimum and maximum temperatures and humidity during application.

.6 Do not install roofing membrane when temperature remains below 5°C for self-adhered installations, or as stated in manufacturer's written specifications. Apply materials in accordance with the manufacturers' written recommendations.

.7 All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

1.9 Safety and Protection

.1 General:

.1 The Contractor shall follow all safety regulations as required by OHS (Occupational Health and Safety) and any other applicable authority having jurisdiction.

.2 All rooftop contamination that is anticipated or that is occurring shall be reported to the manufacturer to determine the corrective steps to be taken.

.3 The Contractor shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense.

.2 Solvents, Adhesives and Membranes:

.1 Store only enough solvents and adhesives on the roof for the same day's use, do not leave adhesives on roof overnight. Manufacturer supplied adhesives to be stored in their overnight containers. Minimum temperature for solvent-based adhesive and primers is -5°C.

.2 Do not install roofing membrane when temperature remains below -18°C for torch application, or 5°C for self-adhesive installations. Apply materials in accordance with the manufacturers' recommendations and in accordance with the Canadian Modified Bitumen Manufacturer's Association.

.3 Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odours could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odour while ventilating the building. Keep lids on unused cans at all times.

.4 Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

1.10 Warranty

.1 Reviews by the System Manufacturer’s representative shall only take place upon approval of the Consultant. Request for such site visits shall be provided to the Consultant at least 48-hours prior to requested site visit.

.2 All roofing work is to meet or exceed CRCA standards as well as roof system Manufacturer’s requirements.

.3 Contractor Warranty:

.1 Contractor shall supply the Owner with a two (2) year Contractor Warranty for workmanship.

.2 In the event any work related to materials installed is found to be within the Contractor warranty term, defective or otherwise not in accordance with the Contract Documents, the Contractor shall repair that defect at no cost to the Owner within 48 hours of receipt of notification. The Contractor shall also pay for all damages resulting from aforementioned defects.

.3 The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.

.4 Warranty shall be issued on the corporate letterhead and signed by an authorized signing officer.

.5 Nothing contained in this article shall be construed as in any way restricting or limiting the liability in common law and statutory liability of the Contractor.

.4 Manufacturer Warranty:

.1 Provide a sample copy of the system manufacturer's warranty with tender submission.

.2 Manufacturer's Extended Warranty: The Manufacturer shall issue a non-prorated warranty for a period of Twenty Years (20-years) at no cost to the Owner. All components including the vapour retarder, insulation, cover board, membrane, flood coat, perimeter flashings including metal shall be covered under this warranty. Wind uplift warranty shall cover wind velocity up to a maximum wind speed of not greater than 117 km/h (73 mph).

.3 Documentation shall be provided that the Manufacturer has personnel to carry out above noted warranty requirements and has a history of providing these for a minimum of 5 years.

.4 Record noted deficiencies and arrange for their proper repair under warranty.

.5 Should leaks occur in any area of the Manufacturer's product roof assembly during the warranty period, Manufacturer warrants that it will furnish, no-charge, sufficient material, and labour to correct the affected area(s). Any repair required under the warranty will be carried out in accordance with the specifications at no cost to the Owner.

.6 The warranty may be transferable subject to review and approval of Manufacturer.

.7 Nothing contained in this article shall be construed as in any way restricting or limiting the liability in common law and statutory liability of the Manufacturer.

.8 Under the terms of the warranty, the Roofing Contractor shall provide: A list of all necessary materials/procedures - as required by the Manufacturer to qualify for the warranty (and install such materials to the acceptance of the Consultant and Manufacturer).

PART 2 - PRODUCTS

2.1 General

.1 The use of materials other than those specified herein must be approved prior to award of the Contract. If substitute materials are proposed, then the list of materials must be included as part of the Tender Form. This submittal shall include product name, number and data sheets and manufacturer's specifications and installation instructions.

.2 Materials listed below are to be used on the project. Under no circumstances will substitute materials be used unless approval is first received from the Owner. Use of substitute materials without prior approval can result in the removal and replacement of these materials at no cost to the Owner.

.3 Note: all materials are to be supplied by one manufacturer meeting manufacturer's respective material compatibility requirements to achieve the required System Warranty. Acceptable membrane manufacturers for this project are:

.4 Components to be used that are other than those supplied or manufactured by the membrane manufacturer may be submitted for review and acceptance by the membrane manufacturer.

.5 The membrane manufacturer's acceptance of any other product is only for a determination of compatibility with the products and not for inclusion in the manufacturer's warranty.

.6 The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with the membrane manufacturer's products.

2.2 Primer

.1 General Purpose: Water-based polymer emulsion primer. It is designed to prepare surfaces for membrane applications to improve the adhesion of self-adhesive waterproofing membrane as required by membrane Manufacturer to achieve the specified warranty.

2.3 Vertical Surface Overlay Board

.1 ¼" plywood. Refer to 06 10 53 - Miscellaneous Rough Carpentry.

2.4 Spray Applied Polyurethane Foam

.1 Non-shrinking, low expansion, closed cell, non-CFC, single component foam to CAN/ULC-S711.1, as manufactured by Handi-Foam, Abisko Enerfoam, Froth-Pak or an approved equivalent.

2.5 Thermal Barrier

.1 Fibreglass mat faced panel with a specially treated gypsum core that resists moisture, surface primed. Panel size to be 4' x 8' (1220mm x 2440mm) with minimum thickness of ⅝" (16mm).

DensDeck Prime by Georgia-Pacific

Securock Glass-Mat Roof Board by CGC, A USG co

Or approved equivalent.

2.6 Vapour Retarder Adhesive

.1 A rapid-curing adhesive primer to meet Manufacturer's warranty requirements.

2.7 Vapour Retarder Membrane

.1 Self-adhered air and vapour control membrane consisting of a self-adhering SEBS rubberized asphalt laminated to a tough slip resistant cross laminated polyethylene surface film.

2.8 High-Temperature Self-Adhered Membrane Adhesive (if required)

.1 Rubber based adhesive for self-adhered membrane.

Approved Products: Blueskin Adhesive by Henry Bakor.

2.9 High-Temperature Self-Adhered Membrane (if required)

.1 Self-adhered composite high softening point SBS membrane with a minimum service temperature of -40°C to 127°C (-40°F to 260°F).

Approved Products: Blueskin Roof High-Temperature Self-Adhered Underlayment (PE 200 HT) by Henry Bakor.

2.10 Insulation Adhesive

.1 Thermal Barrier and Laminated Coverboard/Base Sheet: Low-rise polyurethane adhesive, compatible with asphalt surfaces and fiber faced insulation to meet Manufacturer's warranty requirements.

2.11 Insulation Fasteners

.1 #15 Philips high load fastener with corrosion resistant plate conforming to ASTM D4470. Must penetrate the roof deck a minimum of ¾" (19 mm). Approved Products: Dekfast by SFS intec, or approved equivalent.

2.12 Base, Tapered, Overlay and Sumped Insulation

.1 Base Insulation: Polyisocyanurate closed cell foam rigid roof insulation board, pentane blown, HCFC free, Type II, Class 2, Grade 2 (inorganic facer) minimum, manufactured with HC blowing agent bonded to glass fiber reinforced facers on top and bottom surfaces during the manufacturing process, meeting the requirements of CAN/ULC-S126-14 (R2024), CAN/ULC-S107, conforming to CAN/ULC-S704 for Long Term Thermal Resistance (LTTR) R-values of R-5.7 R per inch, for Class 1-90 windstorm classification & meeting FM4450 approval requirements for Class 1 Fire as a component in roof deck construction.

Board size 3" x 4' x 4' (75 mm x 1200 mm x 1200 mm).

.2 Tapered Insulation Crickets

.1 Rigid high thermal insulation board and crickets composed of closed cell polyisocyanurate foam core manufactured with fiberglass reinforced facers. Physical properties of insulation meet or exceed CAN/CGSB-51.26-M86. Insulation compressive strength to meet or exceed 20 kpa (138 psi) using test method ASTM D 1621. Insulation dimensional stability change must not exceed 2% when tested using ASTM D 2126. Insulation must be ULC approved.

Tapered Insulation and Crickets 2%.

.3 Overlay Insulation:

.1 Install asphalt coated high density fiberboard roof insulation impregnated with a water-repellant petroleum paraffin emulsion that imparts a high moisture resistance to the product. Board Density to be minimum 15.40 lbs/ft3 with CAN ULC-S706 Type II Class I and ASTM C-208 Type II Grade I Standards, R-Value of 1.3.

Board size to be ½" x 2' x 4' (13 mm x 600 mm x 1200 mm).

Or,

.2 Expanded perlite mineral aggregate board; 60 psi (414 kPa) at 10% Consolidation, square edges Meeting ASTM C 728.

Board size to be ½" x 2' x 4' (13 mm x 600 mm x 1200 mm).

.4 Tapered Drain Sump

Fiberboard: High density, asphalt coated and/or impregnated fiberboard or perlite insulation conforming to standards described in ASTM C208 or ASTM C728. Drain sump to be created for a distance of 16' x 16' (4800 mm 4800 mm) and 2% slope.

2.13 Membrane and Flashing Adhesives

.1 General Purpose: Solvent based primer composed of volatile solvents, synthetic polymers, and/or adhesive enhancing resins to prepare surfaces for membrane application as required by membrane manufacturer to achieve the specified warranty.

.2 High Tack for Self-Adhering Membranes: composed of volatile solvents, synthetic polymers, and/or adhesive enhancing resins to prepare surfaces for self-adhering membranes as required by membrane manufacturer to achieve the specified warranty.

2.14 Laminated Cover Board/Base Sheet

.1 2-1 Base sheet membrane, minimum thickness 2.2 mm with minimum 180g/m^2 non-woven polyester mat reinforcement, polyisocyanurate (ISO) HD panel and coated with SBS modified bitumen, sanded top surface, and conforming to ASTM D 6164, Type I, Grade S and/or CSA A123.23.23 Type B Grade 3 factory laminated to a high density polyisocyanurate cover board, minimum thickness 12.7 mm (1/2").

2.15 End Lap Cover Strip

.1 Heat-welded cover membrane composed of a composite reinforcement and SBS modified bitumen designed to ensure waterproofing of the end laps.

2.16 Self-Adhered Base and Cap Sheet Field and Flashing Membrane

.1 Field and Flashing Application: A base sheet membrane composed of SBS modified bitumen reinforced with a composite reinforcement. The surface is sanded and the self-adhesive under face is covered with a silicone release film and conforming to CSA A123.23-23 Type C, Grade 3.

2.17 Liquid Applied Flashing

.1 Flexible polyurethane/bitumen resin system for use in combination with fleece fabric or mesh to form a monolithic, reinforced flashing membrane.

2.18 Roof Drain (Supplied by Others)

.1 New Roof Drain Clamping Ring: No-hub cast iron roof drain with steel flange, clamping ring with water dam and screen, by Watts, Zurn or approved alternate.

.2 New Copper Roof Drains: New 24oz./.05" (1.2mm) roofing grade T-2 copper roof drain to be complete with flat flange, brass stabilizing ring, cast aluminum strainer dome with integrated or separate clamping ring, stainless-steel underdeck clamp and new MJ Clamp or Fernco coupler for hard internal connections.

2.19 Roof Drain Scuppers

.1 Refer to SECTION 07 62 00 - Sheet Metal Flashing and Trim.

2.20 Pitch Pans and Filler

.1 Refer to SECTION 07 51 13 – Sheet Metal Flashing and Trim

2.21 Penetration Flashing (Supplied by Others)

.1 Insulated aluminum sleeves and collars with vandal proof cap fabricated from 0.051" pre-spun aluminum of size to suit supplied by (wire):

.1 MEFA-V2 by Altra Metal Specialties

.2 Flash-Tite by Lexcor Canada

.3 Copper Hercules by OMG Roofing Products

.4 SJ-26 by Thaler Metal Industries

.5 or approved alternate.

.6 Flanges to be primed both sides as per manufacturer requirements.

.2 To be manufactured with matching vandal-proof caps or collars (plumbing vent). All sleeves to have foamed in place closed cell urethane foam insulation sprayed into the unit at the plant under controlled conditions. Flanges to be primed both sides as per manufactures requirements. Plumbing stack flashings prefabricated from heavy gauge spun aluminum, complete with wide base flange, telescoping cap and pre-insulated. Minimum 450mm (18") above roof surface.

.1 AVS-1 Series by Altra Metal Specialties

.2 Flash-Tite VB/VC Series by Lexcor Canada

.3 PVP-3 Series with cap by National Roofing Supply

.4 SJ-27 Series by Thaler Metal Industries

2.22 Roof Accessories

.1 Batt Insulation: Mineral wool batt insulation by Roxul: or approved equivalent.

.2 Rubberized Mastic to meet Manufacturer's warranty requirements.

.3 Precast Concrete Pavers: 2" x 24" x 24" (50 mm x 600 mm x 600 mm) precast concrete pavers to meet CSA 231.1-1972 or CAN3-A231.2-M85. Standard diamond texture surface with natural colour. Brooklin Roof Ballast Slab by Brooklin Concrete Inc.

.4 Insulation Pads for Concrete Pavers: 1" x 22" x 22" (25 mm x 550 mm x 550 mm) Type IV extruded polystyrene insulation. Roofmate by Dow Chemical Canada Ltd., or approved equivalent.

.5 Butyl Sealant formulated from a blend of butyl rubber and polyisobutylene.

.6 Cap Nails: 1" (25 mm) square or round head, ring shanked or Ardox galvanized or non-ferrous type with 1" disk, length as required to suit application.

.7 Termination Bar: Light-weight flexible aluminum 6063 T-5 grade and corrosion resistant. Pre-drilled every 8" (150 mm) and in 10' lengths with a ⅛" (3 mm) lip sealant edge for secure seal.

.8 Backer rod where required to fill applicable gap.

2.23 Fasteners and Fastener Accessories:

.1 Wood to steel, wood to wood or steel to steel:

.1 Tru-Fast Ultra Solid Stainless-Steel fastener to penetrate substrate by minimum 19mm (3/4").

.2 Wood/steel to concrete or concrete block:

.1 Perma-Grip Tap Grip H.D. Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 32mm (1 1/4").

.2 Tru-Fast Tap Grip H.D. Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 32mm (1 1/4").

.3 Tru-Fast DP with Trucote PC-3 corrosion protection fastener c/w EPDM galvanized steel sealing washers to penetrate substrate by 19mm (3/4").

.3 Termination Lip Bar for Membrane:

.1 Light-weight flexible aluminum 6063 T-5 grade and corrosion resistant. Pre-drilled every 8" (150 mm) and in 10' lengths with a ⅛" (3 mm) lip sealant edge for secure seal.

.2 Add fasteners where contact is not firm between fasteners.

.4 Termination bar fastener for wood, steel, or aluminum:

.1 Tru-Fast Ultra Solid Stainless-Steel fastener to penetrate substrate by 19mm (3/4") c/w EPDM galvanized steel sealing washers or Construction Fasteners Inc. Woodgrip #14 screw complete with Sentri coating on threads, Chromagard colour match head and EPDM washer.

.5 Termination bar fastener for concrete or masonry:

.1 Tru-Fast Tap Grip Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 32mm (1 1/4") c/w EPDM galvanized steel sealing washers.

.6 Prepainted metal flashing to steel or wood:

.1 Construction Fasteners Inc. Woodgrip #14 screw complete with Sentri coating on threads, Chromagard colour match head and EPDM washer or approved equal. Fastener to penetrate substrate by minimum 19mm (3/4").

.7 Membrane to wood:

.1 Galvanized round top nails with minimum 25mm (1") diameter heads to penetrate the substrate a minimum 32mm (1 1/4").

.8 All fasteners and plates to meet the requirements of Factory Mutual 4470 Standard for wind uplift and corrosion resistance.

.9 All fasteners used with pressure treated lumber to be stainless steel or hot dipped galvanized, minimum G185 in accordance with ASTM A653-03.

2.24 Sheet Metal Flashings and Trim

.1 As per Section 07 62 00.

2.25 Sealants: As per Section 07 90 00

.1 Refer to SECTION 07 92 00. Exterior grade silicone sealant. Clear silicone is not acceptable, and all sealants must be tooled.

PART 3 - EXECUTION

3.1 Examination

.1 Inspect existing conditions and substrates upon which work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the work.

.2 Defective work resulting from application to unsatisfactory substrate conditions will be considered the responsibility of those performing the work of this section.

.3 Prior to the removal of any roof components all existing openings (drains, vents, air intakes, etc.) shall be covered or plugged to prevent any debris or contaminate from entering the building below. All such coverings are to be removed at the end of each working day and reinstalled prior to the next days start up.

3.2 Workmanship

.1 Execute roofing work which is not specifically covered by these Specifications in accordance with applicable standards in Canadian Roofing Contractors Association (CRCA) and the National Roofing Contractors Association Roofing Specification Manual, in accordance with the Canadian Modified Bitumen Manufacturer's Association's recommendations, in accordance with the manufacturer's preprinted and published specifications and to ULC Design No. S-107, to FM 1-28 and 1.49 criteria, compliance with local fire insurance requirements and/or local building codes, except where specified otherwise.

.2 Do not install any material when it is raining or snowing, on wet/humid surfaces and/or outside of the application temperature allowed by the manufacturer.

.3 Do priming for asphalt roofing in accordance with CAN/CGSB 37-GP-15M and as recommended by membrane manufacturer.

.4 Procedures for application of materials should be in accordance with manufacturer's recommendations; otherwise, the Consultant should be notified if any conflict with this Specification arises.

.5 All work shall be carried out in accordance with drawings, specifications, and contract documents.

.6 Adhesives or sealants and liquid primers will not be applied until surfaces are dry.

.7 Inspect the underside of roof deck when installing fasteners, where possible, to avoid accidental damage.

.8 While work is in progress, all steps must be taken to safeguard the building from damage due to the elements.

.9 Advise the Consultant of adjustments to specified roofing procedures recommended by the Manufacturer or due to site conditions. Written approval is needed to make any adjustments to the specified procedures.

.10 Lay out Work to avoid working over newly installed membranes. If any foreign material is inadvertently incorporated into the membrane, remove the material immediately and repair to restore membrane to its original integrity.

.11 Maintain equipment in good working order to ensure control of roofing operations and protection of Work. Types of roofing equipment and laying techniques to be employed are to meet the approval of the Consultant.

.12 Do not penetrate roof deck with any fastening devices that would do damage or impair the function of the roof assembly.

.13 Unless otherwise specified, complete entire roofing operation up to the line of termination of each day's Work to meet the design intent in order to safeguard and protect the Work and building from damage and weather.

3.3 Preparation

.1 **A copy of this specification shall be kept on site at all times for reference purposes.**

.2 Use warning signs and barriers. Maintain in good order until completion of work.

.3 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.

.4 Contractor is to take care to not damage any previously performed work, any closely located buildings and all grounds in the vicinity during roofing operations. Garbage chutes are to be located as to minimize their exposure to the building and its occupants. Protect walls by means of tarpaulins where garbage chutes and hoisting equipment is located. Cover dumpsters and bins so that debris does not blow away.

.5 Before work commences, ensure all air in-take air exchangers, drains, down venting and similar, are protected from the intrusion of dust and debris.

.6 Roof access is to be unobstructed. Doorways and fire routes are to be kept clear of any obstacles.

.7 Protect surrounding surfaces from work in progress by covering walls.

.8 Examine all site conditions to ensure that they are in satisfactory condition for the commencement of the work of this section.

.9 Examine work of other trades for defects and discrepancies and report them to the owner/consultant in writing. Do not proceed with work until surfaces are satisfactory.

.10 Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

.11 The Contractor shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Contractor shall report any such blockages in writing to the Owner's Representative for corrective action prior to the installation of the roof system.

.12 Prior to the removal of any roof components, all existing openings (drains, vents, air intakes, etc.) shall be covered or plugged to prevent any debris or contaminate from entering the building below. All such coverings are to be removed at the end of each working day and reinstalled prior to the next day’s start up.

.13 The existing metal flashings and roof membrane shall be removed and associated debris to expose the existing overlay board and vertical substrates ensuring proper and adequate adhesion of the new roof assembly.

.14 Once the existing roofing materials are removed, the substrates shall be reviewed by the Contractor and Consultant. The entire roof area is to be reviewed in order to satisfy warranty requirements of the manufacturer of the new roof system. The Consultant is to be notified 48 hours prior to testing.

.15 All unused and abandoned pitch pockets, vents, curbs, sleepers, projections, etc. are to be removed from the designated areas and disposed of. Obtain verification and authorization from the Owner before removing any suspected unused or abandoned projections. New decking is to be installed as required to close off any openings prior to the installation of the new roofing system.

.16 Ensure roof drains have been installed at proper elevations relative to finished roof surface in order to allow for sufficient drainage of the roof surface.

.17 Disconnect Electrical Services as required.

.18 Disconnect Mechanical Equipment as required.

.19 Ensure that projections and any equipment (electrical conduit, gas lines etc.) are correctly secured to the decking where applicable. If any inadequate securement is found, the Consultant is to be informed and work around that area is to be halted until the situation has been rectified.

.20 Prior to application of membranes, examine substrate and ensure any defect of level or construction is correct before proceeding with the work.

.21 Inspect wood blocking, cants and the like. Do not install roofing unless such items are adequately installed to withstand stresses imposed by thermal movement of the roof components.

.22 Apply each part of roofing system when surfaces are free of moisture for successful application. Consult with manufacture's printed instructions for successful application.

.23 All details supplied with this scope of work package are acceptable installations. Any deviance from these details must first approved by the Consultant prior to installation.

.24 Examine and repair or replace damage caused by work of this Contract with materials and finish to match original, to Consultant's approval.

.25 Defective work resulting from application of material on unsatisfactory surface will be considered the responsibility of the Contractor.

.26 Provide a 20 lb. Dry chemical fire extinguisher fully charged and in operable condition at every location where open flames are used. Extinguisher to be visible at all times.

3.4 Surface Preparation

.1 Thoroughly sweep and vacuum surface free of all stones and debris and remove any irregularities to provide a smooth, even, dry surface over which to apply vapour retarder. Remove all grease, residual asphalt, dirt, oil, debris, diesel fuel, water, and all other foreign matter from the top surface.

.2 Report any deck damage or deterioration to the Consultant. No deck repair or replacement may be performed without the previous written consent of the Consultant/Owner. Costs for such repair or replacement shall be performed in accordance with the unit rates. All additional billing shall be delivered to the Owner with a copy submitted to the Consultant, accompanied with an itemized breakdown of costs incurred.

3.5 Carpentry

.1 Add new wood blocking as necessary to maintain minimum heights at perimeters and curbs. The minimum height above the finished roof at curb locations and at wall bases is to be 200mm (8"). The minimum height at parapets is to be 150mm (6") above the finished roof.

.2 Replace any seriously damaged or deteriorated wood at perimeters and projections with new construction grade spruce wood blocking or exterior grade, good one side plywood to match existing. Determination of the suitability to re-use or replace existing wood to be at the sole discretion of the Consultant.

.3 Ensure existing wood blocking remaining at perimeters and curbs is securely fastened to existing substrate before installing any new blocking.

.4 Install wood blocking as required to ensure that all curbs and sleepers for H.V.A.C. and mechanical equipment are level.

.5 All wood blocking and plywood is to be considered part of the roof, and to be made watertight by the end of each working day to eliminate moisture infiltration into the roof system.

.6 All fasteners to be flush or slightly sunk with surface of wood blocking being secured where possible.

.7 As indicated on drawings, install blocking and cant strips to accommodate slopes and insulation, roofing and sheet metal.

.8 Carpentry alterations will be performed to accepted trade practice.

.9 Before proceeding, installation of vapour retarders is to be in place.

.10 Wood to wood, wood to metal, wood to masonry or concrete to be secured at 300mm (12”) on center staggered.

3.6 Spray Applied Polyurethane Foam

.1 At openings and gaps along perimeter, curbs, and penetrations, install non-shrinking, low expansion, closed cell, non-CFC, single component foam to CAN/ULC-S710.1, as manufactured by Handi-Foam, Abisko Enerfoam, Froth-Pak or an approved equivalent.

.2 Other (larger applications): non-shrinking, medium-high expansion, closed cell, non-CFC, two component foam to CAN/ULC-S711.1, as manufactured by Handi-Foam, Abisko Enerfoam, Froth-Pak or an approved equivalent.

.3 Use batt insulation around voids to prevent foam from dripping into the building.

3.7 Primer

.1 Apply primer in accordance with manufacturer's directions to clean and dry surfaces.

.2 Ensure all substrates are fully covered with primer leaving no areas bare.

.3 Avoid pools and heavy areas and allow primer to dry a minimum 30 minutes or until staining does not occur to the touch and surface becomes tacky.

3.8 Vertical Surface Overlay Board

.1 Mechanically fasten the plywood along the perimeter, wall and curbs prior to the flashing membrane.

3.9 Thermal Barrier

.1 Where required, install in parallel rows and with joints staggered from boards below by half a board width and all ends staggered and in firm contact with one another.

.2 Ensure insulation is installed in a staggered butt joint configuration and is offset a minimum of 12" (300 mm).

.3 Fill gaps between insulation boards greater than ¼" (6 mm).

.4 Install ISO insulation low-rise foam adhesive in accordance with Manufacturer's instructions. Apply ¼" – ½" wide adhesive ribbons spaced 12" on center. Install insulation boards immediately into wet adhesive. Do not allow adhesive beads to skin over before placing the boards. Walk on board to fully press them into the wet adhesive in accordance with insulation manufacturer's application techniques and rates, using approved applicator. Check adhesion of insulation boards frequently. Spots compressed should be approximately 1 ½" (38 mm) to 2" (25 mm) diameter. Apply boards using pressure at several points to adhere maximum contact throughout all field areas.

3.10 Vapour Retarder

.1 Lay out the new vapour retarder atop the primed surface, fold the membrane in half lengthwise. Apply primer if required, allow to dry, and remove the release paper and press one corner of the membrane into place.

.2 Lift the free end of the membrane and pull until taught, then bond to the deck. Push the remaining membrane in place, ensuring there are no voids or wrinkles. Terminate all end laps atop the high side of the deck flutes. Sides shall be overlapped a minimum of 3" (75 mm) with end-laps primed and covered a minimum of 6" (150 mm).

.3 Extend membrane up and along the perimeter wall and curbs a minimum 3" (75 mm) above the top of the cant strip to ensure a continuous air-vapour barrier.

.4 Seal roof deck penetrations such as pipes, roof anchors, skylights, roof hatches, joints at roof/wall details, etc. first by applying the primer, then pressing pre-cut pieces of the vapour barrier snugly into place, ensuring no gaps or voids in coverage (use vapour barrier tape if so desired).

.5 At perimeters and large penetrations, such as curbs, a 6" (150 mm) envelope will be constructed to encapsulate the insulation, serving as a water cut-off membrane.

.6 Pack voids between deck and penetrations such as at plumbing vents, hot exhaust stacks, etc. using mineral wool insulation.

.7 Seal vapour retarder around all deck openings and penetrations, except hot vents.

.8 Seal perimeter of vapour retarder as follows: Fully envelope insulation with vapour retarder at walls, perimeters, curbs, etc., 6" (150 mm) minimum and adhere vapour retarder to top of insulation at enveloped areas; apply primer to the top of the insulation, fold the envelope on top and press the membrane into place, ensuing the envelope extends a minimum of 6" (150 mm) onto the horizontal surface. In torch applications, envelope the vapour retarder over the first layer of prime insulation prior to installing the overlay board.

3.11 High-Temperature Self-Adhered Membrane and Adhesive

.1 Prime surfaces with primer using a roller to achieve membrane to surface adhesion at (200-250 ft2 /gal) or (5-6 m2 /L) and allow to dry. It is important to avoid over-application of primer and allow drying for at least 30 minutes prior to covering. Not allowing the primer/adhesive to dry fully prior to covering may result in failed laps and/or failed adhesion to the substrate.

.2 Seal inside and outside corners of sheathing boards with a strip of membrane extending a minimum of 5" (13 cm) on either side of the corner detail. Prime surfaces where appropriate to achieve surface adhesion as per manufacturer's instructions and allow to dry.

.3 Install membrane in shingle fashion and press firmly into place, overlap minimum 5" (13cm) overlap at all ends (vertical) and 2" (5cm) side laps (horizontal). Promptly roll all laps and membrane to ensure the seal.

3.12 Base, Tapered and Overlay Insulation

.1 Install insulation boards with edges in moderate contact, without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

1. Install in parallel rows and with joints staggered from boards below by half a board width and all ends staggered and in firm contact with one another.

2. Ensure insulation is installed in a staggered butt joint configuration and is offset a minimum of 12" (300 mm).

3. Fill gaps between insulation boards greater than ¼" (6 mm) with the same insulation.

4. Off-set fiberboard insulation layer from polyisocyanurate insulation layer a minimum of 12" (300 mm).

.2 Base Insulation – Mechanically Fastened

.1 Mechanically attach extruded polyisocyanurate (ISO) base layer with five (5) fasteners per 4' x 4' board penetrating the roof deck a minimum of ¾" (19 mm).

.3 Overlay Insulation – Hot-Applied Modified Asphalt

.1 Fully adhere the overlay insulation boards in hot-applied modified asphalt to achieve good adhesion. Fully adhere insulation in hot-applied modified asphalt, applied at a rate of 25 lbs/100 ft2 (1.25 kg/m2), and applied in a full, continuous and uniform coating to achieve good adhesion. Check adhesion of insulation boards frequently. Step boards into place to maximize adhesion.

.2 Install insulation boards with edges in moderate contact, without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

1. Ensure insulation is installed in a staggered butt joint configuration and is offset a minimum of 12" (300 mm).

2. Fill gaps between insulation boards greater than ¼" (6 mm) with the same insulation.

3. Off-set fiberboard insulation layer from polyisocyanurate insulation layer a minimum of 12" (300 mm).

.3 Install in parallel rows and with joints staggered from boards below by half a board width and all ends staggered and in firm contact with one another.

3.13 Roof Penetrations

.1 Coordinate installation of roof drains and other related flashings.

.2 Prime all metal flanges and allow solvents to flash off prior to installation.

.3 Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

.4 Install metal plumbing stack flashings and roof drains in accordance with manufacturer's recommendations.

.5 Coordinate installation of roof drains and related flashings.

.6 Install 1-ply or 2-ply flashing membrane centered on drain, and to extend a minimum 4" (100 mm) and 6" (150 mm) (2-ply), or 6" x 6" (150 x 150 mm) (1-ply) beyond the flange onto the field-of-roof in specified modified bitumen adhesive.

.7 Reinforce leading edge laps of 1-ply EPDM/SBR flashing membrane with 6" (150 mm) BURmesh set in SEBS modified mopping asphalt followed by a flood coat and gravel.

.8 Reinforce leading edge laps of membrane flashing with reinforcement mesh and hot asphalt as recommended by Manufacturer for 1-ply EPDM/SBR elastomeric membrane only.

.9 Apply silicone sealant tooled around top of plumbing vent and install vandal-proof cap mechanically fastened using two (2) stainless-steel screws.

3.14 General Guidelines

.1 Sufficient adhesive should be applied at the laps to result in a visible bead of adhesive at the completed lap edge.

.2 Unroll membrane and allow to relax on a clean surface prior to installation. Time required for relaxation will vary with weather conditions in accordance with Manufacturer's requirements. Once relaxed sufficiently, re-roll the membrane, and begin application.

.3 Surface Inspection: Modified Bitumen membranes can be applied over wood, metal, gypsum board and steel decks which must be clean, smooth, free of snow, ice, moisture, and debris.

.4 Application of Primer: Priming is required for all substrates prior to the installation of a modified bitumen membrane. The primer is to be applied as per the manufacture's recommendations with a roller or sprayer. Contractor is to allow primer to dry prior to mopping to the prepared substrate. Drying time will vary according to the deck and weather conditions.

.5 Alignment of Rolls: The first roll to be completely unrolled and aligned with the edge of the roof. Where required, the membranes are to be unrolled and allowed to relax for the required time. The membrane is to be re-rolled from both ends to the centre and then applied as per specifications.

.6 Staggering of Sheets: End laps between base and cap sheets to be staggered in accordance with Manufacturer's requirements and guidelines.

.7 End lap and side lap sealing at areas of potential moisture infiltration at voids created by overlapping rolls of membrane, **heat-weld using a hot-air welded all end and side laps, gussets and inside and outside corners for the modified bitumen field and flashing membrane layers**.

.8 Membrane must be applied without voids, wrinkles, buckles, fish mouths or any evidence of lack of full adhesion. Deficiencies must be repaired to the satisfaction of the Consultant. Cut out fish mouths at field areas and side laps which are not completely sealed and repair to meet manufacturer's recommendations. Replace all membrane which is not fully and continuously bonded.

.9 At the end of each day's work, all laps must be inspected.

3.15 Roof and Flashing Membrane

.1 General Application Procedures: The following general procedures shall apply to the modified bitumen membrane installation.

.1 Surface Inspection: Modified Bitumen membranes can be applied over wood, metal, gypsum board and concrete decks which must be clean, smooth, and free of snow, ice, moisture, and debris. Concrete decks must have all holes filled and rough patches removed.

.2 Application of Primer: Priming is required for all substrates prior to the installation of a modified bitumen membrane. The primer is to be applied at a rate of approximately 1/2 gal/100ft2 with a roller or sprayer. Contractor is to allow primer to dry prior to adhering membrane to the prepared substrate. Drying time will vary according to the deck and weather conditions.

.3 First Roll Starting Point (Low Slope Roofs): Base sheet to begin at drain level with the side lap aligned with the centre of the drain, rolls to run perpendicular to the slope (where applicable). Cap sheet to be installed over the base sheet and cover the overlap in the base sheet. Center of cap sheet to align up with centre of the drain.

.4 Alignment of Rolls: The first roll to be completely unrolled and aligned with the edge of the roof. Where required, the membranes are to be unrolled and allowed to relax for the required time. The membrane is to be re-rolled from both ends to the centre, then applied as per specifications.

.5 Staggering of Sheets: End laps between base and cap sheets to be staggered approximately 600mm (24″). Side laps between base and cap sheets are to be offset 300mm (12″). Laps in the membrane (base and cap) are to be 75mm (3″) wide for side laps and 150mm (6″) wide for end laps.

.6 Procedure to Sealing Voids Created by Overlapping Rolls of Membrane:

.1 Prior to installation, the corner of the salvage edge covered by the next roll of material is to be cut off when the membrane is unrolled.

.2 This procedure to be carried out for the application of membranes (base sheets, cap sheets and flashings).

.7 Selvage Edge Protection: Granular along the edge of the membrane is to be primed prior to the application of adhesive to provide good adhesion of the laps.

.8 Membrane Flashings:

.1 Base flashings to extend minimum 150 (6″) onto the field from the bottom of the perimeter detail.

.2 Cap flashings to extend minimum 230 mm (9″), maximum 76 mm (3″) beyond edge of base sheet, onto the cap sheet from the bottom of the perimeter detail.

.9 Seams: Seams in all sheets to be checked with a round nosed trowel while work is in progress. Deficiencies found to be repaired prior to installing the covering layer or leaving the roof area at the end of the day.

.10 Reinforcement: Reinforcement is required at corners, vents, and drains, mechanical units, and gravel stops.

.11 The membrane shall not be installed under the following conditions without consulting the manufacturer's Technical Dept. for precautionary steps:

.1 The roof assembly permits interior air to pressurize the membrane underside.

.2 Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.

.3 The wall/deck intersection permits air entry into the wall flashing area.

.12 When primer application is required, the membrane must be installed on same day as primer application.

.13 Power vacuum surfaces to remove any loose dirt and debris. Substrate must be clean, dry, and free of non-bitumen compatible residues, dust, grease, and other contaminants.

.14 Lay out all sheets so as to allow them to relax a minimum of 30 minutes. When temperatures are below 5°C (40°F) keep and lay out rolls in heated storage. Install rolls before temperature fallback of the sheet occurs.

.15 Discard any defective material. Do not use the last meter of any roll for the construction of the roof membrane. This may be used for membrane flashings.

.16 Take care to ensure proper alignment of first roll. Install all membrane into place true to line, free of buckles, air pockets, fishmouths or tears.

.17 Lay membrane starting at low point so that seams do not face the flow of water.

.18 Ensure all corners and laps are properly lapped and sealed for watertightness.

.19 Cut off corners of roof membrane at 45° at end laps to be covered by the next roll prior to installation of following sheet.

.20 Overlap all end laps minimum 150 mm (6") and side laps 75 mm (3").

.21 Installation of Reinforced Gussets

.2 Install gussets at every angle, on inside and outside corners.

.3 Heat-weld using a hot air welder, the gussets in place after installing the base sheet membrane, and prior to the cap sheet membrane.

.2 Laminated Cover Board/Base Sheet

.1 Self-Adhered Installation

.1 Apply low-rise foam adhesive in accordance with Manufacturer's instructions with ¼" – ½" wide adhesive ribbons spaced 12" on center.

.2 Prime substrate to receive self-adhering base sheet membrane.

.3 Install base sheet flashing onto substrate in 1m (40") wide strips extending over perimeters and curbs and/or terminating up vertical surfaces as shown on detail drawings.

.4 Align and position the membrane parallel with the substrate and adjoining membranes and lay in place without removing the release film. Remove part the release film from the back of the membrane and apply to the substate for initial adhering. Gradually remove the remaining release film while at the same time pressing the membrane onto the substrate.

.5 Using weighted roller as recommended by manufacturer, roll all surfaces of the membrane to ensure continuous adhesion to the substrate. Firmly press the membrane into the substrate to ensure proper bond.

.6 Lap base sheet flashing onto base sheet field membrane minimum 150mm (6").

.7 End Laps, Thermofusible Top Surface: Using a hot air welder, weld minimum 25 mm (1') of the end laps.

.8 End Laps, Sanded Top Surface: Apply cold adhesive on the first 100 to 125 mm (4 to 5 in) of the end laps and weld the last 25 to 50 mm (1 to 2 in) using a hot air welder.

.3 Base Sheet Flashing

.1 Self-Adhered Installation

.1 Prime substrate to receive self-adhering base sheet membrane.

.2 Install base sheet flashing onto substrate in 1m (40") wide strips extending over perimeters and curbs and/or terminating up vertical surfaces as shown on detail drawings.

.3 Align and position the membrane parallel with the substrate and adjoining membranes and lay in place without removing the release film. Remove part the release film from the back of the membrane and apply to the substate for initial adhering. Gradually remove the remaining release film while at the same time pressing the membrane onto the substrate.

.4 Using weighted roller as recommended by manufacturer, roll all surfaces of the membrane to ensure continuous adhesion to the substrate. Firmly press the membrane into the substrate to ensure proper bond.

.5 Lap base sheet flashing onto base sheet field membrane minimum 150mm (6").

.6 End Laps, Thermofusible Top Surface: Using a hot air welder, weld minimum 25 mm (1') of the end laps.

.7 End Laps, Sanded Top Surface: Apply cold adhesive on the first 100 to 125 mm (4 to 5 in) of the end laps and weld the last 25 to 50 mm (1 to 2 in) using a hot air welder.

.4 Cap Sheet (Field)

.1 Self-Adhesive Installation

.1 Prime substrate to receive self-adhering base sheet membrane.

.2 Starting at low point on roof, perpendicular to slope, align the sheet and lay flat. Offset joints in cap sheet minimum 300mm (12") from those of base sheet.

.3 For non-split-back release films, peel off a corner of the silicone film to allow the membrane to adhere to the surface. Then remove the silicone film at an angle of 45°. While one applicator peels off the silicone paper from the underface of the membrane, another should pull on its free end to prevent creating any wrinkles in the membrane.

.4 For split-back silicone release films, fold one half of the roll lengthwise onto the other half. Peel the film, fold the exposed half over the base sheet, first by the centre, then by the two ends (butterfly technique) and repeat for the second half.

.5 Apply pressure over the whole surface using a manufacturer recommended heavy membrane roller to ensure a complete and uniform adhesion.

.6 Using a hot air welder, weld minimum 25 mm (1′) of the side laps.

.7 For the end laps, apply cold adhesive on the first 100 to 125 mm (4 to 5 in) of the end laps and weld the last 25 to 50 mm (1 to 2 in) using a hot air welder.

.5 Cap Sheet Flashing

.1 Self-Adhesive Installation

.1 Prime substrate to receive self-adhering cap sheet membrane.

.2 Install cap sheet flashing onto substrate in 1m (40″) wide strips extending over perimeters and curbs and/or terminating up vertical surfaces as shown on detail drawings. Extend top of cap sheet minimum 25 mm (1″) above the top of the base sheet for fastening with a termination bar.

.3 Lap sheets minimum 203 mm (8″) onto cap sheet field membrane, max. 51 mm (2″) beyond edge of base sheet flashing.

.4 Align and position the membrane parallel with the base sheet and lay in place without removing the release film. Offset joints in cap sheet minimum 300mm (12") from those in base sheet. Remove part the release film from the back of the membrane and apply to the substate for initial adhering. Gradually remove the remaining release film at a 45° angle while at the same time applying pressure to the membrane.

.5 Using weighted roller as recommended by manufacturer, roll all surfaces of the membrane to ensure continuous adhesion to the substrate. Firmly press the membrane into the substrate to ensure proper bond.

.6 Using a hot air welder, weld the side laps to the lapped membrane.

.7 For the end laps, apply cold adhesive on the first 100 to 125 mm (4 to 5 in) of the end laps and weld the last 25 to 50 mm (1 to 2 in) using a hot air welder.

.8 Where indicated on details, secure top edge of the cap sheet to substrate with termination lip bar and fasteners spaced at maximum 203 mm (8") o/c. Align the top of the flat part of the termination bar with the top edge of the cap sheet and apply a continuous bead of sealant to the top lip of the termination bar/cap sheet.

3.16 Roof Drain

.1 General:

.1 Remove and discard existing drains and pipe fittings that are no longer required.

.2 Ensure that the drains are clear of debris and free flowing prior to the installation of the insulation and the membrane.

.3 Any blockages are to be reported prior to the start of work. Once work has begun, the Contractor assumes responsibility for free-flowing drains and the cost associated with clearing.

.4 Prior to the installation of new insulation and membrane, ensure that all new drains are located at a height where the roof is able to clear the majority of roof top water caused by rainfall within a 48-hour period.

.5 All plumbing to be executed in accordance with relevant Provincial Building Codes and Local Building Codes.

.6 **No roof area shall be left overnight without adequate provision for drainage at the existing roof scupper drain locations.**

.2 Roof Drain

.1 Remove any other components of the existing roof drain which may prevent the drain flange from sitting flush with the roofing membrane.

.2 After installing vapour retarder to edge of drain opening, install new wood blocking to extents of drain flange and secure to deck. Refer to Drawings.

.3 Install sloped insulation sumps around drain to provide positive drainage as specified in the Scope of Work and/or shown on the Drawings. Adjust size and slope of drain sumps as required to suit site conditions.

.4 Install new cover board and base membrane over the drain location prior to installing the drain as per Drawings and membrane installation methods.

.5 Prime and coat drain flange bottom in a continuous layer of modified sealant. Ensure primer is dry before proceeding.

.6 Insert the drain body down into the existing drainpipe until the drain flange is embedded into the surface of the base sheet membrane. If the drain body is too long, it may be shortened by cutting the copper drain stem prior to installing the drain seal connection.

.7 The drain body is to be secured to the substrate with a minimum of 4 fasteners per drain or additional as required to secure the drain body.

.8 Prime drain flange with modified bitumen primer. Install 1-ply modified bitumen base sheet flashing (target patch), size 1000 mm x 1000 mm (39" x 39") centred over the drain. Use the drain seal hole puncher tool to make neat membrane penetrations for the drain studs.

.9 Install cap sheet and install a continuous bead of modified sealant and set clamping ring. Secure clamping ring and integral strainer as dictated by drains design. Tighten bolts to ensure a permanent watertight compression seal. Torque to 13.6 N.m (10 lb ft.) with torque wrench.

.3 Scupper Drains and Downspouts

.1 Install base flashing membrane through the perimeter scupper opening prior to the metal scupper.

.2 Prime all metal flanges and allow solvents to flash off prior to installation.

.3 Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

.4 Install base ply membrane to the base of the metal flashing staying short of curved metal section.

.5 Extend base flashings a minimum of 6" (150 mm) onto the roof membrane.

.6 Install the scupper Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

.7 Install an additional ply of base sheet membrane over the flange as per the manufacturer's written instruction prior to installing the field cap sheet membrane. The additional ply of membrane to extend a minimum of 150mm (6") past the edge of the flange.

.8 Install cap ply to the base ply flashing ensuring a full bond to the base ply and apply bead of sealing compound at the termination point.

3.17 Roof Penetrations

.1 Coordinate installation of roof drains and other related flashings.

.2 Install roof penetration flashings and seal with membrane in accordance with the manufacturer's recommendations and as indicated on detail drawings.

.3 Prime all metal flanges and allow to solvents to flash off prior to installation.

.4 Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.

.5 Install an additional ply of base sheet membrane over the flange as per the manufacturer's written instruction prior to installing the field cap sheet membrane. The additional ply of membrane to extend a minimum of 150mm (6") past the edge of the flange.

.6 Install cap ply to the base ply flashing ensuring a full bond to the base ply and apply bead of sealing compound at the termination point.

.7 Plumbing, Mechanical, Electrical and Miscellaneous Roof Penetrations

.1 Install new flashings and sleeves at plumbing, mechanical, electrical, and miscellaneous roof penetrations as specified in the Scope of Work and/or as shown on the Drawings.

.2 Inspect and clean vent pipes and stacks clean of debris to operational condition.

.3 Make all roof penetrations air and watertight at the deck level by installing flexible membrane seal over the pipe and extending 152 mm (6") onto the roof deck. Clamp flexible membrane to pipe and seal with modified sealant. Seal the vapour barrier to the air seal with a continuous layer of modified sealant.

.4 Adjust the existing pipes to specified heights by either cutting down or extending the pipes with matching materials attached with mechanical couplers. Ensure pipes are 38 mm (1.5") higher than flashing to allow for sealing to prevent condensation.

.5 Install metal flashings and sleeves on top of the completed membrane roofing.

.6 Prime and set flanges in a continuous layer of modified sealant on installed base sheet. Ensure primer is dry before proceeding.

.7 Protect all metal sleeves and flashings not to be covered with roofing with flashing protector to prevent bitumen stains and damage.

.8 Prime flanges to be covered with flashings with modified bitumen primer and flash with modified bitumen base sheet. Ensure primer is dry before proceeding.

.9 Seal the joint between the metal upturn and the cap sheet with modified sealant and tool to form a minimum 19 mm (3/4") wide bead.

.10 Insulate all stacks and sleeves unless otherwise shown on the Drawings. Insulate with loosely packed mineral wool insulation or two-part polyurethane foam if otherwise shown on the Drawings. Seal the opening between the top of the flashing and the pipe with polyurethane sealant sloped minimum 30º to shed water.

.11 On vent pipes with telescopic caps, seal cap to the top of the vent pipe with a continuous 13 mm (1/2") thick bead of polyurethane sealant to prevent a condensation trap.

.12 On vent pipes with tapered rubber gasket collar, verify size and install collar as shown on the Drawings.

.13 Install rain collars on all stacks as shown on the Drawings. Weld rain collars 22-gauge or heavier. Where collars are less than 22-gauge, install custom or pre-manufactured collars soldered or caulked in place as shown on the Drawings.

.14 Remove and replace all damaged flashings and poorly fitting collars. Clean exposed surfaces free of bitumen before leaving site. Paint all sleeves marred with bitumen with two coats of compatible paint to match original colour.

3.18 Termination Bars

.1 Install butyl sealant between new and old membrane and new termination bar where required.

.2 Ensure all metalwork and / or terminations are installed within 72 hours of completed membrane applications.

.3 Install 1" (25 mm), 14-gauge termination bar ⅛" (3 mm) below the top of the flashings and secure to the masonry wall using 1 ½" 'Tapcon' fasteners every 8" o/c.

.4 Seal the top of the termination bar with specified silicone sealant.

3.19 Miscellaneous

.1 Install new weather-stripping foam with adhesive back (closed cell) around top of all curbs after flashing membrane installation and prior to metal cap flashing installation.

.2 Installation of install Quick Blocks (or approved equivalent) under conduit lines supported on 1" (25 mm) extruded polystyrene insulation to match existing number and location. Secure conduit line on top of supports with galvanized clamp, fastened on both sides.

.3 Installation of new 2" x 24" x 24" (50 mm x 600 mm x 600 mm) concrete pavers, supported on 1" (25 mm) extruded polystyrene insulation, at all roof access, hatches (2 each), discharge pipes at all applicable curb locations (1 each) and existing walkway location.

3.20 Temporary Water Cut-Off

.1 Temporary waterproof seals will be placed on daily work. Only areas which can be made watertight in the same day will be removed to ensure protection of the interior. Temporary seals will be removed before proceeding with the remaining work.

.2 All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses.

.3 All temporary water-stops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation.

.4 The new membrane shall be carried into the water-stop. The water-stop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing.

.5 The edge of the membrane shall be sealed in a continuous heavy application of sealant.

.6 When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of offsite. None of these materials shall be used in the new work.

.7 If inclement weather occurs while a temporary water-stop is in place, the Contractor shall provide the labour necessary to monitor the situation to maintain a watertight condition.

.8 If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Contractor's expense.

3.21 Cleaning

.1 Clean up and remove from job site on a daily basis, all rubbish and surplus materials resulting from this work.

.2 All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.

END OF SECTION – 07 52 16

PART 1 - GENERAL

1.1 General Requirements

.1 All conditions of the contract and Division 1, General Requirements apply to this section.

.2 All materials and equipment must be set up in a position satisfactory to the Owner's representative.

.3 All materials shall be new and free from defects which may impair strength, durability, or appearance.

.4 Scheduling of the work shall be discussed with, and be subject to, the approval of the Owner.

1.2 References

.1 Comply with requirements of the following documents, latest edition:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A606, Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.2 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792, Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.32, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB 93.1, Sheet, Aluminum Alloy, Prefinished, Residential.

.3 CGSB 93-GP-3, Sheet, Steel, Galvanized Prefinished.

.4 CSSBI Bulletin No. 9, Care and Maintenance of Prefinished Sheet Steel Building Products.

.3 Sheet Metal & Air Conditioning Contractors' National Association (SMACNA) Manual (Latest Edition).

.4 NRCA (National Roofing Contractors Association) and CRCA (Canadian Roofing Contractors Association) – Roofing and Waterproofing Manual.

.5 Ontario Building Code (OBC).

1.3 Quality Assurance

.1 Contractor Qualification:

.1 Contractor and their staff must be accredited by the membrane manufacturer to supply and install the specified materials.

.2 Contractor must be approved by the Owner and Consultant.

.2 Work in this section shall comply with the guidelines, standards and current details from the following related organizations:

.1 Sheet Metal and Air Conditioning Contractors National Association - SMACNA

.2 Canadian Roofing Contractors Association – CRCA

.3 National Roofing Contractors Association – NRCA

.3 Field Review:

.1 Review of sheet metal flashing and trim installations will be carried out by the Consultant. Contractor to make site available for review at Consultant's request. Any work not accepted by the Consultant shall be corrected by the Contractor to meet the requirements of the specifications, manufacturer's requirements and/or good construction practices.

1.4 Delivery, Storage and Handling

.1 Deliver and store materials to manufacturer's instructions and CSSBI guidelines.

.2 Store materials under cover on elevated platforms.

.3 Remove and replace damaged material.

1.5 Protection

.1 Protect the work of this section from damage. Damaged work, which cannot be satisfactorily repaired, restored, or cleaned, shall be replaced at no cost to the Owner.

1.6 Warranty

.1 Submit a Contractor's written warranty for repair work specified in this section covering a period of two (2) years, including materials and application, at no cost to the Owner. The contractor shall warrant that the installation will be free from defects related to workmanship or material deficiencies.

.2 Any repair required under the warranty will be carried out in accordance with the specifications at no cost to the Owner.

PART 2 - PRODUCTS

2.1 List of Proposed Materials

.1 All materials listed below must be used on the project. Under no circumstances will substitute materials be used unless approval is first received from the Owner or Consultant. Use of substitute materials without prior approval can result in the removal and replacement of these materials at no cost to the Owner.

2.2 Prefinished Sheet Metal Flashings

.1 Galvanized steel, 0.6mm (24ga.) core nominal thickness unless specified otherwise on drawings, with Z275 (G90) zinc coating designation to ASTM A653M (A653), complete with factory applied silicone modified polyester (SMP) resin coating system.

Approved Products: WeatherXL by Valspar Corp. or Perspectra Series by Baycoat Ltd. Colour to be approved by Owner.

2.3 Cleats and Hook Strips Not Otherwise Specified

.1 Two gauges heavier of matching materials of flashing being employed. Minimum 0.76mm (22ga) and of the same material. All hook strips shall be continuous and secured at 6" (152mm) on center in an alternating high – low pattern. Lower fasteners to be within 1.25" (32mm) of drip.

2.4 Adhered Transition Membrane:

.1 Transition Membrane:

.1 Blueskin PE 200 HT by Henry;

.2 Lastobond Shield HT by Soprema;

.3 AcrylicStick SA by IKO;

.4 Clad-Gard SA Metal Underlayment by Firestone;

.5 Approved equivalent.

.2 Transition Membrane Primer:

.1 Blueskin Primer by Henry;

.2 Elastocol Stick Primer by Soprema

.3 SA-Solvent Based (SB) Primer by Firestone;

.4 Approved equivalent.

.3 Transition Membrane Sealant: As recommended by the membrane manufacturer.

2.5 Fasteners:

.1 All direct fasteners for sheet copper and fasteners for cleats to be 300 tailless steel, wood screws, min. #10, minimum 13mm (1/2") embedment into plywood.

.2 All fasteners in contact with sheet copper shall be copper, brass or series 300 stainless steel.

.3 Replacement screws should be at least one (1) gauge thicker than the screws installed at the same location. Screws should have flat heads for any hidden location and round heads for expose locations.

.4 Use galvanized, copper, aluminium or stainless-steel screws as most compatible with materials being employed. Use fasteners as most generally suitable to.

.5 Fasteners for Wood:

.1 No. 10, flathead, size, and length to suit material.

.6 Exposed Fasteners:

.1 No.10 hex head cadmium plated with neoprene and solid washers by Atlas Bolt or approved equal. Fastener to penetrate substrate by 25mm (1"). Consult manufacturer for screw type and sizing for materials being secured. Provide caps for screw heads to match colour of flashing as specified or shown.

.7 Masonry Fasteners:

.1 Tapcon, Gripcon or Rawl spike sized to penetrate concrete 38mm (1.5") minimum unless otherwise shown.

.8 Fasteners for Masonry and Concrete Substrates:

.1 Tapcon Anchors with Climaseal corrosion resistant finish as supplied by Buildex or approved equivalent, 6mm (1/4") diameter and of sufficient length to provide a minimum of 50mm (2") penetration into substrate.

.9 Stainless Steel Pop Rivets:

.1 3mm (1/8") diameter.

2.6 Solder:

.1 Block solder 50% tin, 50% lead to ASTM B32. Use only rosin flux.

2.7 Touch-up paint:

.1 As recommended by pre-finished material manufacturer.

2.8 Bituminous Paint:

.1 Gilsonite asphalt 910-02 by Bakelite to CGSB 1-GP-108 Type II.

2.9 Sheet Panels

.1 Copper Scupper

.1 To ASTM B370-09, cold rolled, weighting 20 oz/ft^2 Panels to be roll formed in continuous lengths, or approved equivalent. Colour to be similar to existing and selected by Owner.

.2 Pitch Pan

.1 To ASTM B370-09, cold rolled, weighting 16 oz/ft^2 Panels to be roll formed in continuous lengths, or approved equivalent. Colour to be similar to existing and selected by Owner.

2.10 Downspouts

.1 4" x 4" (100mm x 100mm) 26-gauge open-face prefinished steel with all associated accessories. Colour to be chosen by Owner.

.2 Affix downspouts to the scupper collector heads.

.3 Secure downpipes to existing exterior wall with double folded 26-gauge every 1.8m (6') vertically and with a minimum of two straps per down pipe.

2.11 Sealing Tape:

.1 Any exposed fasteners penetrating sheet copper shall be installed with 13mm x 13mm (1/2" by 1/2") pressure sensitive 100 solids polyisobutylene compound sealing tape with release paper backing.

2.12 Dissimilar Materials:

.1 Protect material from electrolytic action when dissimilar metals are in contact with one another.

2.13 Sealant:

.1 To Section 07 92 00.

PART 3 - EXECUTION

3.1 Examination

.1 Examine the drawings and specifications to determine the extent of the work involved, together with other data affecting the work, as in no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the extent of such work shown, herein described or implied.

3.2 Fabrication

.1 Verify all dimensions on site prior to fabrication.

.2 Use competent mechanics and work accurately to details indicated and as herein specified.

.3 Fabricate all possible work in shop in 2.4m (8ft) lengths by brake forming, bench cutting, drilling, and shaping. On high vertical sections install metal in 1.2m (4ft) section as specified and detailed.

.4 On coping or flashing with a horizontal dimension of 406mm (16") or greater, fabricate metal flashings in maximum 1.2m (4 ft) sections.

.5 On coping or flashing with a horizontal dimension of 508mm (20") or greater, use 25mm (1") lock folded standing seam joints.

.6 Form bends with straight sharp lines, angles, and corners into true planes, free from twists, buckles, dents and other visual distortions.

.7 Double-back exposed metal edges at least 13mm (1/2"). Raw edges will not be permitted.

.8 End joints where adjacent lengths of metal flashing meet shall be made in accordance with jointing method specified hereinafter.

3.3 Dissimilar Materials

.1 Protect material from electrolytic action when dissimilar metals are in contact with one another.

.2 Paint the mating surfaces of aluminum and galvanized steel with bituminous or zinc chromate primers. Taping or gasketing with non-absorptive materials or sealants is also acceptable.

3.4 Installation

.1 Install sheet metal flashings at copings, walls, joints, roof openings and other components required to protect the membrane flashings as shown on the drawings, or otherwise required.

.2 Install continuous concealed hook strips where indicated or required to present a true, non-waving, leading edge. Install cleats as required to protect membrane roofs and flashings from damage at lock joints and as required to permanently hold flashing in place. Secure cleats at 150mm (6") o.c. in V-pattern, keeping lower fastener within 32mm (1-1/4") of the drip edge.

.3 Sheet metal work shall be installed to cover the entire area it protects and shall be watertight under all service and weather conditions. Install in a uniform manner, level, true to line, free of dents, warping and distortion.

.4 Back-paint at the rate of 0.12L/m^2 (1/4 Gal/100 ft^2) with bituminous paint, sheet metal that comes into contact with another kind of metal, masonry or concrete.

.5 Install sheet metal with concealed fasteners at lock joints. Exposed fastening will be permitted only with the approval of the Consultant. Space all fasteners evenly in an approved manner. Use lead plugs and screws where fasteners are exposed, otherwise use concrete drive fasteners where metal flashings are installed over concrete or masonry.

.6 Install underlay under sheet metal, installed directly over wood or masonry surfaces. Overlap joints and turn up at edges where horizontal surfaces intersect vertical planes 76mm (3") minimum.

.7 Join sheet metal by "S" lock seams, to permit thermal movement. Fill all joints with caulking as flashing is being installed. Clean off all excessive material visible subsequent to installation.

Space joints evenly where exposed. Form inside and outside corners by means of raised seams. Lock seams and caulk all overlaps to ensure water tightness. Do not use pop rivets. Provide fully caulked standing seams at all cap flashing joints 8" (200 mm) or wider.

.8 Slope all metal to interior to maintain minimum 10% slope. Do not form open joints or pockets that fail to drain water.

.9 Caulk all open sheet metal joints. Solder corners and other locations as required for a permanent waterproof connection.

.10 Insert metal flashing under cap flashing and behind other claddings a minimum of 38mm (1 ½").

.11 Provide new reglets sized minimum 10mm (3/8") wide, 19mm (3/4") deep.

.12 Clean reglets free of contaminates and dust.

.13 Wedge flashings into reglet joints with lead wedges at 229mm (9") o.c. Set minimum 6mm (1/4") from masonry surface.

.14 At reglets wider than 10mm (3/8") and deeper than 19mm (3/4") provide backer rod, 25% wider than joint width. Install sealant to provide a continuous waterproof seal. Use colour to match materials. Conform to manufacturer's latest printed recommendations for use of products being employed.

.15 Carry flashings out onto the roof minimum 76mm (3").

.16 Prepare a mock up installations of the metal flashing details for approval by Consultant prior to the installation of the metal flashings.

3.5 Roof Drain Scupper

.1 To meet or exceed ASTM B370-09, cold rolled, 0.69 mm thick (20 oz/ft^2) grade sheet copper, shop fabricated with fully soldered corners and throat.

.2 To be 100mm (4") in height x 150mm (6") in width minimum.

.3 Face of scupper to be encapsulated with prefinished metal cover. Colour to be chosen by Owner.

.4 Install new metal open-top scupper drains as shown on the roof plans or at existing locations unless otherwise directed by the Consultant.

.5 Install transition piece gutter outlet to receive downspout at connection to eavestrough to be fully soldered. Apply bead of silicone sealant around lip of transition piece before assembly and attachment.

3.6 Downspout Installation

.1 Review location of downspouts with Consultant prior to installation.

.2 Install transition piece outlet to receive downspout at connection. Apply bead of silicone sealant around lip of transition piece before assembly and attachment.

.3 Secure downspouts to wall with double folded 26-gauge. strap every 1.8m (6ft) vertically and with a minimum of three (3) straps per downspout. Strap at top shall be fixed to downspout, intermediate and bottom straps shall be slotted to allow not less than 13mm (1/2") movement for each 3m (10ft) of downspout.

.4 Install elbows, offsets and shoes where required. Slope not less than 45 degrees. All securements shall be with aluminum rivets and fasteners. Cadmium plated fasteners shall not be accepted.

.5 Extensions are to be installed at all downpipe locations and extend a minimum of 300mm (1ft) away from the building.

3.7 Finish

.1 At project completion, leave surface and adjacent work areas free of damage and clean of debris. Finished surfaces of formed metal flashings shall be free of oil canning, dents and be perfectly colour matched. Changes in colour between sheets and dented or oil canned surfaces that detract from the visual appearance of finished product are to be replaced at the Contractor's expense. Remove and replace damaged, defaced, or defective work.

.2 Paint all exposed metal due to cutting.

.3 Touch-up finish surfaces damaged during handling and erection in conformance with manufacturer's recommendations. Refinish shop applied finishes as approved by Consultant.

.4 Remove deposits or protections and wash metals left unpainted and exposed to view as specified by metal manufacturer.

3.8 Cleaning

.1 Maintain project free of accumulated waste and rubbish. Disposal of debris and garbage shall be on a daily basis with minimum disturbance to the Owner.

.2 Final cleaning:

.1 Remove temporary protection.

.2 Remove dust, dirt and foreign matter from surfaces.

.3 Broom clean paved exterior surfaces, rake clean other exterior surfaces. Use magnet to sweep sodded areas for metallic debris.

.4 Ensure that all fasteners have been removed from the roof and surrounding site. Clean all eave-troughs and downspouts of debris generated as a result of this work.

.5 Remove all stains, caulking or other adhesive from all affected surfaces.

.6 Clean surface of metal and apply touch up paint to all scratches.

.7 At the end of the project, landscaping shall be repaired to match original conditions.

END OF SECTION – 07 62 00

PART 1 - GENERAL

1.1 General Requirements

.1 All conditions of the contract and Division 1, General Requirements apply to this section.

.2 All materials and equipment must be set up in a position satisfactory to the Owner's representative.

.3 All materials shall be new and free from defects which may impair strength, durability, or appearance.

.4 Scheduling of the work shall be discussed with and be subject to the approval of the Owner.

1.2 References

.1 Comply with requirements of the following documents, latest edition:

.1 ASTM C719, Standard Test Method for Adhesion and Cohesion of Elastomeric Sealant Joints Under Cyclic Movement (Hockman Cycle).

.2 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

.3 ASTM C1193, Standard Guide for Use of Joint Sealants.

.4 ASTM C1311, Standard Specification for Solvent Release Sealants.

.5 ASTM C1330, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

.6 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing

.7 SWRI (Sealant, Waterproofing and Restoration Institute) – Sealant and Caulking Guide Specification.

.8 The Professionals' Guide, Sealant, Waterproofing and Restoration Institute.

.9 Ontario Building Code.

1.3 Submittals

.1 Product Data: After the award of contract, submit the following:

.1 Manufacturer's product data and specifications needed to prove compliance with the specified requirements.

.2 Sealant manufacturer's recommended installation procedures which will become the basis for accepting or rejecting actual installation procedures used on the work. Indicate special procedures, surface preparation, perimeter conditions requiring special attention, and field quality control testing.

.2 Samples: Upon request, submit samples of each sealant, each backer rod and each bond breaker to be used.

1.4 Delivery, Storage and Handling

.1 Materials to be stored on-site at a location approved by the Owner.

.2 Deliver all materials to the job site in their original unopened containers, with all labels intact. Verify the sealant(s) and the primer(s) for expiry date upon their arrival to site. Materials shall be used within their stated shelf life.

.3 Store and use materials in strict accordance with manufacturer's recommendations. Protect from freezing, moisture, water and contact with ground or floor.

.4 Unless otherwise approved, do not transport any materials through the buildings.

1.5 Environmental and Safety Requirements

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to local Labour regulations.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use, including but not limited to:

.1 Weather dry.

.2 Imminent weather forecast, dry.

.3 Ensure that sealant and substrate materials are not less than 5°C when applied.

.4 Should it become necessary to apply sealants at temperatures below 5°C, consult the sealant manufacturer's technical representative. Proceed on manufacturer's written instruction only.

.3 Apply sealants only to completely dry and clean surfaces. (Note: Although the joint interface may appear to be dry, the substrate below the immediate joint surface may still be moist. This moisture can migrate rapidly to the joint surface thereby contaminating any surface preparation.

1.6 Measurement for Payment

.1 All work shall be paid on a lump sum basis, unless otherwise indicated.

.2 If scope of work is extended, then sealant replacement shall be performed on a per metre basis, which includes removal, surface preparation and installation of new material, complete with bond breaker, as per Unit Prices submitted.

PART 2 - PRODUCTS

2.1 Sealant Materials

.1 Sealant compounds must:

.1 meet or exceed all applicable governmental and industrial safety and performance standards.

.2 be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by-laws, and regulations.

.2 Sealant compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.

.3 Sealant that emits strong odours, contains toxic chemicals, or is not certified as mould resistant shall not be used in or near air handling units.

.4 Compatibility: All materials in a sealant system shall be compatible with each other and with the substrate.

.5 The use of materials other than those specified herein must be approved prior to award of the Contract. If substitute materials are proposed, then the list of materials must be included as part of the Tender Form. This submittal shall include product name, number and data sheets and manufacturer's specifications and installation instructions.

.6 All materials listed below must be used on the project. Under no circumstances will substitute materials be used unless approval is first received from the Owner. Use of substitute materials without prior approval can result in the removal and replacement of these materials at no cost to the Owner.

2.2 Sealant Material Designations

.1 General:

.1 Colour of sealants shall be selected to match substrates and/or existing sealants and shall be approved by the Owner prior to application.

.2 Silicone Sealants: Single component moisture curing, non-staining, conforming to CGSB-19.13.

.1 Exterior Sealant:

.1 Spectrem 2 by Tremco Ltd.

.2 Tremsil 400 by Tremco Ltd.

.3 DOWSIL 795 by Dow

.4 DOWSIL Contractors Weatherproofing Sealant (CWS) by Dow

.5 Silpruf by GE

.6 ADSEAL DWS 4580 SERIES by Adfast

.7 or approved equivalent

.3 Gasket / Sealant Tape:

.1 EMSEAL MST (Multi-Use Sealant Tape) by EMSEAL Joint Systems Ltd.

.2 POLYshim II Tape by Tremco Ltd.

.4 Sealing Mastic / Adhesive

.1 M-1 Structural Adhesive/Sealant and One-Part Pourable Sealer by Chem Link

.2 Sopramastic SP2 by Soprema

.5 Cleaning Materials:

.1 Acceptable cleaners are:

.1 Isopropyl Alcohol (IPA)

.2 Methylethylketone (MEK)

.3 Or another solvent cleaner as recommended by sealant manufacturer

.2 Surfaces to receive sealants shall not be cleaned with Xylene unless cleaned with Isopropyl Alcohol (IPA) after.

.3 Xylene and Toluene shall not be used for cold weather cleaning.

.4 All substrate materials shall be cleaned with compatible cleaners.

.6 Masking Tape:

.1 For masking around joints, provide an appropriate masking tape which will effectively prevent application of sealant on surfaces not scheduled to receive it, and which is removable without damage to the substrate.

.7 Void Filler:

.1 Clean, glass fibre batt insulation.

.8 Cloths For Solvent Cleaning:

.1 Cloths for solvent cleaning of surfaces prior to application of sealants shall be clean, white, and solvent resistant. Coloured cloths shall not be used. Change cloths frequently as they become soiled during cleaning.

.9 Primer:

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant. Primer as recommended by sealant manufacturer.

.2 The deletion of primer shall be at the sole discretion of the Consultant, with consideration given to manufacturer recommendation and/or field-testing results.

.10 Joint Backing:

.1 Backer Rod must be used, where applicable, to control depth of sealant. Acceptable materials are:

.1 Closed Cell: Polyethylene, urethane, neoprene, or vinyl, extruded closed cell foam, in circular shape with diameter 25% greater than joint width before installation.

PART 3 - EXECUTION

3.1 Examination of Site Conditions

.1 Examine the Drawings and Specifications to determine the extent of the work involved, together with other necessary data affecting the work, as in no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the extent of such work herein described or implied.

.2 Bidders shall visit the site and acquaint themselves with the existing conditions. Prior to bidding, bidders shall make investigations to satisfy themselves as to the job requirements, existing conditions, and quantities.

.3 Before any sealant replacement is performed, the type of existing sealant shall be determined. If uncertain as to type, then the sealant manufacturer technical representative shall be contacted to confirm type. Only sealant compatible with the existing shall be installed as part of repairs.

.4 Inspect existing conditions and substrates upon which work of this section is dependent. Report to the Owner's Representative in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the work.

.5 Ascertain that sealers and coatings applied to sealant substrates are compatible with the sealant used and that full bond between sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and bond if necessary.

.6 Inform Owner's Representative of any unusual or deteriorated construction revealed during performance of Work. Allow Owner's Representative to review conditions prior to retrofit.

.7 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

3.2 Surface Preparation

.1 Prepare surfaces in accordance with manufacturer's directions.

.2 Before any sealant repairs are made, the type of existing sealant shall be determined. If uncertain as to type, a sealant manufacturer technical representative shall be contacted to confirm type. Only sealant compatible with the existing shall be installed as part of repairs. Polyurethane based sealants are not to be applied over existing silicone sealants.

.3 Where existing, remove sealant completely. In no case shall new sealant be applied over old. In addition:

.1 Remove existing sealants, dust, oil, grease, oxidation, mill scale, coatings, and all other loose material by cutting, brushing, scrubbing, scraping and/or grinding. In no case, however, shall remaining components such as window frames be damaged during surface preparation.

.2 Prior to use of any solvents, ensure that solvent does not damage existing materials and finishes.

.3 Clean substrates with the recommended solvent cleaner. Apply solvent with a clean cloth, pad or soft paper towel. The applicator cloth or towel shall not leave fiber residue on the substrate surface. The surface should be wiped clean and dried with a second clean cloth to ensure removal of contaminants. If substrate surfaces is still not clean, repeat procedures as needed. Change cloths frequently to prevent depositing contaminants from the cloth onto the substrate surface.

.4 Use method of surface preparation suitable for substrate, as recommended by sealant manufacturer and that does not damage existing finishes.

.4 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.5 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.6 Ensure joint surfaces are dry and frost free.

.7 Do not install sealant until joints are in compliance with the manufacturer of the sealant and the specific requirements of other sections of the Specification.

3.3 General Installation

.1 Install sealant in compliance with sealant manufacturer's recommendation. Joint designs and profiles shall be as described below and in accordance with Sealants: The Professionals' Guide, Sealant, Waterproofing and Restoration Institute. Joint designs deviating from those listed below and as described in the aforementioned document shall not be accepted.

.2 Where surfaces adjacent to joints are likely to become coated with sealant during application, or where irregular surface or sensitive joint border exist, mask edges with masking tape prior to sealing.

.3 Do not apply work of this section on surfaces which are wet, damp or have frost.

.4 Equipment:

.1 Apply sealant under pressure with power-actuated handgun, with manually operated handgun, or by other appropriate means.

.2 Use guns with a nozzle of proper size and length and providing sufficient pressure to completely fill the joints as designed.

.3 Provide suitable nozzle extensions where double stage joints are installed.

.4 Provide appropriate nozzles to create profiles required. This may require custom cutting of nozzles tips.

.5 Apply sealant in continuous beads. Fill joints completely to required depths with sealant compound. Use sufficient pressure to fill all voids and joints.

.6 Ensure that the new sealant is adhered to substrates a minimum of 6mm (1/4") at each side of joint. Depth of sealant at center to be a maximum of 13mm (1/2") while maintaining a 2:1 joint width to depth ratio.

.7 Tool joints to a slight concave bead, smooth and free from ridges, wrinkles, sags, air pockets and imbedded impurities. Tooling to be performed by proper metal or wood tool. Finger tooling joints will not be accepted.

.8 Remove excess compound promptly as work progresses and upon completion.

.9 Where possible (i.e. for new cladding installations), install sealant as a recessed joint (at least 3/4" back from face of the joint) to allow for sealant replacement in the future without removing the existing sealant.

3.4 Cleaning

.1 Remove sealant smears and droppings using recommended cleaners as work progresses as follows:

.1 Non-Porous Surfaces: Immediately remove all excess sealant adjacent to the joint with one of the recommended solvents as work progresses.

.2 Porous Surfaces: Allow sealant to develop initial cure, then remove by abrasion or other mechanical means. Caution should be exercised to maintain original surface integrity.

END OF SECTION – 07 92 00

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PART 1 GENERAL

1.1 SECTION INCLUDES

1. Substrate preparation
2. Sheathing over deck surface.
3. Vapour retarder.
4. Insulation.
5. Membrane roofing.
6. Membrane Accessories
7. Membrane Flashings
8. Roofing Accessories.

1.2 REFERENCES

1. ASTM C578-13 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
2. ASTM C612-10 - Standard Specification for Mineral Fiber Block and Board Insulation
3. ASTM C726-12 - Standard Specification for Mineral Fiber Roof Insulation Board.
4. ASTM C1002-07(2013) - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
5. ASTM C1177/C1177M-13 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
6. ASTM C1396/C1396M-13 - Standard Specification for Gypsum Board.
7. ASTM D6878/D6878M-13 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
8. CSA-A231.1-06/A231.2-06 (R2010 - Precast Concrete Paving Slabs/Precast Concrete Pavers.
9. CAN/ULC-S107-10 - Methods of Fire Tests of Roof Coverings.
10. CAN/ULC-S701-11 - Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
11. CAN/ULC-S702-09 - Standard for Mineral Fibre Thermal Insulation for Buildings (Includes Amendment 1, 2012).

12. CAN/ULC-S704-11 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

13. CRCA (Canadian Roofing Contractors' Association) - CRCA Roofing Specifications Manual.

14. FM (Factory Mutual) - Roof Assembly Classifications.

15. Province of Ontario Roofing Contractors Association - Roofing Specifications Manual.

16. ULC-BM-14 - Building Materials Directory (2014 Edition).

1.3 SYSTEM DESCRIPTION

1. Assembly of components include TPO Adhesive Adhered Roofing System with vapour barrier, fully adhered insulation, and adhesive applied membrane, as well as all related roofing accessories in strict accordance with specifications and details approved by the roof system manufacturer.
2. Note: this section is for the Alternate Price Option as per the Supplementary Tender Form. The Base Bid amount is not to include this product.

1.4 ADMINISTRATIVE REQUIREMENTS

1. Related Documents

    1. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.

2. Coordination:

    1. Coordinate with other work having a direct bearing on work of this section.

    2. Coordinate the work with the installation of associated metal flashings, as the work of this section proceeds.

3. Pre-installation Meetings:

    1. Convene 2 weeks before starting work of this section.

    2. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.5 SUBMITTALS

1. Section 01300

2. Product Data: Provide characteristics on membrane materials, flashing materials, insulation, vapour retarders, [protective coating].

3. Samples: Submit two (2), 300 x 300 mm in size.

4. Shop Drawings:

    1. Tapered insulation, roof cricket infill, setting plan layout, and details.

    2. Membrane layout on detailed roof plan, complete with full assembly section, vertical parapet details, joint or termination detail conditions, and conditions of interface with other materials.

5. Manufactures field reports: Indicate procedures followed; ambient temperatures, humidity, wind velocity during application.

1.6 QUALITY ASSURANCE

1. Roofing Contractor shall be an approved applicator of the roofing system supplier.

2. Workmen shall be trained and experienced in the installation of this type of roofing system and shall be under full time competent supervision.

3. Comply with all industry recommended safety practices during construction.

4. Perform Work to CRCA Roofing Specifications Manual and manufacturer's written instructions. Maintain one (1) copy of document on site.

1.7 DESIGN REQUIREMENTS

1. Conform to applicable code for roof assembly fire hazard requirements.

    1. CAN/ULC-S107: Class A Fire Hazard Classification.

2. The specified roofing assembly must have been successfully tested by a qualified testing agency to resist the design uplift pressures calculated according to

    1. ANSI/SPRI WD-1 "Wind Design Standard Practice for Roofing Assemblies" American Society of Civil Engineers (ASCE 7) International Building Code (IBC).

    or

    2. FM: Roof Assembly Classification, Class [1] Construction, wind uplift requirement of [1-60] [1-90], in accordance with FM 1-28 "Design Wind Loads" and complies with FMG Property Loss Prevention Data Sheet 129 for enhancements at the perimeter and corners.

    3. CSA A123.21 and Provincial Building Code wind uplift requirements; obtain applicable wind isotachs and Building Code hourly wind velocity pressure for 1 in 50 year return value, necessary for the selection of the proper roof system design specific to this project.

1.8 DELIVERY, STORAGE, AND PROTECTION

1. Deliver all roofing materials in original, unopened containers, complete with labels indicating brand name, contents, usage instructions and safety precautions. Membrane rolls are to be left in their unopened packaging until prior to install.

2. Protect membranes from cuts, abrasion or other abuse that might adversely affect performance in service.

3. Adhesives, sealants and flashing accessories are to be stored in a clean, dry area at a temperature between 5°C and 27°C. When the temperature is expected to fall below 5°C, outside heated storage boxes should be provided on the roof for temporary storage of adhesives and sealants.

4. Protect insulation, vapour retarder and other materials subject to water damage while stored on the job-site by covering them with a weatherproof tarpaulin and keeping them a minimum 15 cm (6") off of the deck or ground.

1.9 SITE CONDITIONS

1. Ambient Conditions:

    1. Do not apply roofing membrane during inclement weather or when ambient temperature falls below -5 degrees C or above 30 degrees C.

    2. Install each roof layer on a dry substrate, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture into the system.

    3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

2. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed section of the membrane system.

1.10 WARRANTY

1. Contractor's Warranty: Provide two (2) year warranty on roofing, dated from time of Substantial Performance. The contractor will repair, at their expense, any leaks in the roofing membrane and membrane flashing including any related Sheetmetal work.

2. Manufacturer's Warranty: Roof System Manufacturer shall provide a written warranty on supplier's standard form for a period of twenty (20) years from the date of roofing system completion.

3. All membrane and accessory components must be Lexsuco Corporation products or approved equal by Firestone or Carlisle Roofing.

PART 2 PRODUCTS

2.1 VAPOUR RETARDER SUPPORT PANELS

1. Glass faced Gypsum Board:

    1. Panels composed of gypsum core, reinforced, faced with glass mat conforming to ASTM C1177, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

        1. Thickness: 12.7 mm (½ in).

        2. Specified product: non-coated Georgia-Pacific Gypsum LLC; DensDeck or comparable product as supplied by Lexsuco Corporation.

2. Lightweight Cementitious Panels: Low density, fibre reinforced, water resistant cement support panels.

    1. Thickness: 11.1 mm (7/16 in)

    2. Specified product: Dexcell Cement Roof Board or comparable product as supplied by Lexsuco Corporation.

2.2 VAPOUR RETARDER

1. Primer Adhesive: Synthetic elastomeric based liquid adhesive used to bond self-adhesive membrane to wood deck.

    1. Specified product: Lexcor Multigrip Fire Retardant Primer by Lexsuco Corporation.

2. Textured Polyethylene Self-Adhered Vapour Retarder: Reinforced membrane with weaved polypropylene laminated to a non-weaved polyester top layer: moisture vapour transmission rate less than 2.4 ng/Pa•s• m^2 (0.04 perms) when tested in accordance with ASTM E-96, procedure B Construction.

    1. Thickness: 0.15 mm (6 mil)
    2. Specified product: Lexcor Permate Stick Peel n' Stick Type 1 Vapour Barrier by Lexsuco Corporation.

2.3 INSULATION

1. Polyisocyanurate Insulation : A rigid foam insulation produced from a chemical reaction between polyol and polymeric isocyanate that results in closed cells containing captive blowing agents. The foam core is integrally laminated to [organic felt paper, or inorganic fibreglass-reinforced facers]. Insulation shall conform to CAN/ULC S-704, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

    1. Thickness: As required to provide minimum R35. [Base Layer Board Size]: [(1220mm x 2440mm), (1220mm x 1220mm) (4'- 0" x 8'- 0"), (4'- 0" x 4'- 0") fully adhered. Thickness, [90mm X 2 LAYERS] R35.

2. Specified product: [Lexcor Isolex™, Lexcor Isolex™ II] manufactured by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

3. Tapered (cricket) Insulation: Insulation panels are to measure 1220 mm (4') square and are to slope at the rate of 2%, with a minimum thickness of [50mm, 101.6 mm (4",2") inches at the drains. Ship lapped edge 2"x 2", panels are to be positioned and installed in accordance with the shop drawings.

    1. Specified product: [Bizolon R+ (2 in 1) prefabricated insulation panel by Fransyl Ltd.], [Lexcor Isolex™, Lexcor Isolex™ II] manufactured by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

2.4 COVERBOARDS

1. High-density Polyisocyanurate Panel: High density panels composed of high density closed cell polyisocyanurate foam core with coated fibreglass facers. Panel shall be compliant with ASTM C 1289, Type II, Class 4, Grade 1, 2 and 3. Panels shall conform to CAN/ULC S-704, Standard for Thermal Insulation, Polyurethane, and Polyisocyanurate Boards, Faced.

2. Thickness: 6.4 mm (1/4 in)

3. Specified product: Lexcor Lexboard by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

2.5 MEMBRANE MATERIALS - Thermoplastic Polyolefin (TPO) Membrane

1. Description: (White, Grey, Tan) Reinforced TPO roofing membrane. Formulated for long-term, direct exposure to the elements. Prefabricated membrane, conforming to ASTM D-6878, Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

2. Thickness: 1.5 mm (60 mil)

3. Specified product: Lexcan Hi-Tuff TPO Reinforced Membrane by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

2.6 ADHESIVE MATERIALS

1. Specified Product: Lexcan Hi-Tuff TPO Bonding Adhesive by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

2. Water-Based Bonding Adhesive: Water-based, formulated for compatibility with TPO membrane and substrate materials

    1. Specified Product: Lexcan BA-160 Bonding Adhesive by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

3. Low-rise Polyurethane Foam: A low rise polyurethane foam used to attach insulation to manufacturers approved substrates. Consult membrane manufacturer for application rates.

1. Specified Product: Lexcor Lexphalt Foamed Polyurethane Adhesive by Lexsuco Corporation or approved alternative by Firestone or Carlisle.

2.7 INSULATION FASTENERS

1. Description: Insulation securement screws are to be Factory Mutual listed and approved #12 diameter with round or flat head, corrosion treated to withstand 30 cycles of the Kesternich test with only a minimum amount of red rust showing. Fasteners must penetrate a minimum 19 mm (3/4") into steel decks or 25 mm (1") into wood decks. Holes for concrete anchors must be pre-drilled not less than 21 mm (1/2") deeper than the penetration depth of the fastener, with a drill bit recommended by the fastener manufacturer. Stress plates are to be 76 mm (3") diameter galvalume metal to fit screw.

2. Specified Product: Lexcor Lexgrip™ Insulation Fasteners or [Lexcor Lexgrip™ Pre-Assembled Insulation Fasteners] treated with Cx-5 coating, complete with metal stress plate.

2.8 WOOD NAILER

1. Description: Blocking and rough framing. No.1 Spruce conforming to National Grades Authority, Standard Grading Rules for Canadian Wood to CSA 0141-05. Wood for roofing to be pressure treated to CSA 080-97, Series (R2002). Plywood Sheathing to be exterior grade conforming to CSA 0121-M1978 or CSA 0151-M1978, select grade, good one side, thickness as indicated.

2.9 ACCESSORIES

1. Parapet / Wall Flashing: TPO membrane as described in 2.5 cut to appropriate widths and lengths.

2. Flashing: Lexcan Hi-Tuff TPO Un-reinforced Membrane by Lexsuco Corporation.

3. Perimeter Securement: Lexcan Hi-Tuff TPO Stripbond II by Lexsuco Corporation

4. Coverstrip: Lexcan Hi-Tuff TPO PS Coverstrip by Lexsuco Corporation.

5. Primer: Lexcan Hi-Tuff TPO Primer by Lexsuco Corporation.

6. Membrane Cleaner: Lexcan Weathered Membrane Cleaner by Lexsuco Corporation.

7. Cut Edge Sealant: Lexcan Hi-Tuff TPO Cut Edge Sealant by Lexsuco Corporation.

8. WATER CUT OFF MASTIC: Lexcan Universal Single Ply Sealant by Lexsuco Corporation.

9. Pourable Sealer: Lexcan Thermoplastic Pourable Sealer by Lexsuco Corporation.

10. Termination Sealer Tape: Lexcan Water Cut-Off Tape by Lexsuco Corporation.

11. Termination Bar: Lexcan Termination Bar by Lexsuco Corporation.

12. Pipe Flashing: Lexcan Hi-Tuff TPO Pre-formed Pipe Boots or Split Pipe Boots by Lexsuco Corporation.

13. Irregular Roof Protrusions: Lexcan Hi-Tuff TPO Molded Sealant Pockets and Lexcan Thermoplastic Pourable Sealer by Lexsuco Corporation.

14. Traffic Pads: Lexcan Hi-Tuff TPO Walkways by Lexsuco Corporation.

15. Roof Edge and Flashing Metal: Lexcan Hi-Tuff TPO Metal, matching the colour of the membrane by Lexsuco Corporation.

2.10 ROOF SYSTEM FLASHING ACCESSORIES

1. Vent Stack Flashing: Vent caps shall be sealed to the pipe with Lexcor Flash-Tite™ Drain and Vent Seals. Vent pipes shall be flashed to the roof membrane with two part, telescoping vent stack covers featuring an 18" high base flange and a 127mm (5") Cap. Vent Stack flashing shall be fabricated from seamless spun aluminum. Caps and base flanges are to match the size of vent pipe. Install in strict accordance with manufacturer's directions and flash into the roof membrane in accordance with the roofing membrane manufacturer's directions and good roofing practice. Vent Stack Flashing as supplied by Lexsuco Corporation, Lexcor Flash-Tite™ Standard Vent Stack Covers (Seamless spun mill finish VB-418-Cap model SCA-4).

2. Vent Stack Flashing (B Vent): B-Vent Flashings shall be fabricated from a single piece of spun aluminum metal this is free from joints. Flashing stack is to be fourteen inches (12,14,18") high complete with Rain Collar. Base flanges are to match the size of vent pipe. Install in strict accordance with manufacturer's directions and flash into the roof membrane in accordance with the roofing membrane manufacturer's directions and good roofing practice. BVent Stack Flashing as supplied by Lexsuco Corporation, Lexcor Flash-Tite™ BVent Flashings.

3. Roof Drains: New Construction drain hoppers shall be 2 mm thick seamless spun aluminum and feature a 430 mm (17") diameter flashing flange, 250 mm (10") downspout, membrane stop and clamping ring studs. [Drains shall also include an integral deck clamp assembly composed of a 65 mm thick cast aluminum hopper reinforcement ring welded to the hopper and adjustable aluminum deck clamp mounted on 4 stainless steel rods]. Drains shall come complete with separable cast aluminum membrane clamping ring, 178 mm (7") high cast aluminum strainer [and spun aluminum Flow Control Insert].

    1. Specified Product: Lexcor Flash-Tite™ NC Aluminum Super Drains [with: Flash-Tite™ Integral Deck Clamp; Flash-Tite™ Flow Control Insert; Mechanical Joint Connector] by Lexsuco Corporation. Drain sizes to match drain pipe diameters.

4. Supports: for Gas pipes; Structural Support Base shall consist of a Pressure moulded using a one or two part mix, utilising milled, sieved and graded Styrene Butadiene Rubber (SBR-Recycled Rubber). Accessory must be complete with

40mm x 20mm Aluminium Channel supplied recessed and bonded into the top face of the foot and BBJ insulclamps to support piping. Specified Product: Fix-it Foot Low 250 (250mm x 130mm x 50mm) supplied by Lexsuco Corporation.

5. Conduit Pipe Split Flashing: Two part stainless steel base and floating rain collar, complete with selvedge style seam, pre-applied seam sealant, stainless steel screws and nuts and EPDM rubber pipe seal strip. [Base flashing is to be insulated on the jobsite with moisture resistant rubber foam].

    1. Specified Product: Lexcor Flash-Tite™ Conduit (Split) Flashing by Lexsuco Corporation.

7. HVAC & Electrical Flashing: To be fabricated from seamless spun aluminum, complete with primer coated flanges. Use appropriate flashing for each application.

    1. Specified Products: Lexcor Flash-Tite™ Electrical Wire Outlet Post [30 cm; 46 cm] high base, complete with rigid PVC cap fitting by Lexsuco Corporation.

    2 Specified Products: Lexcor Flash-Tite™ Electrical Wire Socket or Switch Posts [30 cm; 46 cm] high base, complete with rigid PVC cap fitting by Lexsuco Corporation.

    3. Specified Products: Lexcor Flash-Tite™ B-Vent Flashing, diameter to match chimney diameter, complete with adjustable galvanized steel rain collar by Lexsuco Corporation.

    4. Specified Products: Lexcor Flash-Tite™ pre-fabricated mastic sealer pockets ("pitch pockets"). 230 mm (9") high x appropriate diameter to exceed diameter or width of protrusion by 50 mm (2"). Pockets to be sealed with Lexcan Pourable Sealer, a two-part urethane, self-levelling sealant by Lexsuco Corporation.

8. Roof Hatch Units: Single leaf type, 762 mm x 914 mm [2'-6" x 3'-0"] inch size, listed by Lexcor: R-100 (Ladder Access) Roof Hatch.

    1. Specified Product: Lexcor R-100G/WGC/SB/R30 by Lexsuco Corporation.

    2. Steel Cover and Curb: 2.95 mm [11 gauge] thick primer coated galvanized steel and shall be neatly welded and ground at corners. Door shall have two layers of 66.1mm [2.6 inches] polyisocyanurate insulation; door liner shall be 18 gauge primer coated galvanized steel. Curb shall be *[<305mm; [12 inch]; 457mm [18 inch]; 610mm [24 inch] >>]* high with two layers of 66.1mm [2.6 inch] polyisocyanurate insulation secured to the curb exterior. Curb shall have 89 mm [3.5 inch, pre-punched flanges. Curb and cap assembly shall be complete with extended flanges ready to receive roof flashings.

    3. Roof Hatches Hardware:

1. Wind Gust Control Unit: shall be mounted on the inside of the hatch opposite to the steel hold open arm. Piston forces shall pull the door closed; or [push door open.
2. Roof hatch shall be completely assembled with heavy duty pintle, torsion bar operated doors, latching mechanism, *interior and/or [exterior]* padlock hasps and neoprene draft seal. Door shall be equipped with an steel hold open arm with foam rubber grip handle. All hardware shall be cadmium plated.

3. Hatch shall be equipped with 35mm [1'-3/8"] diameter Safety Bar coated with mil PVC colour coated roof safety green. Safety Bar shall be mounted on the *[right; left]* corner of hatch curb with out impeding operation of the door.

PART 3 EXECUTION

3.1 EXAMINATION

1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions, which would be detrimental to installation.

2. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

3. Ensure mechanical and electrical systems have been co-ordinated and curbs have been constructed.

4. Examine substrate for compliance of conditions that affect installation and performance of the roof system.

5. Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and wood nailing strips are in place.

3.2 PREPARATION - CONCRETE DECK

1. Fill surface honeycomb and variations with latex filler.

3.3 VAPOUR RETARDER APPLICATION

1. Application of Self Adhesive Vapour Retarder:

    1. Where the vapour retarder is applied to a support panel, use only vapour retarder support panels approved by the membrane manufacturer.

    2. Where the self-adhesive vapour retarder is to be adhered to a cementitious panel, apply a light coat of primer as recommended by the membrane manufacturers.

3. All surfaces to be primed must be free of dust, or any residue that may hinder adhesion of the vapour retarder. Cover primed surfaces with vapour retarder as soon as possible.

4. When applied directly to steel deck align the roll parallel to the flutes of the deck. Ensure that the vapour retarder overlaps are positioned on the top ribs of the deck and supported along their entire length.

5. Beginning at the bottom of the slope and without adhering the membrane, unroll onto the substrate for alignment. Do not immediately remove the release sheet.

6. Overlap each preceding sheet by 75 mm (3 in) at the side laps and 150 mm (6 in) at end laps. Stagger end laps by a minimum of 300 mm (12 in).

7. Once aligned peel back one end of the release sheet and adhere the exposed membrane to the substrate. Peel back the remaining release sheet at a 45° angle to avoid wrinkles in the membrane.

8. the membrane is not properly aligned, do not adjust it. Instead, cut the roll and start again, making sure that it is properly aligned and that it overlaps the end of the misaligned piece by 150 mm (6 in).

9. Roll the self-adhesive vapour retarder onto the substrate with a 34 kg (75 lb) roller. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the lap.

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3.4 INSULATION APPLICATION

1. Insulation shall be installed according to the insulation manufacturer instructions.

2. Where there is no support panel, install insulation so that long dimensions of the board are parallel with the flutes of the steel deck and fully supported on the top rib.

3. Attach with low-rise (Lexcor Insultac II) insulation adhesive. Apply directly to the substrate using a ribbon style pattern. Make sure that substrate is clean and dry. Space 3/4',1"(13mm, 19mm,) diameter beads on [6"] (150mm) centres to achieve proper coverage rates for insulation attachment. As adhesive is applied, immediately place the insulation board into wet adhesive. Do not allow the adhesive to skin over

4. Where more than one layer of insulation is used, stagger joints at least 300mm (12in) between layers.

5. Position Insulation Board in adhesive, ensuring panels are butt-edged together with a maximum separation of 2 mm. Walk the boards into the adhesive and roll using the 30" wide, 100 – 150 pound weighted steel roller to ensure full embedment. Optimal set up time should be approximately 5 to 10 minutes.

6. After the adhesive has dried, test each panel to ensure it is completely secured to the deck. If it is not 100% secure, the insulation panel must be removed and discarded. A new insulation panel must be adhered in its place. **The Contractor is responsible to ensure that all insulation panels are properly adhered to the substrate.**

7. Mechanically fasten composite layer of insulation through the vapour retarder and into the deck using fasteners and plates specified in 2.6. Mark out any conduit runs on the surface of insulation prior to fastening. Ensure that plates have been sufficient clamping force so as not to compromise the vapour retarder. Do not overdrive the screws.

8. Butt-edges together with a maximum separation of 2mm.

9. Insulation shall be neatly cut to fit around penetrations and projections.

10. Install tapered insulation around drains creating a drain sump.

11. Insulation shall be neatly cut to fit around penetrations and projections.

12. Do not install more insulation boards than can be covered with membrane by the end of the day or the onset of inclement weather.

13. Do not drive fasteners into any utility lines such as electrical, conduit or gas pipes.

14. Minimum penetration to fasten into a metal deck is 19 mm (3/4 in.), or [Minimum penetration to fasten into a concrete deck is (1)" (25.4mm).]

15. Minimum number of fasteners required per 4'x8' sheet is [4,6,8,10,12,16,20] in the field.

16. Attach any 4'x 4' tapered insulation with low-rise (Lexcor InsulTac II) insulation adhesive. Apply directly to the substrate using a ribbon style pattern. Make sure that substrate is clean and dry.

3.5 COVER BOARD APPLICATION

1. Attach with low-rise (Lexcor InsulTac II) insulation adhesive. Apply directly to the substrate using a ribbon style pattern. Make sure that substrate is clean and dry.
2. Stagger joints at least 300mm (12 in) between layers. All tapered insulation joints should be overlapped by the cover board.

3. Position Cover Board in adhesive, ensuring panels are butt-edged together with a maximum separation of 2 mm. Walk the boards into the adhesive and roll using the 30" wide, 100 – 150 pound weighted steel roller to ensure full embedment. Optimal set up time should be approximately 5 to 10 minutes.

4. After the adhesive has dried, test each panel to ensure it is completely secured to the deck. If it is not 100% secure, the insulation panel must be removed and discarded. A new insulation panel must be adhered in its place. Ensure all insulation panels are properly adhered to substrate

3.6 MEMBRANE APPLICATION

1. The contractor shall be responsible for the suitability of the substrate surface to accept the membrane. Ensure cover board surface or substrate is clean, flat and free from dirt, debris or sharp objects that might be detrimental to the performance of the membrane.

2. The ambient temperature should be +5° C and rising when fully adhering the membrane.

3. Unroll membrane sheets and position according to the approved shop drawings. For roofs with edge drainage, start at the low edge with the first sheet and install adjacent sheets by overlapping the lower sheets. For roofs with interior drainage, start with the first sheet centred on the drain valley and install adjacent sheets by overlapping the lower sheet. Outside perimeter sheets shall be brought to the base of the perimeter parapet or wall and turned up the wall (76.2mm) 3" and secured with a batten every 6" on center. Adjoining sheets are to overlap a minimum of 140 mm (5.5") on sides and wherever fasteners are included within the seam. End laps without fasteners are to be lapped a minimum of 140 cm (5.5").

4. Optionally, the membrane may be extended up and over a parapet wall or a roof edge, provided it is secured along the perimeter edge using the Stripbond II™ or Lexcan PS Batten Bar method of perimeter securement. As shown in Lexcan detail H-E-018.

5. Fold the sheet in half lengthwise to expose one-half of the sheet underside.

6 , Apply Hi-Tuff TPO Bonding Adhesive with a plastic core, medium nap roller to the underside of the roofing membrane and to the substrate at the combined net coverage rate of 5.7 m^2 (60 Sq.Ft.) / gallon. Do not apply the Bonding Adhesives to areas on the membrane that are to be heat welded. Apply both adhesives evenly, without globs and puddles. Allow both adhesives to flash-off until they are tacky but do not string when touched with a dry finger.

7. If the adhesive becomes contaminated by blowing dust, moisture, walking in it, etc. it should be allowed to completely dry (no longer tacky) and new adhesive applied to both surfaces.

8. When the adhesives have sufficiently dried, carefully unroll the glued portion of the membrane back over the glued substrate, avoiding wrinkles, voids or air pockets. Immediately, roll with weighted steel roller or brush the membrane heavily with a push broom to ensure 100% complete contact.

9. Fold back the other half of the sheet and repeat steps .3 through .7

10. Layout subsequent sheets by positioning them so they overlap the previously adhered sheet by a minimum of 50 mm (3"). Seam overlaps should be overlapped downward (shingle fashion) to avoid catching water. Heat weld the subsequent sheet to the first sheet as per section [3.7] below. Once the weld has cooled, completely fold the subsequent sheet back over the splice to

expose the entire underside of the subsequent sheet. Apply Hi-Tuff TPO Bonding Adhesive as per section [.6] above

3.7 SPLICING MEMBRANE SHEETS

1. Field's seams must be welded with an automatic hot air welder operated by an individual thoroughly trained and competent in the machine's operation. Small work and repairs can be done efficiently with a hand welder. However, hand-held welders are not an accepted means of field seaming.

2. Hot air weld all seams a minimum of 38 mm (1.5") wide.

3. Dirty, dusty or contaminated membrane or membrane exposed for more than seven days prior to welding must be cleaned with Lexcan Weathered Membrane Cleaner. With a clean scrub pad saturated with Cleaner, aggressively scrub the seam area of the roof membrane. Follow with a final one swipe pass, being careful not to re-deposit contaminants back onto the cleaned area. Ensure that the Seam Cleaner and adjacent Bonding Adhesive have completely flashed off before welding. Follow standard welding procedures with a 20% reduction in speed.

4. All splices are to be probed along their entire length with a seam probing tool to verify that the welder is operating effectively. The membrane must be allowed to cool prior to testing. In addition, there should be a destructive peel strength test performed at the start of each day and each time the robot welder is reused after being allowed to cool. The destructive test sample should be 5 cm (2") wide and should show membrane delamination from the scrim prior to weld failure. Roofing contractor must date the test samples and submit them to the system manufacture.

5. Cut membrane edges shall be sealed by applying Hi-Tuff TPO Cut Edge Sealant along the exposed edge.

3.8 . PERIMETER FLASHING AND SECUREMENT

1. Install the (roof edge system; gravel stop; drip edge) according to an approved Lexcan detail and in accordance with the manufacturer's directions. Nailers are required at all roof edges; gravel stops or drip edges.

2. Direct Fastener Perimeter Securement Method: Hi-Tuff TPO membrane shall be brought to roof edges, parapets, walls, expansion joints, curbs and all other roof penetrations that exceed 60 cm (24") in any dimension and turned up the wall (76.2mm) 3" and secured with a batten every 6" centered at the vertical plan to the parapet (12") centres with Lexcor Lexgrip Membrane Fasteners and Plates.

3. Reinforced Hi-Tuff TPO flashing membrane shall be extended up all parapet walls, curbs, roof edges, etc. If using the Direct Fastener Method of perimeter securement, the flashing membrane must extend a minimum of 140 mm (5-1/2") beyond the Perimeter edge out onto the flat area of the roof.

4. Hi-Tuff TPO membrane shall be used for all vertical flashings and shall extend from a seam just beyond the perimeter fastener row, up to the curb or parapet.

Apply with Hi-Tuff TPO Bonding Adhesive as per sections 3.5.6 to 3.5.7. Be careful not to wrinkle the membrane or bridge it at the vertical / horizontal juncture (crease the membrane first). Brush the membrane heavily with a push broom to ensure complete contact.

5. Unless approved detail shows otherwise, membrane must either terminate in a reglet, be fastened according to paragraph .6 below, or be carried over the top of wall or parapet and counter-flashed with sheet metal or a stone cap. All metal work must be installed to be wind resistant and sealed and waterproofed in an acceptable manner.

6. If terminating membrane part way up to a wall or parapet, apply Lexcan Water Cut-Off Tape to the backside of membrane edge. Press membrane against wall and roll with a steel hand roller. Fasten Lexcan Termination Bar along the upper edge of the membrane into the wall, using appropriate fasteners on 15 cm (6") centres. Apply Lexcan Universal Single Ply Sealant along the upper edge of the Termination Bar and over the top of all fastener heads.

3.9 PROTRUSION AND CORNER FLASHINGS

1. Install pre-formed metal flashings; drain hoppers, etc. according to the manufacturer's installation instructions.

2. Flash all corners, vent pipes, posts, curbs and pre-formed flashings in strict accordance with current Lexcan installation instructions and details. Use Hi-Tuff TPO Bonding Adhesive as per section 3.6, above. Do not apply the Bonding Adhesives to areas on the Flashing that are to be seamed. Seam as per section 3.7 above.
3. All flashing shall be mechanically fastened at the top, under or through appropriate counterflashing with approved fasteners and in accordance with Lexcan details.

4. Membrane connections to drains are to be sealed with All-Purpose Sealant or Lexcan Water Cut-Off Tape and clamped with a clamping ring to ensure a 100% continuous seal, as per Lexcan details. Field seams shall not run through drains.

3.10 TRAFFIC WALKWAYS

1. Ensure membrane to receive traffic pads is clean and dry. If the membrane is not clean and dry, follow the steps in section 3.6.3 before proceeding with the remainder of this section.

2. Position the walkway pad and cut to desired length. Wherever possible, walkway pad shall not cover seams. When installed adjacent to a seam, the pad should be kept a minimum 50 mm (2") from the edge of the seam on the bottom sheet and 15 cm (6") away from the edge of the seam on the top sheet.

3. When covering seams is unavoidable; the lap seam should be completed per section 3.6 above and thoroughly probed, with any deficiencies corrected prior to pad installation.

4. Where drainage around the pads is desired, cut pads to a uniform length and space the sections 50 mm (2") apart.

5. Weld the perimeter of the walkway pad to the membrane following standard welding procedures. Leave 25 mm to 50 mm (1" to 2") gaps in the weld on the low slope edge every 60 cm (2 ft.) to prevent the accumulation of water under the pad.

3.11 METAL COUNTERFLASHING, CAP, SCUPPERS AND FASCIA FLASHINGS

1. Allow warranty inspector to inspect all membrane flashings and roofing before installation of metal counterflashing and fascia.

2. Install all metal counter-flashing and fascia in strict accordance with CRCA 'FL' specifications and good roofing practice.

3. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance and performance. Mitre all corners. Irregular or badly fabricated work will not be accepted. Hem all edges 12 mm (1/2") and cut corners of straight edges on a 45° angle. Remove all burrs and metal scrap.

4. Use concealed fastening and clamping (termination) bars to secure fascia and counter-flashing.

5. Use standard 2.44 m (8') metal lengths. Space joints symmetrically and evenly in relation to the module, columns, pre-cast panels or other distinguishing features of the building. Use tight-fitting S-lock joints. Fabricate joints to permit free movement of metal without leaking.

6. Apply isolation membrane or coating to separate dissimilar metals or metal from concrete.

3.12 TEMPORARY NIGHT SEAL

1. At the end of each day or at the threat or onset of inclement weather, the insulation shall be protected by extending the membrane beyond the insulation and sealing it to the deck with an approved temporary sealant. Ensure membrane edge is either mechanically fastened or sufficiently ballasted to protect against wind uplift.

2. When resuming works cut and dispose of the portion of membrane contaminated with the night sealant.

3.13 FIELD QUALITY CONTROL

1. Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and clearing of product.

2. The Manufacturer's representative will regularly review the fieldwork, to verify the satisfactory completion of the work in accordance with the Manufactures Membrane System Warranty.

3. Once the project is in progress work will be continuous, weather permitting, until completion.

4. Do not conceal or cover any phase of the work until after it has been inspected and approved by the Roof System Manufacture.

5. Roofing System Manufacturer (Lexcan) must be notified in writing that the project is ready for a Final Inspection within 120 days of substantial completion of the roofing system. All trades that have work to do on the roof must be completely

6. finished. All TPO seams and details will be probed and voids will be clearly marked with a red crayon. If a Final Inspection indicates that deficiencies are still outstanding, then additional Final Inspections will be conducted until all work has been completed to the Manufactures satisfaction.

3.14 CLEANING

1. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

3.15 PROTECTION OF FINISHED WORK

1. Protect building surfaces against damage from roofing work.

2. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

PART 1 GENERAL

1. GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 REFERENCES

1. ASTM A563/A563M-97 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.

2. ASTM A591/A591M-89 Specification for Steel Sheet, Electrolytic ZincCoated, for Light Coating Mass Applications.

3. ASTM A606-96 Specification for Steel Sheet and Strip, Hot-Rolled and ColdRolled, High Strength, Low Alloy, with Improved Atmospheric Corrosion Resistance.

4. ASTM A792/A792M-96 Specification for Steel Sheet, Aluminum-Zinc AlloyCoated by the Hot-Dip Process.

5. ASTM D523-89 (1991)el Specular Gloss.

6. ASTM D822-96 Recommended Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.

7. CSA A123.3-M1979 Asphalt or Tar Saturated Roofing Felt.

8. CSA B111-1974Wire Nails, Spikes and Staples.

9. CAN/CGSB-37.5-M89 Cutback Asphalt Plastic Cement.

10. CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type.

11. Canadian Roofing Contractors Association (CRCA).

1.3 SUBMITTALS

1. Submit shop drawings in accordance with Section 01300 - Submittals.

2. Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

3. Submit manufacturer's full colour range for Architect's selection for all prefinished sheet metal.

PART 2 PRODUCTS

2.1 SHEET METAL MATERIALS

1. Zinc coated steel sheet: 24 ga. 0.6 mm core nominal thickness, commercial quality CS type (A) to ASTM A653/A653M, with Z275 designation zinc coating.

2. Aluminum-zinc alloy coated steel sheet: to CSSBI 201M-84 commercial quality, grade with AZ150 coating, regular spangle surface, 24 ga. 0.6 mm base metal thickness, not oiled.

2.2 PREFINISHED STEEL SHEET

1. Prefinished steel to CAN/CGSB 93.3-M91 with factory applied polyvinyl chloride. Class F1S.

2. Prefinished with 0.200 mm thick polyvinyl chloride paint on exposed side and 0.005 mm thick epoxy primer on concealed side.

3. Colours to match wall below. Confirm with Architect prior to ordering of material.

4. Specular gloss: 30 units +/- 5 in accordance with ASTM D523.

5. Coating thickness: not less than 200 micrometers.

6. Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

7. Outdoor exposure period 5000 hours.

8. Humidity resistance exposure period 5000 hours.

2.3 ACCESSORIES

1. Isolation coating: alkali resistant bituminous paint.

2. Plastic cement: to CAN/CGSB-37.5.

3. Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32 asphalt laminated 3.6 to 4.5 kg kraft paper No. 15 perforated asphalt felt to CSA A123.3.

4. Sealants: 1 part acrylic, high molecular weight polymer flexible sealant Dymonic as manufactured by Tremco Ltd. in colours to match the 3 flashing colours.

5. Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness 0.8 mm.

6. Fasteners: of same material as sheet metal, to CSA B111, galvanized steel spiral thread, nailing disc, nails of length and thickness suitable for metal flashing application, minimum 25 mm into nailing substrate.

7. Washers: of same material as sheet metal, 1 mm thick with rubber packings.
8. Screws: o. 305 stainless steel, self-tapping hexagonal head, neoprene washer and lead expansion shield.

9. Wedges: high impact polypropylene or rolled lead, 24 mm x 76 mm, tapered 1.6 mm to 6.4 mm.

10. Joint Filler: extruded polyethelane, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, outsized 30 to 50%, CFC free.

11. Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

1. Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA as indicated to conform to CRCA 'FL'series details.

2. Fabricate aluminum flashings and other sheet aluminum work in accordance with Aluminum Association Aluminum Sheet Metal Work in Building Construction.

3. Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

4. Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

5. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

6. Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

1. Form flashings, copings, parapet and curb flashings, openings for mechanical roof openings and fascia to profiles indicated of 24 ga. 0.6 mm thick prefinished steel .

2.6 REGLETS AND CAP FLASHINGS

1. Formed recessed reglets for roof flashings by Masonry Section 04200 – Unit Masonry.

2. Cap Flashings shall be to profiles indicated of 24ga (0.6mm) G90 galvanized Grade A prefinished sheet steel conforming to ASTM A525.Colour as selected by Architect from manufacturers full range. Allow up to 3 colours.

2.7 SCUPPERS

1. Form scuppers from 24 ga. 0.6 mm thick (4.88) kg/m2 prefinished steel sheet metal.

2. Sizes and profiles as indicated.

3. Provide necessary fastenings.

4. Install sheet metal in accordance with CRCA FL5 detail to provide detail as shown on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

1. Install sheet metal work in accordance with CRCA FL series details, FL 1, 2, 5, 11, 12, 13, 14, 15, 23, 126, 17 and as detailed.

2 Use concealed fastenings except where approved before installation.

3. Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

4. Counter flash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.

5. Lock end joints and caulk with sealant.

6. Install surface mounted reglets true and level, and caulk top of reglet with sealant at locations where concrete or masonry does not occur.

7. Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.

8. Caulk flashing at reglet and cap flashing with sealant.

9. Install pans, where shown around items projecting through roof membrane.

3.2 SCUPPERS

1. Install scuppers as indicated on architectural drawings.

3.3 VENT STACK FLASHING

1. Vent stack flashing to be SJ-20 or SJ-26 pre-insulated spun aluminum with telescoping cap complete with stainless steel vandal proof cap by Thaler Metal Industries Inc. Coordinate with Mechanical drawings and specifications for sizes, number and locations. Coordinate with roofing specifications to avoid duplication.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

1. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 SUBMITTALS

1. Product Data: Submit manufacturer's product data.

2. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

3. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

1. Manufacturer: A minimum of 5 years experience manufacturing similar products.

2. Installer: A minimum of 2 years experience installing similar products.

3. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

1. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

1. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 GENERAL

1. Subject to compliance with requirements, provide the specified products and/or materials from indicated manufacturers. Other comparable products may be submitted as substitution requests.

2. Other manufacturers, product information and test data showing that products are equal or better may be submitted ten (10) days prior to bid closing for Architect and/or Owner's review and approval.

3. Requests for substitutions will be considered in accordance with provisions of Sections 01016 - Products and Section 01500 - Substitutions.

2.1 BASIS-OF-DESIGN

1. Manufacturer: **BILCO – www.bilco.com**
   BILCO Canada
   847 Highbury Ave. N, Building 11
   London, On N5Y 5B8
   800.366. 6530 | 519.659.7331

2. Type: **NB-50 Roof Hatch**

2.2 ROOF HATCH

1. Furnish and install where indicated on plans metal roof hatch Type S, size width: typically, 30" (762mm) x length: 54" (1372mm) **Confirm with drawings** . Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

2. Performance characteristics:

   1. Cover shall be reinforced to support a minimum live load of 40 psf (195 kg/m2) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m2) wind uplift.

   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

   3. Operation of the cover shall not be affected by temperature.

   4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.

3. Cover: Shall be 14 gauge paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

4. Cover insulation: Shall be fiberglass of 1” (25.4mm) thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.

5. Curb: Shall be 18” (457mm) in height and of 14 gauge paint bond G-90 galva nized steel . The curb shall be formed with a 3-1/2” (89mm) flange with 7/16” (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6” (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

6. Curb insulation: Shall be rigid, high-density fiberboard of 1” (25.4mm) thickness on outside of curb.

7. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

8. Hardware:

    1. Heavy pintle hinges shall be provided

    2. Cover shall be equipped with a spring latch with interior and exterior turn handles

    3. Roof hatch shall be equipped with interior and exterior padlock hasps.

    4. The latch strike shall be a stamped component bolted to the curb assembly.

    5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” (25mm) diameter red vinyl grip handle to permit easy release for closing.

    6. All hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, use Type 316 stainless steel hardware].

    7. Hardware to be bolted into heavy ga channel reinforcing welded to the underside of
    the cover and concealed within the insulation space.

8. Finishes: Factory finish shall be prime and painted, colour GREY.

PART 3 EXECUTION

3.1 EXAMINATION

1. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

1. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

2. Test units for proper function and adjust until proper operation is achieved.

3. Repair finishes damaged during installation.

4. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

1. Clean exposed surfaces using methods acceptable to the manufacturer.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

1. This specification covers labor, materials, equipment, and application necessary for, and incidental to, the complete and proper installation of intumescent fire protection for application to steel structures and supports in accordance with all applicable requirements of contract documents.

2. This specification shall be supplemented by the applicable requirements of building codes, insurance rating organizations and all other authorities having jurisdiction.

3. Provide only at any exposed steel members requiring fire resistance rating where such members cannot be protected by means of masonry, drywall or fire insulation spray.

1.2 SECTION INCLUDES

1. Intumescent fire protection material.

2. Top-coat protective decorative finish.

1.3 REFERENCES

1. Underwriters Laboratories Inc. (UL) Fire Resistance Directory.

2. ULC - List of Equipment and Materials Test Standards

3. UL 263 (ASTM E119) - Fire Tests of Building Construction and Materials

4. CAN/ULC-S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

5. ASTM E84 (UL723, CAN/ULC-S102) - Surface Burning Characteristics of Building Materials. Class A Rating Required; Flame Spread Maximum: 10 and Smoke Developed Maximum: 50.

6. ASTM D2240 – Durometer Hardness (Shore D Only). Minimum: 84 Shore D.

7. ASTM D2794 – Impact Resistance. Intrusion minimum: 26 inch-lb. (0.65 kg-m)

8. ASTM D4060 – Abrasion Resistance. Maximum 0.7411 grams/1000 cycles.

9. ASTM D4541 – Bond Strength. Minimum: 165 psi. (1138 k Pa.)

10. Steel Structures Painting Council (SSPC) Surface Preparation Standards.

11. Material manufacturer's current published information.

12. AWCI Technical Manual 12-B "Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide", Second Addition.

1.4 SYSTEM DESCRIPTION

1. The intumescent fire protection materials shall be applied at the required thickness to provide the UL fire resistive ratings.

1.5 SUBMITTALS

1. Manufacturer's Data: Submit manufacturer's specifications, including certification as may be required to show material compliance with contract documents, Section 01300 – Submittals.

1.6 QUALITY ASSURANCE

1. Manufacturer - Company specializing in manufacturing fire protection products.

2. The intumescent fire resistive material shall be manufactured under the Follow-Up Service program of UL or ULC and bear the UL and/or ULC label (mark).

3. Applicator - A firm with expertise in the installation of fire resistive or similar materials. This firm shall be licensed and approved by the fire resistive material supplier.

4. Product - The product shall be approved by the architect and applicable authorities having jurisdiction.

1.7 DELIVERY, STORAGE AND HANDLING

1. Deliver materials to the project in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaged materials shall bear the appropriate labels, seals and UL label (mark) for fire resistive ratings and shall be stored at temperatures between 50° F (10° C) and 100° F (38° C), in a dry interior location away from direct sunlight. DO NOT FREEZE.

1.8 PROJECT / SITE CONDITIONS

1. When the temperature at the job site is less than 50° F (10° C) a minimum substrate and ambient temperature of 50° F (10° C) shall be maintained prior to, during and a minimum of 72 hours after application. If necessary, for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

2. In enclosed areas, ventilation shall not be less than 4 complete air exchanges per hour.
3. Relative humidity shall not exceed 75% throughout the total period of application and drying for the intumescent fire resistive material and must not exceed 75% throughout the application and drying for the protective decorative top-coat.

1.9 SEQUENCING AND SCHEDULING

1. Applicator shall cooperate in the coordination and scheduling of fire protection work to avoid delays in job progress.

2. The installation of piping, ducts, conduit or other suspended equipment shall not commence until the application of the thin-film fire resistive material is complete in that area.

PART 2 PRODUCTS

2.1 COMPATIBLE METAL PRIMER

1. Primer shall be approved by manufacturer and applied in full accordance with the primer manufacturer's written instructions.

2.2 INTUMESCENT FIRE PROTECTION SYSTEM

1. The intumescent fire resistive material shall be CAFCO SprayFilm® - WB 2 (lintels & beams), or WB 3 (exposed columns) as supplied by Isolatek International or CAFCO Industries or approved equal by A/D Fire Protection Systems, or Carboline Coatings.

2. Intumescent fire resistive material shall be applied in accordance with drawings and/or specifications and shall have been tested in accordance with the procedures of UL 263 or ASTM E119 or CAN/ULCS101, and reported by Underwriters Laboratories, Inc. or Underwriters Laboratories of Canada only.

2.3 DECORATIVE TOP-COATING

1. Top-coat materials shall be as required for color-coding, aesthetics or additional surface protection, and approved by the thin-film fire resistive manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

1. All surfaces to receive thin-film fire resistive material shall be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other materials which would impair bond of the thin-film fire resistive material to the surface. Any cleaning of the surfaces to receive fire resistive material shall be the responsibility of the General Contractor or steel erector, as outlined in the structural steel section.

2. Confirm compatibility of surfaces to receive thin-film fire resistive material. Steel surfaces shall be primed with a compatible primer recommended by the thin-film fire resistive material manufacturer.

3. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with intumescent coating.

3.2 APPLICATION

1. The thin-film fire resistive material shall be applied at the required dry film thickness per the appropriate UL Design No.

    1. for beams: WB2 - F908, F911

    2. for columns: WB3 - cUL X650, ULC Z619

3.3 MOCK UP

1. Before proceeding with the work, the applicator shall apply the thin-film fire resistive material to a section witnessed by the architect's or owner's representative. The application shall be subject to their approval and shall be used as a guide for texture and thickness of the finished work.

3.4 CLEAN UP AND REPAIR

1. Upon completion of installation, all excess material, overspray and debris shall be cleared and removed from the job site.

2. All patching of and repair to thin-film fire resistive material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by applicators licensed or otherwise approved by material supplier.

3.5 INSPECTION AND TESTING

1. In addition to continuous Wet Film Thickness checks performed by applicator during application, the installed intumescent material shall be inspected by a qualified independent testing laboratory for thickness in accordance with the AWCI Technical Manual 12-B "Standard Practice For The Testing and Inspection Of Field Applied Thin-Film Intumescent Fire Resistive Materials; an Annotated Guide", Second Addition, before application of the top-coat.

2. The results of the above tests shall be made available to all parties at the completion of each area and approved prior to the application of topcoat.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 SYSTEM DESCRIPTION

1. Supply all labour, materials and equipment necessary for the complete work of this Section as indicated on the drawings, specified herein, or as required by job conditions and normally considered as work covered by this Section.

2. The term "sealant" to be synonymous with the term "caulking" where used on the drawings and/or specifications.

1.3 SUBMISSIONS

1. Submit complete colour samples for Architect's approval.

2. Supply a sample container of each type of caulking or sealant.

3. Sample joints of each type and colour of caulking shall be prepared at the site in a location directed by the Architect and be approved by the Architect before work commences. Approved joints will represent minimum acceptable for the work.

4. Cure samples and under conditions anticipated at job site during construction.

1.4 ENVIRONMENTAL CONDITIONS

1. Sealant and substrata materials to be minimum 5 C (41 deg. F.).

2. If necessary, to apply sealants below 5 C., consult sealant manufacturer and follow their recommendations.

1.5 DELIVERY AND STORAGE

1. Deliver and store materials in manufacturer's original wrappings and containers.

1.6 PROTECTION

1. Mask adjacent surfaces as necessary to prevent contamination.

2. Protect all sealant against puncture or damage until sealant has attained its final set.

3. Be responsible for any damage to adjacent surfaces caused by the work of this Section. Provide extra protection as required when sandblasting.

Provide temporary covers over joints where joints have been cleaned out, but not yet caulked.

1.7 WARRANTY

1. Provide a written warranty, signed and issued in the name of the Owner stating that caulking work of this section is guaranteed against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion, or staining adjacent surfaces, for a period of five years from the date of Substantial Certificate of Completion and that any defective caulking will be replaced.

2. At completion of the work, provide a written statement from the manufacturer or authorized manufacturer's representative that material used in the various applications is the recommended one and that the final application is as recommended by the manufacturer for the construction conditions detailed and for the performance required. These requirements are applicable to every material included in the work of this Section.

1.8 QUALIFICATIONS

1. Applicator for the work of this section shall:

2. Be approved by the materials manufacturer and Architects.

3. Have at least five years proven satisfactory experience in this type of work.

4. Have adequate equipment and skilled personnel to expediently complete the work of this section in an efficient and very best workmanlike manner.

5. Be completely familiar with the published recommendations of the manufacturer of the caulking material being used.

6. Indication of lack of skill or defective work to be sufficient grounds for the Consultant to reject the installed caulking and to require its immediate removal and complete recaulking at no additional cost to the Owner during the guaranty period.

7. Co-operate with the Consultant and/or any inspection and testing agency he may appoint.

8. Materials to be utilized shall be inspected and tested as required.

9. Provide cut tests of 6 inches in length in order to ensure correct thickness, hardness, mixing and surface finish. Provide these cut test samples at times and from locations as directed by the Consultant and make good the areas from which the samples are taken.

10. All tests of the sealant installation shall be inspected by the sealant manufacturer's representative.

PART 2 PRODUCTS

2.1 MATERIALS

1. Primers: type recommended by sealant manufacturer.

2. Joint Fillers:

    1. General: compatible with primers and sealants, outsized 30 to 50%.

    2. Polyethylene: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.

3. Bond Breaker: pressure sensitive plastic tape, which will not bond to sealants.

4. Sealant Type A: Equal three part polyurethane 'Tremco Dymeric 240' conforming to C.G.S.B. CAN2-19-24-M80. Colours to be tinted to specifically match wall colours. Maximum of five colours.

5. Sealant Type B: One part silicone mildew resistant type equal to sanitary sealant 1702 by C.G.E. Silicones and conforming to CGSB 19-GP-22m or Dow Corning 786.

6. Sealant Type C: Equal to Sikaflex - 15 LM. Colours to be tinted to specifically match wall colours. Maximum of six colours.

7. Colour of Sealants: to be selected by the Architect. Colours of sealant to change where wall colours change (i.e. banding).

8. Joint Cleaner: xylol, methylethyleketon or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

9. Vent Tubing: 6 mm (1/4") inside diameter extruded polyvinyl chloride tubing.

10. Threshold Bedding: oil base caulking compound, to CGSB 19-GP-6.

11. Deliver materials to job site in sealed containers with manufacturer's original labels attached and accompanied by certification of compliance with the specifications.

PART 3 EXECUTION

3.1 EXAMINATION

1. Examine all surfaces prior to application and notify the Architect of any conditions detrimental to satisfactory application.

    Commencement of work shall imply acceptance of surfaces.

3.2 PREPARATION

1. Use a dry, clean, oil free compressed air stream to remove dust and other contaminants. Masonry surfaces shall be cleaned with wire brush and then blown

clean. Any waterproofing treatments contaminating the joint must be completely removed.

2. Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

3. Remove oil, grease and other coatings from non-ferrous metals with joint cleaner.

4. Prepare concrete, masonry, glazed and vitreous surfaces to sealant manufacturer's instructions.

5. Examine joint sizes and correct to achieve depth ratio ½ of joint width with minimum width and depth of 6 mm (1/4"), maximum width 25 mm (1").

6. Before caulking, fill spaces deeper than 13 mm (½") with bedding material, packed tightly in place and set below finished surfaces to suit specified sealant depth. Provide joints less than 13 mm (½") deep with an approved joint breaker.

7. Where necessary to prevent staining, mask adjacent surfaces with tape prior to priming and caulking.

8. Apply bond breaker tape where required to manufacturer's directions.

9. Prime sides of joints to sealant manufacturer's instructions immediately prior to caulking.

10. Remove all existing caulking and prepare for replacement.

11. Check form release agent used on concrete for compatibility with sealant and primer. If they are incompatible inform Consultant and change sealant to compatible type approved by Consultant or clean concrete to Architect's approval.

3.4 APPLICATION

1. Before application of any sealants, confirm that sealant material is compatible with the materials and finishes of the surfaces to which the material is applied or is in contact with.

2. Apply sealants, primers, joint fillers, bond breakers, to manufacturer's instructions. Apply sealant using a gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.

3. Thoroughly mix caulking materials with a mechanical mixer capable of mixing at 80-100 rpm without mixing air into the material. Mix material in accordance with the manufacturer's directions and instructions.

4. Install caulking to the joints using manually operated or power operated guns. Use nozzles of the correct size and shape and provide sufficient pressure to completely fill the joints and make adhesive contact with the backs and sides of the joints. Caulk solidly around entire perimeter of openings.

5. Finish the surface of the caulking with a smooth, full bead, free from ridges, wrinkles, sags, air pockets and embedded impurities. Tool the finish bead with a water wet or dry tool as recommended by the manufacturer, to a slightly concave joint.

6. In masonry cavity construction, vent caulked joints from cavity to 3 mm (1/8") beyond external face of wall by inserting vent tubing at bottom of each joint and maximum of 1500 mm (5'-0") o.c. vertically. Position tube to drain to exterior.

7. Clean adjacent surfaces immediately and leave work neat and clean. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints. Finish work damaged due to this work shall be replaced at this contractor's expense to satisfaction of the Architect.

8. Set thresholds in a full bed of caulking compound at least 1/2" (12 mm) thick. Remove excess compound after threshold is set and neatly point joints.

9. All hidden joints or joints concealed by metal covers occurring in window and door frames, metal curtainwalls, other locations, to be clean, sealant applied and tooled, and inspected and approved prior to the installation of metal covers.

10. Use of sealants specified in the following locations:

    1. Type A: Use at all exterior locations and interior control joints and expansion joints. NOTE: this sealant must not be painted over.

    2. Type B: Joints between flooring (except carpet areas) and door frames; between countertops and walls; all high humidity locations at shower and changeroom locations.

    3. Type C: At all remaining interior locations.

3.5 LOCATIONS

1. Do all caulking required (except where specified under other sections).

2. Caulk exposed control joints and expansion joints occurring in masonry and concrete walls. (See item 3.6)

3. Caulk along underside of projecting flashings, except at roof eave detail.

4. Caulk joints between aluminum panels, window or door frames to adjacent building components around perimeter of every external window or door opening at interior and exterior sides aluminum units which work shall be performed by Automatic Aluminum Doors - Section 08710, Aluminum Windows - Section 08520 and Section 07461 Aluminum Architectural Composite Panel System – Section 07461, Aluminum Curtain Wall - Section 08900.
5. Caulk around exterior louvres.

6. Set window sills in a bed of caulking compound by Sections 08400 – Aluminum Entrance Framing and Doors and Section 08900 – Aluminum Curtain Wall.

7. Interior hollow metal where it abuts interior finishes.

8. Caulk where shown on drawings and not specified in other sections.

9. Caulk joints at junction of different materials and junction of surfaces in different planes as required or directed (i.e. concrete to metal, concrete to masonry, masonry to metal, masonry to drywall, etc.).

10. Caulking elsewhere to provide a water and weatherproof condition.

11. Caulk areas on interior walls to stop air infiltration.

12. Caulking between resilient/sheet flooring and masonry or concrete walls; and between resilient/sheet flooring and hollow metal frames (Type 'B' sealant).

13. Caulk joints between masonry and gypsum wallboard or plaster.

14. Caulk control joints in drywall partitions.

15. Caulk around access panels, built-in specialties, grilles, pipes, ducts, conduit, outlet boxes, etc. penetrating floors, walls and ceilings.

16. Caulk joints around metal items projecting from ceramic tile work (Type "B" sealant).

17. Caulk around toilets, urinals, sinks, bathtubs, showers, etc. at junction with floor and wall surfaces (Type "B" sealant).

18. Caulk joints as required to provide soundproofing where soundproofing walls are indicated.

19. Caulk joints between wood window and wall surfaces and wood door frames and wall surfaces, etc.

20. Caulk perimeter of all countertops and window plastic laminate sills (including underside) with (Type "B" sealant).

21. Caulk around access panels and washroom accessories in ceramic tile faced walls.

3.6 CAULKING NOT TO BE DONE UNDER THIS SECTION

1. Caulking of Sidewalk Joints - Section 02600

2. Firestopping and smoke seals - Section 07270, Div. 15 and Div. 16

3. Caulking between aluminum work and aluminum work to surrounding surface - Section 07461, Section 08400, and Section 08520.

4. Caulking of Roofing - Section 07513

5. Caulking of Metal Flashings - Section 07620

6. Caulking of Vapour Barrier - Section 07190

7. Caulking and sealants for glazing - Section 08800

8. Caulking of Acoustic Drywall Partitions - Section 09250

9. Caulking of Porcelain and Ceramic Tile - Section 09300

10. Caulking of sheet flooring - Section 09650

3.7 CAULKING OF MASONRY CONTROL JOINTS

1. Caulk all Masonry Control Joints where shown on drawings. Refer to exterior elevations and interior elevations.

   NOTE: For Base Price at each control joint shown on exterior wall elevation allow for control joint to also be located in back up masonry concrete block wall as per AD detail, backer rod and Caulking by this Section. Compressible joint filler by Masonry Section 04200.

2. In addition to locations noted in item a. above, allow for the following additional linear quantities for Caulking of interior concrete block control joints, as per drawings as follows:

   1. 3500 lineal metres of caulking complete with backer rod.

   NOTE: Linear quantity based on one side/face of exposed concrete block masonry wall.

   NOTE: Verification of linear quantities of control joints to be made later. Locations of all additional required Concrete Block Joints to be finalized later after submission of proposed control joint locations on shop drawings to be submitted by Masonry Contractor as required by Specifications Section 04200 – Unit Masonry.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements is part of this Section and shall apply as if repeated here.

1.2 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 – Submittals.
   Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, finishes and fire ratings.

2. Fire Ratings indicated on Door Finish Schedule are minimums. If door design cannot be satisfied at specified rating (i.e. 20 min), supply door or frame with acceptable higher rating (i.e. 45 min.).

1.3 QUALIFICATIONS OF MANUFACTURER

1. Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

2. Only steel hollow metal doors and frames manufactured by members of the Canadian Steel Door and Frame Manufacturer's Association (CSDFMA) are eligible for use on this project.

3. Qualified Manufacturers:

    1. S. W. Fleming
    2. Baron
    3. Daybar
    4. Artek
    5. Trillium
    6. Ambico

4. All other manufacturers to submit for approval a minimum seven (7) days prior to tender closing.

1.4 PROTECTION

1. Use all means necessary to protect materials of this Section before, during and after installation and to protect installed work & materials of all other trades.

1.5 REPLACEMENTS

1. In the event of damage, immediately make all repairs & replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.6 WORK INCLUDED

1. Supply all hollow metal doors, frames and screens as shown on drawings and on door schedule.

2. Provide removable mullions where indicated. Refer to door and frame schedule.

3. Supply and install all hollow metal fire doors, frames and screens shown on the drawings and on door schedule.

4. Door cutouts, complete with reinforcing, stops, and closures required for glazing.

5. Cut outs and reinforcing for finishing hardware including preparations for mortice type hardware.

6. Cutouts for security system. Coordinate with Div.16.

7. Supply all necessary fastening and anchoring devices for above items.

8. Supply and install door grilles where indicated on drawings or sizes as indicated on the drawings and specified in Mechanical Sections.

1.7 STANDARDS

1. Materials and workmanship to be in accordance with Canadian Steel Door and Frame Manufacturer's Association Specifications Standards for steel doors and frames.

1.8 REGULATORY REQUIREMENTS

1. Supply fire labelled steel doors and frames in accordance with NFPA-80, current edition, except where specified otherwise.

PART 2 PRODUCTS

2.1 MATERIALS

1. Steel: cold rolled steel, double annealed patent levelled, fully pickled and free from scale and internal defect. Surfaces shall be free from perceptible waves, buckles and other imperfections.

2. Zinc Coating: wipe coated galvanizing in conformance with ASTM 527, Coating Class A01.

3. Primer for Touch-Up: conforming to CGSB 1GP-181M.

4. Labels: Provide ULC or Warnock-Hersey Labels for doors and frames as per Door Schedule.
5. Thermal Break: Polyvinyl Chloride (PVC) thermal break.
6. Reinforcing Channel: to CAN/CSA - G40.21-M7, grade 300W, 3.25 mm.

2.2 FABRICATION

1. Generally:

    1. Fit and assemble work in shop where possible. Execute according to details and approved shop drawings. Where shop fabrication is not possible, make trial assembly in shop.

    2. Weld all components of doors and frames. File or grind exposed welds smooth and flush. Exposed welds shall be continuous. Knock-down frame not to be used on this project.

    3. Workmanship shall be best grade modern shop and field practice known to recognized manufacturers specializing in this work. Joints and intersecting members accurately fitted made in true planes with adequate fastening.

    4. Insulate where necessary to prevent electrolysis between metal to metal or metal to masonry or concrete.

    5. Fabricate and erect work square, plumb, straight, true and accurately fitted. Provide adequate reinforcing and anchorage.

    6. Clean, scrape and remove rust, mill scale, grease or extraneous material from frames and doors following fabrication. Flood coat with air-drying paste filler and again sand to eliminate all unevenness or irregularities. Apply in shop a full smooth coat of zinc chromate primer to all surfaces. Deliver work to site with primer undamaged and otherwise satisfactory for following work specified in Section 09900 – Painting and Finishing.

2. Doors:

    1. Provide hollow metal doors of type and size indicated on Door Schedule, and as detailed on Drawings.

    2. Construct flush type continuously welded exterior doors conforming to ASTM A527 16 gauge (1.6 mm) hollow metal construction, steel stiffened with vertical steel ribs, all voids filled with semi-rigid fibrous insulation minimum density 24 kg/m3 polystyrene polyurethane and complete with top and bottom caps. Finish shall be "wipe coat" galvanized steel.

    3. Construct interior slab and stile and rail type doors and panels of 18 gauge (.683 mm) cold rolled, roller levelled sheet "wipecoat" galvanized steel with

honeycomb structural core consisting of pre-expanded, resin impregnated Kraft paper having 3/4" (20 mm) cell size to thickness indicated.

4. Provide 16 gauge (1.6 mm) continuously welded interior doors, reinforced with interior stiffeners at all corridor, washrooms, changerooms and Gymnasium and elsewhere where indicated on drawings and Door Schedule. Interior Stiffeners: for steel doors and panels, spot weld interior stiffeners at 150 mm (6") o.c. maximum to face sheets. Laterally stiffen steel doors at top and bottom by continuous channels securely welded to both face sheets.

5. Doors shall be mortised, reinforced, drilled and tapped to receive templated hardware including mortise type hardware. Reinforce for surface mounted hardware.

6. Prepare doors to receive glass or grilles as required. Provide removable stops secured with countersunk tamperproof head screws at 6" (150 mm) o.c. Prepare exterior doors to receive 1" (25 mm) thick insulated sealed glass units.

7. Weld door and panel components together to provide integrated units, square, true and free from distortion or waves. All 18 gauge doors to have welded seams minimum 30% overall and 2" (50 mm) length welds. Weld above and below all hinge locations. All 16 gauge doors to be continuously welded. Grind and fill smooth welded seam.

8. Door head and bottom shall have channel shaped member, closing off top and bottom of door flush with face skins. NOTE: close off top and bottom of exterior doors even with outer edge of door.

3. Fire Rated Doors:

1. Provide doors, frames and hardware with Underwriters Laboratories of Canada labels where noted "Label" on Door Schedule.

4. Door and Screen Frames:

1. Provide steel hollow metal door and window frames for openings indicated on Door Schedule and as detailed elsewhere on drawings.

2. Form interior hollow frames to profile indicated of 16 U.S. gauge (1.6 mm) hot rolled "wipe coat" zinc coated steel. Construct exterior frames of 16 U.S. gauge (1.6 mm) hot rolled, zinc coated steel.

3. Cut mitres and weld corners continuously along inside frame profile. Fill corners of steel frames with metallic paste filler and sand smooth and uniform. Do not weld corner of removable stop.

4. Provide 10 gauge channel stiffeners in mullions each side of door openings occurring in screens, or as required to provide a rigid installation.

5. Prepare removable stops secured with counter-sunk tamperproof screws at 6" (150 mm) o.c.

6. Provide three (3) neoprene single stud bumpers for each interior door frame and (2) bumpers at head for pairs of doors.

7. Prepare frames for mortise type hardware at all doors except panic hardware locations at exterior doors, stair doors, corridor cross doors, gym doors and library doors. Blank, reinforce for butts with 1/4" (6.35 mm) steel plate, drill and tap as required. Reinforce both sides of every door closer, provide for concealed door closers where required.

8. Cover reinforcement plates or attachments and cut-outs with 22 gauge (0.8 mm) steel sheet boxes to protect against mortar. Provide channel or angle spreaders readily removable.

9. Provide adjustable "Tee" or wire masonry anchors with head of No. 6 gauge (4.94 mm) steel and body of 10 gauge (3.45 mm) corrugated steel where frames are built into masonry, except at thermal broken frames. Provide manufacturer recommended anchor at all other locations.

10. Supply three anchors for jambs between 4'0" (1219 mm) and 7'0" (2134 mm) and four anchors for jambs exceeding 7'0" (2134 mm) high. Adjustable type shall be as recommended by manufacturer. Provide adjustable jamb anchors for fixing at floor.

11. Provide head reinforcement in frames wider than 4'-0" (1200 mm) and where indicated or recommended by manufacturer.

12. Prepare frames for electric hardware and security systems. Reinforce and drill and tap frames as required. Coordinate with Div.16.

13. Prepare frames for continuous door length type hinges where indicated on door schedule.

14. Provide 12 gauge reinforcing in frames for continuous door length type hinges where indicated on door schedule.

15. Provide removable mullions where indicated on door frame schedule.

16. Provide insulated doors at all exterior locations and at interior locations in the music rooms and anywhere acoustic doors are called for on the drawings

5. Thermal Door Frames and Screens:

1. Equal to "Therma-Frame" door frames and screens as manufactured by S. W. Fleming Ltd. at all exterior hollow metal door frame and screen locations as indicated on drawings and in the door schedules.

2. Frames must meet or exceed CGSB 82-GP-5M.
All jambs, heads, sills, centre rails and mullions will be fabricated from 16 gauge (1.63 mm) wipe coated galvanized steel meeting the requirements of ASTM Designation A527, Coating Class A01.

3. Interior and exterior frame sections shall be separated by a Polyvinyl Chloride (PVC) thermal break and the sections must not be fixed by screws, grommets or other fastening devices.

4. Wall and floor anchors to be supplied to suit wall conditions and shall be designed so as not to permit thermal transfers from exterior to interior surfaces of the frames sections.

5. Where doors are required frames shall be mortised, reinforced, drilled and tapped to receive hardware as specified in the hardware list.

6. Where welded frames are employed, welds must not cause thermal transfers between exterior and interior surfaces of the frame sections.

7. Provide reinforcement in frames wider than 4'-0" (1200 mm) and where indicated or recommended by manufacturer.

8. Prepare frame for hardware, electronic hardware and security systems. Drill, tap and reinforce frames where required.

9. Prepare for 1" (25 mm) thick insulated glass units at all glass locations in doors and screens.

6. Metal Panels and Closures:

1. Provide 16 U.S. gauge (1.6 mm) hot rolled zinc coated steel closures (at corners and/or between frames) and panels as indicated and detailed on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

1. Frame Installation:

1. Allowable limit of distortion shall be 1/16" (1.5 mm) out of plumb each jamb, measured on face of frame, resulting in maximum twist of frame of 1/8" (3 mm) measured diagonally from upper to lower corner.

2. At masonry walls: install frames using the corrugated or wire masonry anchors. At preformed openings and exterior thermally broken doors use machine screws and expansion anchors as provided for this application. After installation, fill countersunk screw heads flush with frame and sand smooth ready for painting. Fill exterior frames with spray-on insulation by Section 07215 – Spray-on Insulation. Co-operated with masonry trade who will fill interior frames with mortar.

3. Brace frames solidly in position while being built in. Install temporary spreader of wood at mid-height of frame until adjacent wall work is completed. Provide vertical support at centre of head for openings of 4'-0" (1200 mm) wide or wider.

4. Remove temporary jamb spreader bars and vertical supports only after frames are securely anchored in place.

2. Door Installation:

1. Install hollow metal doors plumb, true and level and at correct elevation.

2. Co-ordinate installation of hardware.

3. Adjust operable parts to ensure proper operation.

4. Install hollow metal panels and closures with concealed fastenings.

5. Install acoustical assembled doors and frames as per manufacturer's recommendation.

6. Install fire rated doors and frames in accordance with National Fire Codes, Volume 4, produced by National Fire Protection Association (NFPA 80).

7. Attach fire rating labels to doors and frames required to be fire rated. Ratings shown on door schedule are minimum. Attach temperature rise rated labels to doors required to be 90 MFR or greater.

8. Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

9. Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08700 - Finishing Hardware.

10. Adjust operable parts for correct function.

11. Install glazed lites, stops and louvres.

12. Install door grilles provided by Mechanical Contractor.

3.2 TOUCH-UP

1. Remove rust, clean and touch-up any damaged galvanizing with "Zincrich" or "Galvicon" paint.

2. Remove rust, clean and touch-up any damaged paint with approved primer.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements is a part of this Section and shall apply as if repeated here.

1.2 QUALIFICATIONS

1. Approved Suppliers are:

    1. Baillargeon Door
    2. Lambton Door
    3. Five Lakes manufacturing

2. All other manufacturers to submit for approval a minimum seven (7) days prior to tender closing.

1.3 SAMPLES

1. Submit samples in accordance with Section 01300.

2. Submit one 1'-0" x 1'-0" (300 mm x 300 mm) corner sample of each type of door showing construction, core, glazing detail and faces.

1.4 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300.

2. Indicate door types and cutouts for lights and louvres.

1.5 SPECIAL PROTECTION

1. Deliver doors to site in protective scuff-resistant wrapping. Do not remove wrapping until doors are installed.

2. Print door identification on wrapping.

1.6 WARRANTY

1. The work under this Section shall be warrantied in accordance with GC 3.11 of CCDC Document 2 - 2020, but for a period of three years from the date of Architect's Certificate of Completion.

2. Warping, twisting, showing of core ghost lines, splitting, delaminating, or sagging under normal use will be considered as defects. Warpage shall not exceed 1/4" (6 mm) clearance over height or width.

3. Warranty shall cover hanging, finishing and complete replacement costs of defective doors.

PART 2 PRODUCTS

2.1 MATERIALS

1. Wood Veneer (Stained and Varnished):

    1. Select Quarter Sawn Oak Veneer, Architectural Grade 'A' No. 1 face grade.
    2. Colour of stain finish to match Tafisa Mojave L546 (AT). Confirm colour of stain with architect prior to ordering material.

2. Door Materials: to CSA 0132.2-M1977.

3. Hardwood Plywood Surface: to CSA 0115-M1982 1/8" (3 mm) thick.

2. Wood Glazing Stops: thin line, clear, solid wood to match veneer at non-fire rated locations.

3. Laminate Plastic Adhesive: Urea resin adhesive to CSA 0112.5, contact adhesive to CGSB 71-GP-20M or resorcinol resin adhesive to CSA-0112.7 to plastic laminate manufacturer's recommendations.

6. Glass for Wood Doors: as per 08800 Glass and Glazing Section.

7. Glass for Wood Frames and Screens: as per 08800 Glass and Glazing Section.

2.2 FABRICATION

1. Manufacture doors in accordance with CAN/CSA 0132.2-M90 for slab doors with 3/16" (4.76 mm) hardwood veneer face, for finish wood veneer or plastic laminate face finishes.

2. Door Construction: 449 kg/m^3 (28 lbs. per cu. ft.) minimum density solid particle board core at non-fire rated and 20 minute fire rated locations. Stiles to be minimum 115 mm wide at sides, top and bottom with outer lamination of 16 mm birch.

    NOTE: Provide additional blocking at lockset/latchset locations at mineral core doors to suit mortise type hardware. Provide additional 125 mm top rail at head to suit door closures at all rated doors.

    1. Acceptable Material: P3200 Series by Premdor for non-fire rated or 20 MFR locations or approved equal by Weyerhauser.

3. Flitches of wood face veneers shall be equal width. Graining of adjacent flitches to be similar. Narrow strips will not be accepted.

4. Door sizes and profiles are shown on the Door Schedule and as detailed on the drawings. Confirm and co-ordinate actual manufactured frame opening sizes prior to door fabrication. Size doors to provide proper clearance (including floor finish allowance) to minimize trimming required on job site. Co-ordinate with Finishing Hardware Schedule. Note that this is a Metric project.

5. Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

4. Radius vertical edges of double acting doors to 60 mm radius.

5. Prepare doors for glass and provide glazing stops and stickings. Allow for 1" (25 mm) thick double sealed glass units at Music Room doors.

6. Affix ULC or WH labels to doors required to be 20 min. or 45 min. fire rated (20 MFR, 45 MFR).

7. Hardware: prepare doors for finish hardware including mortise type hardware at factory where practical. Co-ordination with approved Finishing Hardware Schedule.

8. Seal top and bottom edges with two coats urethane finish or lacquer applied in door manufacturer's plant.

9. Provide solid wood edging on Face Veneer doors. Match solid wood edging to match Face Veneer p. lam veneer (wood grain colour) on stained and varnished finished doors.

10. Undercut or rebate bottom rails as required.

PART 3 EXECUTION

3.1 STORAGE

1. Store doors in flat position off the floor with separation strips between to prevent scratching.

3.2 INSTALLATION

1. Install doors and hardware in accordance with manufacturer's printed instructions. Hardware door preparation and installation to be carried out by tradespersons specializing in this trade.

2. Doors shall be hung by skilled carpenters per Section 06200 - Finish carpentry.

3. Neatly and accurately fit required finishing hardware.

4. Adjust hardware for correct function.

5. Install louvres and stops. Refer to mechanical for louvre locations and requirements.

6. Secure transom and side panels by means of stops concealed fasteners or countersunk screws concealed by means of plugs matching panel.

7. The completed installation requires all doors to fit accurately in their frames, swing easily without binding and close snugly without movement when latch is engaged.

3.3 ADJUSTMENT

1. Re-adjust doors and hardware just prior to completion of the building to function freely and properly.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is part of this Section and shall apply as if repeated here.

1.2 QUALIFICATIONS

1. Manufacturers approved for the work of this section are:

    1. Commdoor Aluminum
    2. Kawneer Company, Canada Limited.
    3. Alumicor
    4. Aerloc
    5. Old Castle Building Envelope

2. No other manufacturer or supplier, except those noted above, shall be used unless approved in writing by the Architect seven (7) days prior to tender closing.

3. It is the responsibility of the approved manufacturers to meet or exceed and submit OBC SB-10 Energy Efficiency Compatibility Results.

    1. **Note:** The above-mentioned submittal is to incorporate the specified sealed glazing unit and each opening component as a whole before the shop drawings are accepted or before any shop drawings are reviewed.

1.3 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 – Submittals.

2. Submit shop drawings for the fabrication and installation of associated components of the work. Indicate anchors, joint system, expansion provisions, hardware, and other components not included in manufacturer's standard data. Include glazing details (where required).

3. Before shop drawings and fabrication are started, take critical measurements at the site to facilitate installation and fitting of work.

4. Shop drawings that are submitted are to be in the units of the tendered drawings with critical on centre mullion dimensions (dimension string from datum level to top of opening noting centre of mullions) noted along with all other regular shop drawing dimensions, no exceptions. Both units (metric and imperial) are allowed. Openings are to be identified with the corresponding tags on the tendered drawings.
(Coordinate with typical A8 drawing notes).

1.4 SUBMITTALS

1. Submit samples of sections and finishes for Architect's approval before fabrication.

2. Furnish templates, diagrams, and other data to fabricators and installers of related work, as needed for coordination installation.

3. Coordinate with Electrical Sections, Section 08700 - Finishing Hardware and security subcontractor for any electrical provisions required.

1.5 DESIGN

1. Design for wind and snow loads as set out by the Ontario Building Code, 2012 as currently amended for the building location. Copies of any and all structural calculations made in connection with the supplementary design and/or detailing of the work of this section shall be promptly furnished to the Architect if requested.

2. Submit with shop drawings certification that window and entrance design and construction will meet the specified requirements. Certification shall be in the form of test reports on similar units performed by an independent testing laboratory and shall meet approval of Architect before fabrication commences.

1.6 WARRANTY

1. The work and materials of this section shall be under warranty in accordance with GC of CCDC Document 2 - 2020 but for a period of five years and ten (10) years for hermetically sealed units from the date of Architect's Certificate of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

1. Aluminium: Extruded Members: 6063-T54 alloy and temper.

2. Fasteners, Screws & Bolts: 300 Stainless Steel or 400 series stainless steel cadmium plated and of sufficient size and quantity to perform their intended function.

3. Glazing Tape: Tremco 440 tape with built-in shim and as recommended by window manufacturer.

4. Weathering and Glazing Gaskets: Extruded black closed cell or dense elastomer of durometer appropriate to the functions.

5. Spacer Shims: oil resistant rubber or plastic acceptable to glass manufacturer, channel shaped and approximately 4" long (100 mm).

6. Silicone Sealant: Dow Corning #795 or as per manufacturers recommendations exceeding CAN2-19.13-M82 Class 40 requirements.

7. Isolating Coating: Black alkali resistant bitumastic enamel.

8. Spray-On Insulation: Supply and install by this section as per Section 07215 – Spray-on Insulation.

9. Miscellaneous: Supply all covers, copings, special flashings, filler pieces, termination pieces, caps closures and expansion joint covers as required and as indicated on drawings.

10. Glass for Aluminium Doors: as per 08800 Glass and Glazing Section.

11. Glass for Exterior Aluminium Entrance Framing: as per Section 08800 - Glass and Glazing.

12. Glass for Interior Aluminium Screens: as per Section 08800 - Glass and Glazing.

2.2 FABRICATION

1. General

2. Construct aluminum assemblies of extruded sections to size and profile shown on Drawings.

3. Build units square, true, accurate to size, free from distortions, waves, twists, buckles or other defects detrimental to performance or appearance.

4. Units too large for handling or shipping shall be prefabricated in shop, disassembled and marked for shipping and field assembly.

5. Use concealed fastenings. No exposed screws shall show in the finished work unless approved by the Architect. Such screws shall be countersunk and finish match surfaces in which they occur.

6. Joints shall be accurately cut and fitted to result in a tightly closed joint.

2.3 DOORS, ENTRANCE SCREENS, EXTERIOR WINDOWS INTERIOR SCREENS

1. Frames

1. "Kawneer 1600UT System 1 & 2" Thermally broken curtain wall framing & entrance screens where the door system is part of a curtain wall frame system and "Kawneer 1600 System 1 & 2" framing for interior entrance screens where the door system is part of a curtain wall frame system. Provide 19mm door stops / seals clipped into curtain wall framing around door perimeters.

2. "Kawneer Trifab 451UT, Center, Interior Glazed" thermally broken framing at exterior windows and exterior entrance screens where the door system is stand alone.

3. "Kawneer Trifab 451, Center, Interior Glazed" framing at interior entrance screens where the door system is stand alone.

4. For products listed above, coordinate with manufacturer and drawings for side light base heights (dimension to match doors) with associated aluminum sill flashing, metal liner, insulation and aluminum panels where indicated on drawings.

    1. **Note** that Kawneer 1602UT system or equal is acceptable alternative product to Trifab 471UT for exterior window locations.

2. Conform to CAN3-A440-M90 performance standards Air Leakage to meet the Fixed rating, and Type A3, Water Leakage Type B5 and Wind Resistance Type C7.

3. Doors

    1. Exterior entrance / vestibule doors to be insulated **"Kawneer 560 InsulClad"** with insulated double glazing. Black anodized finish. (Coordinate with door schedules on Drawings)

    2. Interior entrance / vestibule doors to be **"Kawneer 500 Wide Stile"** with single glazing. Black anodized finish. (Coordinate with door schedules on Drawings)

    3. Interior screen doors to be coordinated with screen schedules and associated door type schedules.

    3. Coordinate with door schedules for heads and stiles sizing and base height. Adjacent screens / curtain wall bases to match door base height typical.

    4. Provide mid-rail at all doors that require panic devices, coordinate with door schedules for sizing.

    5. The core shall be foamed-in-place urethane foam at density of 5.0 lb./cu.ft. (64 kg.m³). Provide insulated aluminum panel where indicated on drawings.

    6. Stiles shall have a wall thickness of .125". (3.2 mm). Glazing mouldings shall be .050" thick (12.7 mm).

    7. Use snap-in type square glazing stops with neoprene bulb type glazing. Do not use exposed screws to secure stops. Use lock-in,

tamperproof type stops.

8. Equip door leaf with an adjustable mechanism in top rail near the lock stile, to provide for minor clearance adjustments after installation.

4. Door Hardware

1. Equip all aluminum doors with continuous weather stripping with adjustable weather stripping at the base; and thresholds, max. ½" (12.7mm)ht.. Closer cover to match door finish colour.

2. Equip all aluminum doors with full height (continuous) heavy-duty stainless steel hinge.

3. All other hardware including concealed closers, exposed closers, locksets, exit device, push/pulls, overhead stops, handicap automatic door openers to be supplied under Hardware Allowance Section 08700 – Finishing Hardware and installed under Section 06200 – Finish Carpentry.

5. Finish

1. Prepare and fabricate components as required before finishing.

2. Finish to be Black anodized typical. Provide alternate price to finish in clear anodized. Caps to remain black anodized. Oversized caps to remain Duranar Finish - allow 4 colours to be selected.

3. Metals other than aluminum shall match colour finishes.

6. Closures, Flashings and Miscellaneous Covers

1. Provide .125" (3 mm) thick aluminum closures and caps where required.

7. Operating Vents:

1. Hinged awning style limited opening to max. 4" (100mm). Provide 1 pair of heavy duty Anderburg or Senator friction arms at all openings and 2 pair where opening is 500mm and wider. Polished US - #4 cam handle (for operation locate handle so that screen does not need to be removed to operate the vent). Duranar Finish – allow 4 colours.

8. Insect Screens:

1. Sized to match operator. Glass fibre mesh in aluminum frame with extruded polymer removable spline.

PART 3 EXECUTION

3.1 INSTALLATION

1. Secure work adequately and accurately to the structure in required position and in manner not restricting thermal movement. Work shall be plumb, square and level, free of twist, warp or other superimposed loads. Provide shims as required.

2. All metal to metal joints shall be sealed to provide a weathertight assembly in accordance with manufacturer's instructions.

3. Use concealed fixings where possible, where not possible use flat head screws in countersunk holes. Exposed bolt or nut heads not permitted. Match exposed fastenings with surfaces on which they occur.

4. Isolate all aluminum coming in contact with unlike materials with heavy shop coating of black alkali resistant bitumastic enamel to prevent electrolytic or chemical reaction.

5. Fill voids between aluminum extrusions and wall surfaces at exterior doors and entrance framing with foam spray applied insulation where required to prevent movement or infiltration of air. Supply and install spray-on insulation as per Section 07215 – Spray-on Insulation.

6. Supply and install all caps and closures where required to create a complete installation and as indicated on the Drawings.

3.2 CAULKING

1. Caulking between aluminum and aluminum; aluminum and glass to conform to this section. Caulking to perimeter drywall masonry and concrete all by this section as per Section 07900 – Sealants.

2. Caulking by this Section shall be installed as per Section 07900 – Sealants.

3.3 GLAZING

1. Glaze windows in accordance with CAN3-A440-M90.

13. Set glazing tape against permanent stops, allow 1/8" for cap bead, set horizontal strips first using full width pieces of tape, then set vertical pieces. Butt tape at corners, do not lap tape or run continuous at corners.

14. Set glass on setting blocks, number as recommended by glass manufacturer. Set glass with draw lines horizontal.

15. Apply heal bead on interior, using sealant. Place spacer shims, set glazing tape against glass and install stops.

16. Apply cap bead to fill void on exterior. Tool sealant with a slight bevel, sloped away from the glass to create a water shed.

17. Mark each light with a large white cross to indicate the presence of glass.

18. Replace under this section defective, damaged or broken glass due to faulty setting, handling or storage.

19. Neoprene bulb type glazing in accordance with manufacturer's instructions.

3.4 ADJUST AND CLEAN

1. Adjust all hinges, closers and weather stripping for optimum condition. Lubricate operating equipment.

2. Clean surfaces promptly after installation, exercising care to avoid damage of the protective coating (if any).

3. Advise the contractor of protective treatment and other precautions required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of acceptance.

4. Aluminum shall be isolated from concrete, mortar, plaster and dissimilar metal with bituminous paint. Windows shall be protected from other building materials during and after insulation until acceptance by the General Contractor. Thereafter, it shall be the responsibility of the General Contractor to maintain protection and provide final cleaning.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements is a part of this Section, and shall apply as if repeated here.

1.2 HARDWARE SCHEDULE

1. Refer to and include in the base bid amount the following information and products included in the attached hardware sections:

    1. See section 01020 for cash allowance to be carried in base bid.

2. INSPECTION

    1. Hardware supplier shall check all hardware when it has been installed and shall notify the Architect of any cases where it has not been properly installed, is defective, or is not as specified. Replace defective hardware. Hardware supplier or closer manufacturer on his behalf shall check all door closers after they have been installed to make sure that all adjustments such as back checking degree have been properly made. Notify the Architect of any closers which have not been properly adjusted.

3. SCHEDULING AND PACKAGING

    1. Supply finishing hardware to those who are to install it complete with templates and other complete installation instructions, in sufficient time to avoid delaying the progress of the work.

    2. Package hardware separately for each door or unit and state clearly on each package the number and description of the door or unit for which the hardware therein is intended.

    3. Supply all required expansion shields, anchors, and other related accessories for satisfactory attaching or installing all finishing hardware.

    4. Supply a key box to hold a minimum of 2 keys for each door.

4. HARDWARE LISTS

    1. See door hardware index, hardware groups and catalogue cuts indicate the type, manufacturer, number, location and finish of each item of finishing hardware supplied under this Section.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 WARRANTY

1. The work under this Section shall be warrantied in accordance with GC's of the CCDC Document 2 - 2020 but for a period of 10 years on insulated units and 5 years on all other work from the date of Architect's Certificate of Substantial Completion.

1.3 PROTECTION

1. Mark each light with a large cross to indicate presence of glass (colour that stands out to the visible eye). Use material that will leave no residue after removal.

2. Replace under the work of this section, defective, damaged or broken glass due to faulty setting, handling or storage.

1.3 SUBMITTALS

1. Submit shop drawings in accordance with Section 01300 - Submittals for items 2.15 and 2.16 below designed and stamped by a Certified Structural Engineer from Ontario for the design thickness of the glass as a Guard per latest OBC, as currently amended.

1.4 STANDARDS

1. Design in conformance with CAN/CGSB-12.20-M, structural design of glass for buildings.

PART 2 PRODUCTS

2.1 MATERIALS

1. All exposed glass edges shall be polished and chamfered typical.

2. Float Glass: 1/4" (6 mm) minimum clear float glass conforming to CAN/CGSB - 12.3 M91.

3. Tempered Glass: 1/4" (6 mm) minimum clear glass tempered conforming to CAN/CGSB - 12.1 M90 equal to Ford Glass.

4. Laminated Safety Glass: 1/4" (6 mm) minimum clear core laminated – 2 layers of 1/8" min (3mm) with laminate between layers conforming to CAN/CGSB - 12.1-M90.

5. Fire Rated Glass: 3/16" (5 mm) minimum thick Firelite NT Standard Grade glass ground and polished both sides manufactured by Nippon Electric Glass Company Ltd. conforming to CAN/CGSB - 12.11-M90, ASTM E2010, CAN 4 S-104 and CAN 4 S-106 and thickness required by manufacturer for fire rating required in the assembly in which the glazing is installed, to be submitted in shop drawings before any manufacturing. Glazing tape to be as per manufacturer's written recommendations.

6. Spandrel Glass Panels

    1. At Exterior Locations:

        1. Outer Light Glass Type: 6 mm (1/4") tempered clear, Solarban 70 xl (2) on inner face of outer light,

        2. Gas Cavity: ½" (12.7 mm) 90% argon and 10% air space, hermetically sealed, insulating units conforming to CAN/CGSB - 12.8 - M90 and with thermally broken stainless steel glazing spacer.

        3. Inner Light Glass Type: 6 mm (1/4") clear tempered glass with opaci-coat high performance glass coating. Colour to be selected by Architect from the manufacturer's full range of colours prior to manufacturing.

        Note: there is an Alternate price called for on the Supplementary Tender Form to use single glazing at spandrel glass locations.

7. Glazing Tape: Tremco 440 tape and as indicated in other glass sections.

8. Sealant: CWS by Dow Corning.

9. Heal Bead Sealant: One part polysulphide or acrylic sealant conforming to CGSB 19-GP-5 and as indicated in other glass sections.

10. Spacer Shims: neoprene, Shore "A" durometer hardness 80, 3" (75 mm) long x 0.08" (2.4 mm) thick and 3/8" (9 mm) high.

11. Setting Blocks: neoprene, Shore "A" durometer hardness, 4" (100 mm) long x ¼" (6 mm) high x width to suit glass thickness.

12. Primer: Sealers and cleaners to glass manufacturer's standard.

13. Vision Glass: Sealed insulated glass units, ten (10) year guarantee, ½" (12.7 mm) 90% argon and 10% air space, hermetically sealed, insulating units conforming to CAN/CGSB - 12.8 - M90 and with thermally broken stainless steel glazing spacer. Warm edge spacer is only allowed in curved glazing units.

    NOTE: Colour selection of glass to be confirmed by Architect prior to manufacturing.

1. Outer Light Glass Types:

    1. 6mm (1/4") Tempered Solargray with Solarban 70XL (Surface 2) by P.P.G. Canada or approved equal typical at all vision glass locations.

    2 Fire rated glass: at all fire rated wall assemblies or exposure situations.

    3. Inner Light Glass Type:

        1. 6mm (1/4") Clear Tempered by P.P.G. Canada or equal.

        2. Provide Fire rated glass at all fire rated wall assemblies or exposure situations. Refer to life safety drawings for locations required.

14. Vision Glass for Exterior Entrance Doors, Sidelights and Transoms: Sealed insulated glass units, ten (10) year guarantee, ½" (12.7 mm) air space filled with 90% Argon and 10% air, hermetically sealed with stainless steel thermally broken glazing spacer (warm edge spacer to be used only at radius / curved glazing units) insulating units conforming to CAN/CGSB - 12.8 - M90.

    1. Outer Light Glass Types:

        1. 4mm Heat Strengthened Clear / .090 PVB interlayer / 4mm Heat Strengthened clear by TRULITE or equal (9.525mm (3/8") air space)

    2. Inner Light Glass Type:

        1. 6mm Solarban 70XL (3) Clear Tempered by TRULITE or equal.

15. Glass for Interior Doors:

    1. Typical 6mm Clear Tempered by P.P.G. / TRULITE or equal.

    NOTE: All vision glazing lower than 1070mm a/f/f (upper floor levels, stair landings, etc.) to be designed to withstand the loading on guards as per OBC SB-13; where the difference in elev. between the adjacent ground or floor level is more than 600mm typical.

16. Glass for Framed Interior Screens:

    1. 10 mm (3/8") minimum Clear Tempered by P.P.G Canada or Equal. Contractor shall verify the minimum required glass thickness based on the manufacturers engineered directions for the size, location and mounting details prior to pricing

17. Glass for Interior Screens (set in CRL stainless steel shoe):

1. 16mm (5/8") minimum Clear Tempered by P.P.G Canada or Equal with caulked butt joints complete with clear CWS silicone by DOW Corning .

2. Shop drawings to be provided stamped by professional engineer with actual glazing thickness indicated in all required guard locations.

NOTE: All vision glazing lower than 1070mm a/f/f (upper floor levels, stair landings, etc.) to be designed to withstand the loading on guards as per OBC SB-13; where the difference in elev. between the adjacent ground or floor level is more than 600mm typical.

18. Glass for Display Cases:

1. Suspended Glass shelves to be clear 13mm tempered with chamfered edges all sides, refer to Section 06400.

2. Glass for Display Case Doors to be 10mm tempered with chamfered edges all sides.

19. Coloured Film Vision Glazing:

1. Where indicated on the drawings supply and install custom film to the glazing. Colour/finish to be selected by Architect.

20. Safety Vision Strips

1. 50mm Vinyl adhesive by 3M or Solar Graphics, pattern to be frosted.

21 Glass for large Mirrors

1. All glass for large mirrors indicated on the drawings to be minimum 6mm tempered.

PART 3 EXECUTION

3.1 WORKMANSHIP

1. Installation of glass shall be by workmen skilled in this trade and done in strict accordance with material manufacturer's directions to produce a first class installation.

2. Accurately cut glass to fit opening and provide for glass expansion.

3. Carefully remove glazing stops and replace after glazing. Exercise care to prevent damage to stops.

4. Collect all glass cuttings in boxes and remove when cleaning up debris.

5. Cut glass and mirrors from dimensions taken in field.

6. Remove protective coatings and clean contact surfaces with solvents and wipe dry.

7. Apply primer-sealer to contact surfaces.

3.2 DOORS, SIDELIGHTS AND SCREENS

1. Interior Lights:

    1. Glaze with glass as indicated, using mastic glazing compound.

    2. Set glass with equal bearing full width of pane. Use setting blocks as per manufacturer's instructions.

    3. Apply thin layer of mastic compound to rebate, set glass, then press until even bed is secured, sprig and run face compound, replace removable stops.

    4. Insert spacer shims to centre glass in space. Place shims at 2'-0" (600 mm) o.c. and keep 1/4" (6mm) below the sight line.

    5. Installation shall be rattle free.

2. Exterior Lights:

    1. Set glazing tape against permanent stops, allow 1/8" (3.2 mm) for cap bead, set horizontal strips first using full width pieces of tape, then set vertical pieces. Butt tapes at corners, do not lap tape or run continuously.

    2. Set glass on setting blocks, quantity as recommended by glass manufacturer. Set glass with draw lines horizontal.

    3. Apply heal bead on interior using sealant. Place spacer shims, at 2'-0" (600mm) o.c. and keep ¼" (6mm) below the sight line. Set glazing tape against glass and install stops.

    4. Apply cap bead to fill void on exterior. Tool sealant with a slight bevel, sloped away from glass to form a water shed.

3.3 ALUMINUM WINDOWS, ENTRANCE FRAMING AND DOORS

1. Specified under this Section.

3.4 HOLLOW METAL DOORS AND SCREENS AND WOOD DOORS

1. Specified under this Section.

3.5 GLASS FOR MILLWORK

1. Supply and install tempered glass and glazing for millwork where glass is indicated on drawings and under Section 06400 – Architectural Woodwork.

3.6 GLASS FOR CURTAIN WALL

1. Specified under this Section.

3.7 MIRROR INSTALLATION

1. Install mirrors where indicated using full adhesive bed and clips.

2. Provide unframed mirrors with polished smooth edges as shown on Drawings. Mirrors shall be equally divided into units, or as shown on Drawings.

3.8 GLASS FOR INTERIOR SCREENS

1. Specified under this Section.

3.9 FINISHING

1. Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed and inspected by Architect.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is part of this Section and shall apply as if repeated here.

1.2 QUALIFICATIONS

1. Manufacturers approved for the work of this section are:
    1. Kawneer Company, Canada Ltd.
    2. Old Castle Building Envelope
    3. Alumicor
    4. Commdoor
    5. Aerloc
2. Only those manufacturers listed above shall be used, unless approved by the Architect in writing 7 days prior to tender closing. All proposed equivalent products shall comply fully with the product performance requirements / finishes / all options specified and detailed on the drawings.
3. It is the responsibility of the approved manufacturers to meet or exceed and submit OBC SB-10 Energy Efficiency Compatibility Results.

    Note: The submittal is to incorporate the specified sealed glazing unit and each opening component as a whole before the shop drawings are accepted or before any shop drawings are reviewed.

1.3 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 – Submittals.
2. Submit shop drawings for the fabrication and installation of associated components of the work. Indicate anchors, joint system, expansion provisions, hardware, and other components not included in manufacturer's standard data. Include glazing details (where required).
3. Before shop drawings and fabrication is started, take critical measurements at the site to facilitate installation and fitting of work.
4. Note that shop drawings for translucent glazing units to be part of this section.
5. Submit with shop drawings certification that window design and construction will meet the specified requirements. Certification shall be in the form of test reports on similar units performed by an independent testing laboratory and shall meet approval of Architect before fabrication commences.
6. Shop drawings that are submitted are to be in the units of the tendered drawings with critical on center mullion dimensions (dimension string from datum level to

top of opening noting center of mullions) noted along with all other regular shop drawing dimensions, no exceptions. Both units (metric and imperial) are allowed. Openings are to be identified with the corresponding tags on the tendered drawings. (Coordinate with typical A8 drawing notes).

1.4 SUBMITTALS

1. Submit samples of curtain wall, panel sections, glazing, fasteners, caulking and finishes / colours for Architect's approval before fabrication.

2. Furnish templates, diagrams, and other data to fabricators and installers of related work, as needed for coordination installation.

3. Coordinate with Electrical Sections, Section 08700 - Finishing Hardware and security subcontractor for any electrical provisions required.

1.5 WARRANTY

1. The work and materials of this Section shall be under Warranty in accordance with GC of CCDC Document 2 – 2020 but for a period of five (5) years from the date of Architect's Certificate of Substantial Completion. Hermetically sealed glazing units shall be guaranteed for a period of ten (10) years.

2. Warranty shall include: Warranty against excessive colour changes or surface deterioration of aluminum finishes; complete weather tightness of the curtain wall and aluminum panel system against unreasonable intensity and frequency, or both, of sound by the curtain wall and aluminum panel system installation or its anchorage system or loosening or deforming of any members of the installation.

1.6 PROTECTION

1. Mark each light with a large cross to indicate presence of glass (colour that stands out to the visible eye). Use material that will leave no residue after removal.

2. Replace under the work of this section defective, damaged or broken glass due to fault setting, handling or storage.

1.7 OPERATION AND MAINTENANCE DATA

1. Upon completion of installation, supply standard parts service kit and service manual. Arrange with, and demonstrate to building maintenance staff window operation, sash removal, cleaning, re-glazing, and general maintenance procedures.

1.8 DESIGN

1. Aluminum Curtain Wall shall be designed to safely withstand a wind load normal to the plane of the wall of twenty (20) pounds per square foot (0.95 kPa.) and shall meet the standards of the latest Ontario Building Code as currently amended in regard to increased design pressure due to height and negative pressures. All components shall be able to withstand the loads with maximum

deflection of L/200 of the span. Aluminum curtain wall shall be designed to accommodate thermal movement over an ambient temperature range of -40 F. to +120 F.

1. Copies of any and all structural calculations made in connection with the supplementary design and/or detailing of the work of this Section shall be promptly furnished to the Architect if requested.

2. Supply all connections, brackets, angles and fasteners to tie curtain wall to main structure, floors, columns and beams.

2. The entire exterior skin execution shall be based on the "Rain Screen" principle and the system shall provide:

1. Such gaskets, baffles, overlaps and seals as required to provide a "Rain Screen" barrier to effectively deter rain water entry into the cavities of the system.

2. The necessary "air seals" to minimize air passage from the system cavities into the building and vice-versa to assure adequate pressure equalization of the system cavities with the outside.

3. The "air and vapour seals" required to minimize air borne vapour exfiltration from the building into the system cavities.

4. Openings between these cavities and the outside of sufficient cross-section to provide pressure equalization. All openings must be effectively baffled or otherwise guarded to minimize direct water entry.

5. Thermally, the grid members shall have a resistance to heat transfer equal to or better than that of the area along the bottom of the 1" (25 mm) sealed glass units.

3. Performance:

1. Air in-or-Exfiltration performance shall exceed industry standards of .06 c.f.m./ft2 (.0003 m3/s-m2) when tested in accordance with ASTM E283 at a 6.24 p.s.f. (300 Pa) pressure difference.

2. There shall be no water infiltration into the building when tested in accordance with ASTM E331 with a pressure differential of 15.0p.s.f. (720Pa) whichever is higher.
3. No condensation shall form on any interior surfaces of the aluminum members before any of the exposed area of the 1" (25 mm) sealed units reaches the dew point temperature.

4. Thermal expansion allowance at aluminum panel system: The system has to take a temperature difference of 185 degrees F. (85 degrees C) without putting stress into any member of sealant.

5. Erected aluminum panel system shall have flatness criteria not to exceed 1/4" (6mm) in 20'-0" (6000mm). Units have rippling, waving, or oil canning exceeding the above criteria shall be subject to reflection if the condition cannot be satisfactorily repaired and corrected in the field.

1.9 STANDARDS

1. Kawneer 1600UT (System 1 & 2 where applicable refer to drawings) Thermally Broken Curtain Wall System with fiberglass perimeter pressure plates - 7 ½" (190.5mm) or6" (152.4mm) deep frames (manufacturer to approve in writing with tender submission prior to start of construction in regard to loading on the system(s)) with 2 ½" (63.5 mm) sightline tubular mullion with 3/4" deep cap or 100mm sloped cap with drip edge and Cap-Less (combination of horizontal and vertical) as indicated on drawings and/or as recommended otherwise by manufacturer.

    1. Provide GlassVent UT (Ultra Thermal), top pivoting awning projecting out window operation with operator assembly and complete with removable insect screens. Operator to work from the interior without removing insect screen. Note some ground floor windows include bottom pivoting hopper style operators opening in with insect screens on the exterior. Refer to building elevations A3 series.

        NOTE Maximum operable opening not to exceed 4" (100mm) on any floor level from above ground (Main, Level 1) floor and up.

2. Provide Air barrier in the form of a sealed insulated metal back pan for all spandrel glazing locations, at aluminium panel locations and plywood infill locations. Install air/vapour barrier transition membrane over plywood infill locations, both to be sealed in curtain wall framing. Provide finished aluminium cover inside on the surface of the sealed metal back between and flush with interior face of mullions.

3. Fabricate and install Curtain Wall in accordance with NAAMM Standard SW-1-68T published by the National Association of Metal Manufacturers. Only those provisions of the Standard applicable to the Curtain Wall shown on drawings and as specified herein shall govern.

4. Comply to CAN3-S157 as currently amended.

5. Aluminum doors at exterior and interior curtain wall locations shall be doors as per Section 08400 - Aluminum Entrance Framing and Doors.

1.10 DESCRIPTION

1. Aluminum Curtain Wall:

    1. Work included: furnish labour, material and other services to complete the fabrication and installation of the framing, including material and fitments required for the operation of any entrance units included, in the manner, direction and performance shown on the shop drawings and specified herein.

    2. Work included: furnish all labour material to provide and install the following items:

        1. Aluminum uninsulated panels.

2. Aluminum flashings, trim pieces, fascia and closer members.

3. Formed subjects.

4. All necessary clips, fastening devices, required accessories needed to attach the composite aluminum pieces indicated on the drawing into position.

5. Aluminum metal weeping channels.

6. All necessary caulking conforming to 19-GP-24M and all necessary gaskets, etc. to weather seal all joints.

7. All necessary flanges and supports as required to keep panels rigid and stable to conform with design as indicated on the drawings.

8. Intermediate galvanized steel stud panel and girt supports.

9. All aluminum framing including "Z" girts, channels, clips, angles or blocking to secure aluminum composite panels.

10. Cutting, reinforcing, closing, trimming of openings.

11. All glass, spandrels and glazing.

12. All caulking and sealants.

13. Aluminum panels, aluminum and galvanized steel air barrier liners and insulation.

14. 1/8" (3mm) aluminum or 1/4" (6mm) aluminum composite panels at walls and entrance canopy and soffit locations and above curtain wall areas below roof parapets.

15. Aluminum Operators as indicated on drawings.

2. Curtain wall supplier engineer to verify all required curtain wall systems, spans, loads etc. prior to tender closing.

PART 2 PRODUCTS

2.1 MATERIALS

1. Aluminum: Extruded aluminum alloy members 6063 T5 alloy, minimum 1.6 mm (0.62") thick. Sheet which is not to be exposed shall be Utility Grade.

2. Aluminum Flashing: Supply 0.125" (3.2 mm) thick aluminum to profiles as indicated on drawings.

3. Aluminum Sills: Sills are to be extruded aluminum in colour to match exterior colour of frame and shall be complete with required anchors, joint covers, end caps or returns, chairs, anchors, anchoring devices and jamb drip deflectors. Extruded sills are to be the profile shown with minimum ⅛" (3mm) thickness with

safety / drip edges. Sills shall be in longest possible lengths, joints only at mullions; all joints are to be sealed with slip joint.

NOTE Aluminum sills to be provided at bottom of all windows and curtain wall locations as detailed.

4. Cavity insulation in Metal Air-barrier Liner / Back Pan: See Section 07213 - Mineral Fibre Insulation.

5. Metal Air-barrier Liner / Metal Back Pan: 3.2mm clear anodized aluminum with all corners of panels sealed where exposed to interior areas. All other locations shall be 20 gauge thick steel air/barrier liner with 1.25 oz./sq. ft. (458 g/m2) galvanizing with corners of panel sealed. Panels to be flat; stiffen as required.

6. Vision Glass: as per Section 08800 Glass and Glazing Section.

7. Operating Vents: Allow 4 Duranar colours for operators as indicated on the drawings. Hinged awning style limited opening to max. 4" (100mm). 1 pair heavy duty Anderburg or Senator Friction Arms with polished US-4 cam handle and keeper for 500mm wide and less and 2 for all windows greater than 500mm wide. (or operation handle that the screen does not have to be taken out in order to open the operable window. Note some operators are awning style (opening out) and others are hopper style (opening in) as shown on the elevations.

8. Insect Screens: Size to match operable window vent as per manufacturer, glass fibre mesh in clear anodized aluminum frame with extruded elastomer removable splines. Provide insect screens at all operating window both awning style and hopper style.

9. Spandrel Glass Panels: as per Section 08800 Glass and Glazing Section.

10. Glazing Tape: Tremco Visionstrip co-extruded EPDM gasket with integral glazing tape on the exterior and a black, closed cell elastomeric glazing gaskets appropriate to the function on the interior. Colour of glazing selected by Architect.

11. Spacer Shims: 1/4" (6 mm) x ½" (12.7 mm) Norton tape. Shims for frame are to be oil resistant rubber or plastic acceptable to glass manufacturer, channel shaped and each approximately 4" (100 mm) long.

12. Thermal Break: Soft PVC, compressed to seal between main sections and pressure plates.

13. Isolating Coating: Black alkali resistant bitumastic enamel.

14. Sealant Bond Breaker: Open cell foam backer rod sized to suit.

15. Silicone Sealant: Dow Corning #795 or as per manufacturer's recommendations exceeding CAN2-19.13-M87 Class 40 requirements. Min 2 colours as selected by Architect.

16. Sealant at Perimeter Masonry Openings: 3 part Tremco Dymeric 240 sealant in accordance with Caulking - Section 07900 (Type A sealant). Minimum 2 colours as selected by Architect.

17. Sprayed-on Urethane Insulation: Supply and installation by this section as specified under Section 07215 – Spray-on Insulation.

18. Fasteners, Screws and Bolts: Stainless steel 300 Series or stainless steel 400 Series cadmium plated of sufficient size and quality to perform their intended function.

2.2 FABRICATION

1. General:

    1. Construct aluminum assemblies of extruded sections to size and profile shown on drawings.

    2. Build units square, true, accurate to size, free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.

    3. Units too large for handling or shipping shall be prefabricated in factory, disassembled and marked for shipping and field assembly.

    4. Use concealed fastenings. No exposed screws shall show in the finished work where finished product is exposed to view, unless approved by the Architect. Such screws shall be countersunk and finished to match surfaces in which they occur.
    5. Joints shall be accurately cut and fitted to result in a tightly closed joint.
    6. Provide additional reinforcing at location of handrail brackets and at stair and landing areas to withstand O.B.C. horizontal loading designs.

    7. Vertical and horizontal members shall be tubular extrusions designed for shear block corner construction.

    8. All joints shall be accurately machined, assembled and sealed to provide neat weathertight joints. Shielded drainage and pressure equalization vents shall be provided where required. All horizontal members shall be sealed to vertical members to provide individual compartments within the system in accordance with the rain screen principle

2. Assembly:

    1. Assembly shall be Kawneer 1600 UT System 1 & 2 Curtain Wall System or approved equal. See item 1.6.

    2. Mullion Depth Sizes exclusive of cap: See Item 1.6

    3. Cap Depth Sizes and Locations:

        1. Exterior horizontal caps 3/4" (19 mm).

        2. Typical exterior vertical caps 3/4" (19 mm).

        3. 200mm oversized caps in Durinar Finish where indicated on the drawings. Allow for up to 4 colours.

4. Do not provide vertical or horizontal caps where single lines are indicated on drawings, these shall be capless.

4. Aluminum caps for mullion assembly to be without gap.

5. All horizontal members must form individually pressure equalized and sealed gutter members.

6. Vertical expansion and construction joints shall be provided and designed for baffled overlaps with a compressed resilient air seal laid in between the mullion ends.

7. At aluminum and spandrel panel locations provide 20 gauge thick steel air/barrier liner with 1.25 oz./sq. ft. (458 g/m2) galvanizing with corners of panel sealed at all concealed locations. Provide 16 ga. clear anodized air/barrier liner panels at all interior exposed locations. Panels to be stiffened as required to maintain a flat surface.

8. Insulation shall be fitted into the air-barrier liners / metal back pans and secured by being impaled onto welded pains and retained by integral discs. Insulation to always extend out to thermal break in framing members. All void spaces to have spray in place insulation installed, this includes where indentations have been created by integral disc compression (where insulation does not fluff up to original shape, thickness), and from thermal break in curtain wall framing sealed to batt insulation, all perimeters of back pan.

9. Structural anchors shall have three-way adjustment and be welded after curtain wall alignment. Field paint touch-up shall follow the welding operation.

10. Provide thermally broken door frame adaptors for all doors in aluminum curtain wall framing.

11. Provide 10" (254 mm) height side light bases with sill flashing by doors where indicated on drawings.

3. Closures, Flashings and Miscellaneous Covers:

1. Provide .125" (3 mm) thick aluminum closures, caps and flashings where indicated

4. Aluminum Finish

1. The aluminum frame finish to be black anodized. Provide alternate price to change aluminum finish to clear anodized. Typical caps to remain black anodized in the alternate price.

2. Caps to be black anodized typical unless noted otherwise on drawings. Provide Duranar coated caps at oversized caps and where indicated on the drawings.

5. Aluminum Sills

1. Provide continuous extruded aluminum sills at bottom of curtain wall set in bed of caulking. Sills to match finish of curtain wall above and be manufactured from curtain wall supplier.

6. Aluminum Door Adapters

1. Provide 19mm perimeter door adapters to suit door installation in curtain walls wherever aluminum doors are indicated on drawings.

7. Aluminum Panel Joints

1. Aluminum panel joints to be aligned with centre line of curtain wall mullions or other panel joints (to be verified at site) and to be coordinated with Architectural drawings prior to manufacturing; also coordinate with drawings for joint detailing, if not on drawings, contractor to ask for detail during shop drawing submission.

PART 3 EXECUTION

3.1 INSTALLATION

1. Install curtain wall in accordance with manufacturer's recommendations and with standards specified herein.

2. Isolate all aluminum coming in contact with other metals, masonry or concrete with heavy shop coating of black alkali resistant bituminous paint to prevent electrolytic or chemical action.

3. Fill voids between aluminum extrusions and masonry or concrete surfaces with sprayed-on urethane insulation where necessary to prevent movement or infiltration of air. Drill and fill aluminum extrusions with sprayed-on urethane insulation where indicated on drawings.

4. Installation of aluminum panel system:

1. Erection shall be by skilled personnel only as directed by Panel Manufacturer. Joints shall be thoroughly sealed against entrance of weather to interior of assembly.

2. Install work, plumb, straight, even and true to required lines, levels and slopes. Reject and replace bent, scratched, dented mismatched, loose, or out-of-true work.

3. Provide custom structural supports and aluminum shims.

4. Fasten panels by system of support and fasteners according to manufacturer's recommendation to provide true surface free from undulations.

5. Install adequate expansion joints to accommodate thermal movement wall.

6. Install copings, closures, drips, and flashings unless specified otherwise. Finish shall match exterior panels.

7. Tape or back paint contact surfaces where galvanized and aluminum metal and concrete come in contact to prevent corrosion

8. Replace all panels with mars, scratches, and cut edges with new panel etc.

9. Install aluminum doors as per Section 08400 - Aluminum Entrance Framing and Doors.

3.2 CAULKING

1. Glazing and aluminum caulking to be under this section as per manufacturer's instructions and as per details on drawings in accordance with procedures specified under Section 07900 – Sealants.

2. Caulking around perimeter of curtain wall between curtain wall and masonry to be done by this section as per Section 07900 - Sealants using Tremco Dymeric 240 (Type 'A') sealant.

3. Caulking to be done between panels including air-barrier liners / metal back pans under this Section using silicone sealant and installed as per Section 07900. All caulking of panels to surrounding masonry, concrete, etc. shall be by Section 07900 – Sealants.

3.3 GLAZING

1. Glazing shall be in strict conformance with manufacturer's instructions and shop drawings.

2. Units shall be manufactured by an I.G.M.A.C. certified facility.

3. Mark each light with a large white cross to indicate the presence of glass.

4. Replace under this Section defective, damaged or broken glass due to faulty setting, handling, storage or cleaning.

5. Glass supplied and installed under this section in accordance to Section 08800 – Glass and Glazing.

3.4 PROTECTION AND CLEANING

1. Aluminum shall be isolated from concrete, mortar, plaster and dissimilar metals with bituminous paint.

2. Framing shall be protected from other building materials during and after installation until acceptance by the Architect.

3. General Contractor to maintain protection and provide final cleaning.

4. Upon completion of erection all aluminum panel surfaces shall be cleaned to the satisfaction of the Architect.

5. Promptly as the work proceeds and on completion, clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing work.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements are part of this section and shall apply as if repeated here.

1.2 QUALIFICATIONS

1. Conform to CSA A82.30-M1980 including appendices.

1.3 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 – Submittals.

2. Shop drawings are to be designed for fabrication to meet all codes and be stamped by a Professional Engineer registered in the Province of Ontario.

3. Clearly indicate construction details, sizes, thickness or gauge of steel studs, connections, joints, method of anchorage, number of anchors, supports, reinforcement and accessories. Confirm all dimensions on site.

4. Indicate control joint and expansion joint locations and framing details.

1.4 ALLOWANCES

1. Allow included in Base Bid amount for **10 sq. meters of additional wall furring and 20 sq. meters of additional bulkheads** for additional work not indicated on drawings. Locations as per later designation by Architect.

PART 2 PRODUCTS

2.1 MATERIALS

1. Non-load-bearing channel stud framing less than 4800 mm long: to ASTM C645-83 size as noted on drawings, roll formed from 25 gauge (0.53 mm) thickness electro galvanized steel sheet; for screw attachment of gypsum board. Knock-out service holes at 1'-6" (460 mm) centres.

2. Extra strength channel stud framing (4800mm long and greater): to CAN 3-S146-M84 for design and ASTM A446 for steel, 3 5/8" (92 mm) or 6" (152 mm) stud size, roll formed from 20 ga. (0.91 mm) thickness hot dipped galvanized steel sheet; for screw attachment of gypsum board. Knock-out service hole a 1'-6" (460mm) centres. Use this type at all exterior framing locations. Note interior extra strength stud partitions with drywall on both sides can be electro galvanized finish.

3. Floor and ceiling tracks: to ASTM C645-83; in widths to suit stud sizes, 1 1/4" (32 mm) flange height. Use hot dipped galvanized units at exterior wall and exterior canopy locations.

4. Metal channel stiffener: size to suit studs, 2 mm thick cold rolled steel, coated with rust inhibitive coating. Use hot dipped galvanized units at exterior wall and exterior canopy locations.

5. Bridging channels and diagonal tension straps (load bearing stud systems): material and gauge to match studs, let into or surface fastened to studs for diagonal/lateral bracing and reinforcement.

6. Screws: CGC Branch Screws (or approved equal) of type recommended in the selector guide on Page 5 of Canadian Gypsum Brochure 09250 - 1E. Use hot dipped galvanized or epoxy coated fasteners at exterior walls and canopies.

7. Furring Channels: 7/8" (22 mm) x 2 3/4" (70 mm), 25 Ga. (18 mils), cold rolled galvanized after fabrication, types manufactured by Bailey Metal Products Limited, D-1001, Donn Products, Universal Sections or Canadian Gypsum Co. to meet CSA A82.30-M1980. Use hot dipped galvanized units at exterior walls and canopies.

8. Resilient Channels: 1/2" (13mm) x 2 1/4" (57mm), Bailey RC Plus, manufactured by Bailey Metal Products Limited, Model No. D-1007, to meet ASTM A653/A653-11. Use G40 galvanizing to ASTM C754-11.

9. Carrying Channels: 1 1/2" (38 mm) x 6 lbs./10 ft. (892 g/m) cold rolled steel after fabrication to meet CSA A82.30-M1980. Use hot dipped galvanized units at exterior walls and canopies.

10. Hangers: 1/4" (6.3 mm) dia. galvanized pencil rods at 4'-0" (1220 mm) o.c. maximum on main tees to meet CSA A82.30-M1980.

11. Tie Wire: No. 16 (1.5 mm) Imperial Wire gauge galvanized soft annealed to meet CSA A82.30 - M1980.

12. Anchors: to meet CSA A82.30-M1980 standard.

13. Heavy Duty Studs: 4" (100 mm) and 6" (150 mm) 16 gauge (1.5 mm) as supplied by Bailey Metal Products Ltd., Toronto, Ontario.

14. Batt Insulation (exterior stud walls): Coordinate with Specification Section 07213, Mineral Fibre Insulation, thickness to suit stud cavity.

15. Vapour Barrier: at exterior stud walls install 6 mil poly to CGSB 51.34 complete with sealants.

16. Acoustical Sealant: Acoustical sealant to CGSB 19-GP-21M by Tremco or approved equal.

17. Insulating Strip: Rubberized, moisture resistant 1/8" (3mm) thick foamstrip, ½" (12mm) wide with self-sticking adhesive on one face, lengths as required.

PART 3 EXECUTION

3.1 GENERAL

1. Installation shall be by mechanics skilled in this trade and done in accordance with best standard practice and material manufacturer's printed directions.

2. Do not cover piping, conduit, duct and the like until inspected and approved by the Architect.

3. Furring indicated shall not be regarded as exact or complete.

4. Method of framing and furring left to Contractor's option but shall result in a rigid, secure, plumb framing and forming, erected to maintain overall sizes as indicated and of adequate strength to support without distortion of the facing indicated. Wall furring and suspended and furred ceilings must be installed to meet CSA A82.31-M1980 except where specified otherwise.

5. Do not make fastenings to ducts, pipes, conduit, door frames, backers or inserts of other trades not specifically intended for fastening metal furring.

6. The completed installation of framing and furring must allow drywall to be installed free of waves, depressions, other defects that would mar the finished appearance.

3.2 PARTITION AND WALL FURRING ON WALLS

1. Install partition tracks at top and bottom of studs, align accurately, and make allowance for deflection under beams and structural slabs to avoid transmission of structural loads to studs. Use 2" (50 mm) leg ceiling track.

2. Secure tracks to concrete and steel with power actuated fasteners at a min. 24" (600 mm) o.c.

3. Install dampproof course (vapour barrier) under stud shoe tracks of partitions on slabs-on-grade.

4. Place studs vertically at 16" (400 mm) centres and not more than 2" (50 mm) from abutting walls, openings and each side of corners. Secure studs to tracks at floor and ceiling using screws or crimp method. Place interior heavy duty studs vertically at 12" (300 mm) centres where indicated on drawings.

5. When necessary, splice studs with 8" (200 mm) nested lap and one positive attachment per stud flange. Place studs in direct contact with door frame jambs, abutting partitions, partition corners and existing construction elements. Where studs are installed directly against uninsulated surfaces install insulating strips between studs and wall surfaces.

6. Anchor studs for shelf-walls and those adjacent to door and window frames, partition intersections and corners to ceiling and floor runner flanges with an approved crimping tool. Securely anchor studs to jamb and head anchor clips of door or borrowed-light frames, place horizontally a cut-to-length section of runner, with a web-flange bent at each end, and secure with one positive attachment per flange. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over door frame header.

7. Install heavy gauge single jamb studs at all openings.

8. Erect metal studding to tolerance of 1:1200.

9. Stiffen partitions exceeding 8' (2400 mm) in height and/or 10' (3000 mm) in length with 3/4" (19 mm) channel bracing extending horizontally across the length of the partition. Provide one horizontal stiffener for partitions under 12' (3600 mm) high; at least two horizontal stiffeners for partitions 12 or more feet high (3600 or more mm), at maximum 6' (1800 mm) centres. Install metal strapping securing stud to masonry or concrete walls at every other stud where horizontal stiffeners occur. Provide other partition reinforcing necessary to support wall hung components, cupboards, closets and the like. Use 2 studs at jambs of openings and corners.

10. Where horizontal runs of service lines are to be installed within the partition, erect studs with web openings aligned.

11. Provide reinforcing and necessary stiffeners to support hollow metal screens. Reinforcing to be capable of supporting screens rigidly and solid without deflection.

12. Work includes the installation of hollow metal frames.

13. All fire rated partitions must be installed from floor to underside of floor slab at ceiling above.

14. Provide horizontal 25 ga. metal anchor strips with wood blocking behind it for blocking behind wood base millwork tackboard and chalkboard, etc. All wood blocking for trim, base, millwork, miscellaneous specialties, to be installed by Section 06100 after erection of metal studs and ceiling suspension system.

3.3 RESILIENT CHANNELLING ON PARTITIONS AND WALLS

1. Work includes as below

2. Installation on Substrate: new and existing (on wood stud framing, metal stud framing, concrete block masonry, brick masonry, poured in place concrete, bulkheads, and all other substrates not noted, that is exposed and seen by line of sight)

    1. ***Walls are to be flat and an even / level & plumb plane, install resilient channelling, blocking, shims as required to achieve this. A wavy wall will not be accepted – wall types do not have to state this in order for it to be installed.***

    2. Install resilient channelling (13mm – ½" min.) at 400mm o/c maximum horizontally on substrate framing as to manufacturer's installation instructions (it is important which direction the fastened side is orientated). Ensure substrate framing is adequate to support loading of wall finish and resilient channelling loadings as per manufacturer's installation instructions / recommendations.

    3. Resilient channelling should not be required on new framed wall systems (unless noted otherwise on wall types) as these should be an even / level and plumb plane when installed – if not the framing is to be rectified.

    4. Also consult manufacturer's installation instructions for other requirements that are to be met.

    5. Erect resilient channelling to tolerance of 1:1200.

3.4 BULKHEADS

1. Work includes fire separations in ceiling space, drywall surfaces above windows and bulkheads to suspended ceilings.

2. Install steel studs and furring of sizes shown at 16" (400 mm) o.c. or as shown.

3. Furring indicated shall not be regarded as exact or complete. Provide adequate bracing at bulkheads to structure to ensure a rigid installation and to meet CSA A82.31-M1980.

4. Locate bulkhead furring no more than 2" (50 mm) from corners abutting partitions or other construction.

3.5 CEILINGS

1. Supply and install suspension and furring system and resilient channelling for exposed gypsum board ceiling.

2. Do not regard suspension system indicated on drawings as exact or complete. The specification for metal framing contained in Canadian Gypsum Co. Ltd. Brochure 09260 - 1E and CSA-A82.31-M80 shall govern installation conditions not covered by this specification. The more stringent being the acceptable.

3. Install hangers for suspended bulkhead or ceiling to support the grillage independent of the walls, columns, pipes, ducts and the like. Erect plumb and securely anchor to the structure. submit details of the proposed method to the consultant for approval. If so requested by the Architect, test hangers to provide that anchorage is adequate to support the proposed loading.

4. Supply hangers to support the grid in time to be installed in slabs.

5. Space hangers at maximum 3'-0" (910 mm) centres in the direction of the carrying channels and at 4'-0" (1200 mm) centres at right angles to the carrying channels, within 6" (150 mm) of ends and where normally required in good standard practice.

6. Space furring channels at maximum 16" (400 mm) o.c.

7. Erect the grillage for suspended ceilings and beams of required elevation to provide rigid, secure, framing independent of walls.

8. Frame all openings on all sides with suitable channels. Check clearances with respective trades. Co-operate with others to accommodate diffusers, grilles, light fixtures and access panels in drywall ceilings. Provide additional hangers and supports for fixtures as required.

9. Level drywall screw channels to a maximum tolerance of 1/8" (3.2 mm) over 12'-0" (3650 mm).

10. Erect ceiling furring system in strict accordance with system manufacturer's printed directions to allow drywall board installation to be free of waves or loose boards.

11. Frame exterior soffits and walls using hot dipped galvanized framing materials and rustproof fasteners.

3.6 RESILIENT CHANNELLING ON CEILINGS

1. Work includes as below:

2. Installation on Substrate: new and existing (on wood stud framing, metal stud framing, concrete block masonry, brick masonry, poured in place concrete, bulkheads, roof rafters, floor joists, stair systems and all other substrates not noted, that is exposed and seen by line of sight)

1. ***Ceiling is to be flat and an even / level plane, install resilient channelling, blocking, shims as required to achieve this. A wavy ceiling will not be accepted – ceiling types do not have to state this in order for it to be installed.***

2. Install resilient channelling (13mm – ½" min.) at 400mm o/c maximum at right angles substrate framing. Ensure substrate framing is adequate to support loading of ceiling finish and resilient channelling loadings as per manufacturer's installation instructions / recommendations.

3. Resilient channelling should not be required on new metal framed ceiling suspension systems as these should be an even / level plane when installed .

4. Also consult manufacturer's installation instructions for other requirements that are to be met.

5. Erect resilient channelling to tolerance of 1:1200.

3.7 CONTROL JOINTS

1. Provide metal studs or furring next to end condition of each side of control joint. Control joints to be provided in accordance with the best standard practice to meet the approval of the Architect and as noted on the drawings.

2. Provide control joints every 25'-0" (7600 mm) o.c. and/or where shown on drawings.

3. Install additional control joints as directed on site by Architect.

3.8 HEAVY DUTY STUDS

1. Use heavy duty studs where shown on drawings and as required in other locations to give firmness to bulkheads.

2. Secure studs at ends with solid bearing at bulkheads.

3.9 CONSTRUCTION OF SOUND ATTENUATED PARTITIONS AND AROUND STEEL JOIST AT TOP OF MASONRY CLASSROOM & FIRE RATED WALLS

1. Install insulating strips under studs and tracks around perimeter of sound control partitions. Install acoustical sealant at joints at each side of studs and tracks, against insulating strips between studs and tracks and floor, wall or underside of floor or roof deck above.

END OF SECTION

1. GENERAL

1. GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

2. DESCRIPTION

1. Work of this Section includes:

1. Gypsum wallboard to partitions, ceilings, bulkheads furring and wall facings at all areas.

2. Products finished by, but not supplied under this section is 06260 Solid Mineral Profile Panelling.

3. QUALIFICATIONS

1. Contractor for this work to have a minimum of five years' experience in installation of wallboard.

2. Install work to CSA A82.31-M1980, C.G.C., Drywall Construction Handbook and the Manual of Gypsum Wallboard Construction by Gypsum Drywall Contractor's International except where specified otherwise.

4. DELIVERY, STORAGE

1. Store materials in a dry weather proof enclosure. Store wallboard flat, in piles without overhanging boards.

2. Do not install damaged or deteriorated material but remove from site.

3. Materials as delivered shall bear the manufacturer's name branch name of material and where applicable, CAN/CSA classification.

5. JOB CONDITIONS

1. Air and surface temperature: Minimum 54 F (12 C) and maximum 77 F (25 C) for 24 hours before, during and until entire installation is complete.

2. Ensure proper ventilation, during and following joint treatment, to eliminate excessive moisture.

3. Examine surfaces in which wallboard is to be attached and check environmental conditions and do not commence work until surfaces and conditions are satisfactory.

4. Commencement of work will denote acceptance of conditions.

6. PROTECTION

1. Protect work of other sections against damage resulting from work of this section. Repair and make good to approval, damage to other sections caused by this work.

7. SUBMITTALS

1. Submit shop drawings showing control joints for Architect's approval.

2. Submit sample of each type of casing bead, corner bead, control joints, reveal moulding, etc.

8. ADDITIONAL DRYWALL AND FURRING

1. Include in base bid quote by this Section 09250 and 09110 for an additional 60 sq. metres of gypsum wallboard complete with metal furring and finished taping for addition furred in pipes at walls or ceilings. Locations as per required by Architect.

2. PRODUCTS

1. MATERIALS

1. Gypsum Wallboard:

1. Manufacturer: Specification is generally based on Canadian Gypsum Co. Ltd. material but equivalent materials by other manufacturers are acceptable.

2. Backing Board and Gypsum Coreboard: CSA A82.27-M1977.

3. Gypsum Wallboard: CSA A82.27-M1977. Use Type 'X' (special fire retardant) board such as CGC Firecode 'C' when fire rating is required,. Use Abuse resistant board such as ToughRock or approved equal 16mm (5/8") thick from floor to minimum 2440mm, above finished floor level in all areas and wherever noted on the drawings. Use board with round or tapered edges.

4. Exterior Sheathing: 5/8" (16mm) thick Dens-Glass Gold Fiberglass - Faced Sheathing by Georgia Pacific Corporation.

5. Tile Backer Board: at showers (walls and ceilings), washrooms (walls and ceilings), drinking fountains (walls), wet or moist areas receiving a tile finish: 16mm (5/8") thick, Dens-Shield tile backer board by Georgia-Pacific Corporation. Use board with round or tapered edges.
(If existing wall systems do not have this wall substrate, it is to be installed, including removal of existing finish substrate and installation of specified substrate above – if existing wainscoting exists, contact architect for further clarification)
(Tile Backer Board is not required on masonry wall substrates unless

otherwise noted on drawings)

2. Accessories:

1. Casing beads, corner beads, fill type: 24 ga. (0.5 mm) base thickness commercial grade sheet steel with G90 zinc finish to ASTM A525-80A; perforated flanges; one piece length per location.

   NOTE: Use Beadex U Trim (thickness as required) where "J" mould is indicated on drawings as manufactured by BeadeX Manufacturing Company Inc.

2. Screws: C.G.S. Brand Screws Type S. 1" (25 mm) and 1 ½" (38 mm) as required to C.S.A. A82.31-M1980. For exterior Sheathing and tile backer board use 1 1/4" Bugle head fine thread rust resistant drillpoint drywall screw (type S-12).

3. Joint Treatment Material: CGC MC "All-Purpose" and CGC MC "Joint Topping" compounds - to ASTM 0474 and 0475. Use materials recommended by board manufacturer for the proposed use. Material shall be pre-mixed, ready to use, in sealed cans.

4. Tile Backer Board Joint Treatment Materials: thin set mortar mixed with acrylic latex. Tape shall be 2" (50 mm) wide alkali resistant fibreglass tape. Screws to be self-taping rust resistant screws.

5. Reinforcing Tape: Perf-a-Tape by CGC or equal.

6. Adhesive: CGC "Durabond" 90 pre-mixed, ready to use in sealed cans.

7. Acoustic Materials:

   1. Acoustical Caulking: Acoustical sealant by Tremco or approved equal to CGSB 19-GP-21M.

   2. Sound Attenuation Batts: Section 07213 Mineral Fibre Insulation

8. Control Joint: equal to C.G.C. control joint No. 093.

9. Thermal Break: Permanent adhesive faced rubberized cork, 1/8" (3 mm) thick by width required.

10. Stud adhesive: to C.G.S.B. 71 GP-25M.

3. EXECUTION

1. EXAMINATION

1. Examine surfaces and other conditions on which work of this Section depends and do not proceed until conditions are suitable.

2. Commencement of work will denote acceptance of conditions.

2. GYPSUM BOARD INSTALLATION

1. General:

1. Do not install gypsum board until work of other Trades which will be covered by the board has been installed and approved.

2. Use board of maximum practical length to reduce number of end joints. Install control joints in long runs of board.

3. Fit ends and edges closely, but do not force together.

4. Attach board to framing using screws, not nails.

2. Installation on Stud Framing:

1. Install board vertically or horizontally whichever results in fewer end joints, use longest possible lengths. Cut and fit boards around openings, beams, joists, ducts, light fixtures and similar items. Install board up to underside of slab or metal deck above to provide sound insulated walls and fire separations.

2. Minimize gypsum board joints over openings. Use one piece application to span over opening width where board lengths allow. There is to be no board joint directly over / above edge condition of opening.

3. Position edges over supports for vertical or horizontal application.

4. For single layer vertical application space screws 12" (300 mm) o.c. for field of panel and 6" (150 mm) o.c. staggered, along vertical abutting edges. For horizontal application space screws 12" (300 mm) o.c. in field and 8" (200 mm) and along abutting end joints. For double layer application, stagger joints in second layer of boards, a minimum of one-stud spacing in both directions and fasten with screws as before.

3. Installation on Ceiling:

1. Install board with long dimension at right angles to furring channels.

2. Position end joints over channel flange and stagger in adjacent rows.

3. Fasten board to channels with 1" (25 mm) type S screws spaced 12" (300 mm) o.c. in field of panels and 8" (200 mm) along abutting edges.

4. Install board continuously above ceiling at exterior walls to support vapour barrier where it occurs.

3. FIRE RATING

1. Conform with following for fire rated partitions, ceilings and bulkheads:

1. Fire resistant ratings called for on drawings and schedules.

2. Appropriate codes and regulations.

3. Use "Firecode C" or approved equivalent gypsum board.

4. FINISHING

1. Mix joint compound (powder) in accordance with manufacturer's printed instructions.

2. Prefill "V" grooves of rounded edges with Durabond 90 compound. Finish flush with tapered surface ready for reinforcing tape application. Allow pre-fill material to dry thoroughly before application of embedding compound and tape.

3. Apply "All-Purpose" compound in thin uniform layer; embed reinforcing tape accurately centred on joint, securely pressed in, leaving sufficient compound under tape to provide proper bond. Immediately apply skim coat over tape application. Allow to dry thoroughly before application of filler coat.

4. Apply filler coat of "Topping" compound such that taper depression is flush with board surfaces. Allow to dry thoroughly before application of finish coat.

5. Apply finish coat of "Topping" compound extending slightly beyond the filler coat and feathered out onto the board surface.

6. Sand between coats and following the finish coat, where necessary, and leave surface smooth and ready for painting.

7. Finish screw depressions with filler material and finish coat as specified in 4. and 5. above.

8. Joint and depression finish shall in no case protrude beyond the plane of the board surface.

9. Finish corner beads and metal trim flush with board surface using filler and finishing coats feathered out approximately 2" (50 mm) and 4" (100 mm)

respectively onto the board surface to ensure that metal visible only at arris.

10. Fill and tape joints and internal corners and fill screw depressions in board face and smooth out along corner beads and metal trim with joint compound.

11. Provide specified metal trim and control joints at exposed edges, at junctions of drywall with dissimilar material, at control joints and at junction with columns. Fasten with screws at 12" (300 mm) o.c. along entire length.

12. Cut out a 'V' at all butt joints and install Durabond 90 then complete with filler and topping coats.

13. Avoid sanding adjacent paper surface of boards.

5. CLEANING

1. Clean thoroughly and remove all excess materials from other surfaces.

2. Remove all excess materials as job proceeds and at completion.

6. ACCESSORIES

1. Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 6" (160 mm) o.c. for full length.

2. Install "J" molds around perimeter of suspended ceilings.

3. Install "J" molds where gypsum board butts against surfaces having no trim concealing junction and where indicated.

4. Install aluminum reveals at all locations as indicated on drawings. Install tape and joint material tight to edges of tape type "reveals". Aluminum reveal to be extruded Alloy 6063-T5 with chemical conversion coating. Primed painted – factory sprayed and baked-on coating to serve as base for field painting. Final paint as per specification Section 09900 and to be selected by Architect prior to manufacturing.

.1 19mm Millwork Reveal – (3/4") Product # MWR7550 by Fry Reglet or approved equal (all vertical and horizontal applications); provide all intersection reveal components to provide a complete system.

.2 MWCLEAT 25 to be provided at all millwork panel locations to provide a straight, secure, horizontal attachment to substrate where shown on drawings; to be extruded alloy 6063 T5, with powder coat finish.

.3 6mm channel screed Model PCS-75-25/25 by Fry Reglet or

approved equal, between wall wood panels (all horizontal and vertical applications) and where indicated on drawings.

7. CONTROL JOINTS

1. Construct control joints using C.G.C. control joint No. 093 set in gypsum board facing and supported independently on both sides of joint.

2. Provide shrinkage control joints in accordance to the best standard practice to meet the approval of the Architect and as noted on drawings.

3. Locate control joints at approximately 25 feet (7600 mm) in ceilings and walls and where shown on drawings.

4. Locate control joints at changes in substrate construction.

5. Install control joints straight and true.

6. Install additional control joints as directed on site by the Architect and as the subtrade recommends to eliminate future drywall problems.

8. ACCESS PANELS

1. Ceiling access panels to be 18" x 18" (460 mm x 460 mm) drywall to match adjacent ceiling finishes except at fire rated ceilings, and as noted on drawings.

2. Provide "J" molds at exposed drywall edges of panel and at ceiling opening.

3. Reinforce panel with 3/4" (19 mm) fire retardant plywood backer as required.

4. Install access panels at wall locations provided by Mechanical and Electrical Sections.

5. Rigidly secure frames to furring or framing systems.

9. THERMAL BREAK

1. Provide a continuous moisture resistant insulating material at edges of wallboard in contact with aluminum windows and exterior door frames to provide a thermal break.

10. CERTIFICATION

1. Provide at completion of work a written certification that all drywall work where applicable conforms to the required ULC fire rated assemblies.

11. ACOUSTICAL MATERIALS

1. Install a continuous double row of caulking beads around perimeter of partitions which are indicated as containing sound attenuation batts.

2. Install sound attenuation batts in partitions where shown, with air space consistently on one side. Continue batts behind electrical boxes and conduits and all other services and items installed in partitions.

3. Provide caulking around all ducts, pipes, conduits and other items passing through partitions

4. Caulk all openings in wall and through base and ceiling plates for plumbing.

5. Electrical Outlets: cut holes neatly to reduce leaks. Caulk it tight around outlets before plate is installed. Do same for wall mounted fixture outlets before fixtures installed.

6. Bring early to General Contractor's attention that no electrical outlets are to be back to back in sound control walls. Consult Electrical Engineer.

7. Caulk edge of drywall to studs at perimeter of wall with 2 beads of caulking.

8. Installation of acoustical walls shall be from floor to bottom of floor above (not ceiling height) and sealed at all perimeters (including voids in metal deck).

12. INSTALLATION OF TILE BACKER BOARD TO WALLS

1. Use maximum length panels. Stagger intermediate end joints of adjacent lengths. Butt ends and edges. Secure tile backer board to studs with grabber type, 1 1/4": (32 mm) galvanized self taping screws at 6" (150 mm) on centre complete with a fosco fastener. Edge screws shall be 1" (25 mm) away from other board.

2. Gap between board panels to be filled with thin set mortar mixed with acrylic latex. Embed 2" (50 mm) wide, alkali resistant fibreglass tape into thin set mortar.

3. Locate control joints and expansion joints at same locations as substrate, and at a maximum 20'-0" (6000 mm) centres.

4. Waterproof membrane over tile backer board by Section 09300.

13. INSTALLATION OF EXTERIOR SHEATHING

9. Examine subframing; verify that surface of framing and furring members to

receive sheathing does not vary more than 1/4" from the place of faces of adjacent members.

10. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253.

11. Install Dens-Glass Gold with gold side out.

12. Use maximum lengths possible to minimize number and joints. Locate edge joints parallel to and located on framing. Stagger intermediate end joints of adjacent lengths of sheathing.

13. Attach sheathing to metal framing with screws spaced 8" (200mm) o.c. at perimeter and 8" (200mm) o.c. in field.

14. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.

15. Locate fasteners minimum 3/8" from edges and ends of sheathing panels.

14. FIRE STOPPING

16. Provide gypsum wallboard and furring as required to box in around steel joists at top of masonry and gypsum wallboard partitions including cross walls parallel to steel joists as per drawings.

17. All firestop sealants and backup mineral wool by Section 07270 - Firestopping and Smoke Seals.

END OF SECTION

1. GENERAL

1. GENERAL REQUIREMENTS:

    1. Division One is part of this Section and shall apply as if repeated here.

2. REFERENCE STANDARDS:

    1. Do tile work to Installation Manual 212-2014 "Quarry Tile and Ceramic Tile", produced by Terrazzo Tile and Marble Association of Canada (TTMAC), except where specified otherwise.

    2. Contractor shall have been and still be a current member of the TTMAC.

3. MAINTENANCE DATA:

    1. Provide maintenance data for tile work.

4. MAINTENANCE MATERIALS:

    1. Provide minimum 2% of each type and colour of ceramic and porcelain tile required for project maintenance use. Store where directed.

    2. Maintenance material to be of same production run as installed material.

5. ENVIRONMENTAL REQUIREMENTS:

    1. Air temperature and structural base temperature at porcelain tile and ceramic installation area must be above 54°F (12°C) for 48 hours before, during and 48 hours after installation.

6. SAMPLES:

    1. Submit 1'-0" x 1'-0" (300 mm x 300 mm) samples of each type, colour, texture, size and pattern of tile to be used for the approval of the Consultant before installation.
    2. Label each sample with appropriate Code as per drawings.
    3. Include in each submittal MSDS & product information.
    4. Provide with each submittal list of items that require selection/ review & approval.

1. SHOP DRAWINGS:

    1. Porcelain and Ceramic Tile: submit shop drawings showing expansion joint, control joint locations and pattern layouts for Consultant's approval.

2. ASSEMBLY:

    1. All installation assemblies will compose of materials from the same manufacturer and be completely compatible. The completed assembly will pass the service requirements "Extra Heavy Duty" (Passing ASTM C627 -

Cycles 1 through 14) as described in the TTMAC Specification Guide and TCA Handbook (Page 10).

2. PRODUCTS

1. Tiles:

    1. Tile: Conforming to CGSB 75-GP-1A.

    2. Colours: Indicated for ceramic, porcelain and glass tiles are for tendering purposes. Final colour selection to be confirmed by Consultant prior to installation. Follow submittal guidelines for Material review & approval.

    3. Substitutions, alternates as per section 01500

    4. NOTE: Provide round edge, round edge both sides, cove base, nosing's and tiles to do all work as per drawings and as required.

    5. Porcelain Tiles: (coordinate with Finish Board, Schedule and drawings)

        1. **PT1** –Tile: As manufactured by Euro tile, series Cosmopolitan, Ghiaccio Matte. Size to be 12" x 24" x 9mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans and schedule for locations.

        2. **PT2** –Tile: As manufactured by Euro tile, series Cosmopolitan, Crema Matte. Size to be 12" x 24" x 9mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans and schedule for locations.

        3. **PT3** –Tile: As manufactured by Euro tile, series Cosmopolitan, Tortora Matte. Size to be 12" x 24" x 9mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans and schedule for locations.

        4. **PT4** – Wall tile: As manufactured by Euro tile, series Anatolia, Cloud Blue, Glossy. Size to be 4" x 12" x 6mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans, washroom elevations and schedule for locations.

        5. **PT5** – Wall tile: As manufactured by Euro tile, series Anatolia, Soft Sage, Glossy. Size to be 4" x 12" x 6mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans, washroom elevations and schedule for locations.

        6. **PT6** – Tile: As manufactured by Centura tile, series Glocal, Toffee. Size to be 12" x 24" x 8.5mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans,

washroom elevations and schedule for locations.

7. **PT7** –Tile: As manufactured by Euro tile, series Anatolia, Halo Grey, Glossy. Size to be 4" x 12" x 6mm thick. Colour to be confirmed by consultant prior to ordering material. Refer to floor finish plans, washroom elevations and schedule for locations.

Grout: Contractor to submit samples for review & selection by consultant.

2. Metal Transition Strips: Add the following transition strip types by Schluter for the following locations (height of transition strips to suit tile thickness):

1. T1 - Transition #1: Schluter Deco Edging profile, satin anodized aluminum finish, profile must be used between two Varying finishes. To be confirmed by Consultant prior to installation. Use the correct Profile height as per site conditions.

2. T2-Transition # 2: Schluter Dilex-AHK profile, Cove shaped profile between inside wall corners and Floor/Wall transitions. Brushed Stain less steel finish. Use the correct Profile height as per site conditions. To be confirmed by Consultant prior to installation.

3. T3-Transition # 3: Schluter Jolly profile, 90 degree profile for Tiles. Brushed Stain less steel finish. Use corners as recommended by manufacturer. Use the correct Profile height as per site conditions. To be confirmed by Consultant prior to installation.

4. A Schluter Commercial Manager shall be contacted to review the site with the awarded Tile Contractor prior to the start of installation to ensure installation methods and guidelines are followed to ensure all warranties will be in effect. On site Demo can be arranged if required.

5. Use floor filler to align the level of the thinner flooring with the thicker flooring, ensuring a flush transition. Install **T1** Trim from Schluter at the transition for a seamless finish.

2. Tactile Warning Surface Indicator (TWSI) Tile:

1. 12" x 12" x 7/16" (300mm x 300mm x 10mm) tile by Kinesik Engineered Products (905-330-9233). Tile to have truncated domes conforming to latest OBC requirements. Colour to be determined / confirmed upon shop drawing submission by Consultant prior to ordering

3. Mortar Beds:

1. For Walls: 1 part Portland Cement: 1/5 to ½ parts hydrated lime; 4 parts sand; gauged with Custom - Flex latex by Custom Building Products as per manufacturer's directions. All Custom-Building Products are distributed by

Brolain Distributors Ltd. 519-740-9311. Approved equal manufacturer is TEC

2. For Floors: 1 part Portland Cement: 4 parts sand: gauged with Custom - Flex latex by Custom Building Products as per manufacturer's directions. Approved equal manufacturer is TEC.

4. Thin Set Mortar: Master Blend Thin-Set Mortar gauged with Custom - Flex latex by Custom Building Products as per manufacturer's directions. Approved equal manufacturer is TEC

5. Porcelain Tile Grout and Joint Filler: Classic-Blend Grout by Custom Building Products floor grout and joint filler mixed with Custom's Acrylic Mortar Admix grout as per manufacturer's directions in colours as selected by I.D. Approved equal manufacturer is TEC. One colour to be selected by I.D for each porcelain tile specified.

6. Caulking:

1. Flexible caulking conforming to CGSB 19-GP.22M: Dow Corning 786 and CGE 1702 Sanitary Sealant. Colours as selected by Consultant.

7. Control Joints:

1. Porcelain Tile:

1. Floor to Floor: Schluter Dilex KSN (height to suit tile thickness). Colour as selected by Consultant, stainless steel / aluminum.

2. Floor to Wall: Schluter Dilex KSA (height to suit tile thickness). Colour as selected by Consultant, stainless steel / aluminum.

9. Crack Isolation Uncoupling Membranes: premanufactured reinforced membrane self-adhering meeting requirements of ANSI A118; thickness as recommended by manufacturer to accommodate in plane substrate movement of 3mm in thin set applications meeting or exceeding requirements of ANSI A108.1.

10. Tile Trim:

1. For porcelain tile base: Schluter, Jolly, ATGB, colour to be stain anodized aluminum.

11. STAIR NOSING:
Schluter, Model #Trep – G-B nosing, 55mm depth, slip resistant stair nosing and all end caps where applicable. Contractor to ensure the nosing does not project past the face of the riser.

12. Sub-floor Filler and Leveller: Adrex SD-F Feather Finish TL 1000, TL Patch portland cement based filler by Ardex Engineered Cements and distributed by Brolain Distributors Ltd. (519-740-9311). Levelrock brand

Super Smooth Patching Compound by C.G.C or Novoplan, Ultraplan 1 Plus, Ultraplan Easy are approved alternative products.

3. EXECUTION:

1. EXAMINATION:

    1. Examine substrates before commencing work to ensure they are satisfactory. Defective work resulting from installation on unsatisfactory surfaces will be considered the responsibility of those performing the work of this section.

2. WORKMANSHIP:

    1. Regard recommendations, installation methods specified and illustrated in Terrazzo, Tile and Marble Association Manual No. 2000, and applicable manufacturer's instructions as minimum acceptable standard accept as varied by this Specification.

    2. Fit tile units around corners, fitments, fixtures, drains and other built-in objects to maintain uniform joint appearance. Make cut edges smooth, even and free from chipping. Edges resulting from splitting are not acceptable.

    3. Maximum surface tolerance: Ensure floor surfaces are smooth and flat to plus or minus 1/8" (3.2 mm) over 10 ft. (3050 mm).

    4. Make joints between tiles uniform. Tile joints shall be approximately 1/8" (3 mm) wide for ceramic tiles and 1/4" (6 mm) wide for porcelain tile, plumb, straight, true, even and with adjacent units flush. Align grout lines from floor to wall.

    5. Drill holes for fixing accessories of other trades.

    6. Finish surfaces flat and level (ensure leveler is used to accomplish this) or sloped and graded to drain where floor drains occur.

    7. Sound tiles after setting and replace hollow sounding units to obtain full bond.

    8. Make internal angles square, external angles bull nosed.

    9. Install transition strips at junction of tile flooring and dissimilar material. Where transition occurs in a doorway, transition strip to be below door.

    10. Clean installed tile surfaces progressively as work proceeds. Do not allow mortar to stain absorbent tile. Do not use acids for cleaning. Seal in accordance with manufacturer's approved products and in accordance with TTMAC certified products only.

    11. Layout borders, defined lines, accent patterns and bands wherever they

occur prior to setting tile. Keep inner edges of borders against fields or wall panels straight.

12. Install base trim, control joints, and beveled reducing strips as per manufacturer's instructions.

3. EXPANSION AND CONTROL JOINTS:

1. Control joints to be located directly on block control joints and concrete floor control joints and expansion joints.

2. Control joints are also to be placed where tile abuts other hard materials.

3. Install control joints in tile floors in accordance with TTMAC Detail 301MJ at 10'-0" (3050 mm) max. o.c. and at 20'-0" (6100 mm) max o.c. at wall locations. Align joints at concrete floor and masonry control joint locations as well.

4. Allow for control joints at the perimeter junction to all walls, around all columns.

5. Submit shop drawings to indicate layout of control joints. Porcelain tile control joints shall occur directly above a concrete floor control joint therefore minimizing the cutting of porcelain tile.

6. The approved control joint shop drawing layout shall be marked onto the concrete floor slabs by the porcelain tile contractor and the actual cutting of the control joints in the concrete floor slab shall be done by the concrete floor finisher.

7. It is the responsibility of the porcelain tile contractor and the concrete floor finisher to co-ordinate through the project manager the exact location of floor control joints.

8. At expansion joint locations install back to back metal transition strips at each side of joint then caulk between

4. PORCELAIN TILE:

1. Refer to TTMAC Specifications and Detail No. 311F-2016 Detail A, thin set method of porcelain tile floor to concrete slab, and Detail No. 303W-2000 thin set method of porcelain tile base to wall.

2. Install tile using thin set mortar, in accordance with manufacturer's instructions.

3. Provide levelling coat where required to achieve a level sub-floor prior to installation. Existing wood sub-floors may require additional plywood flooring coverage and shimming to achieve this, install as required.

4. Provide leveling coat at all wall tile locations.

5. Wall to wall, floor to wall, wall to ceiling tiles should not touch to stop transfer of noise and vibrations from one plane to the other, all joints are to be caulked (wall tile should start above floor tile with caulking space typical).

6. Porcelain tile base to be installed on first course of block without rounded corners (i.e. square). Block to be ground above base to match radius of block courses above first course.

7. Install porcelain tile base using Schluter, Jolly stainless steel cap (thickness to suit tile) complete with 90 degree corner return caps installed as per manufacturer's instructions.

8. Install porcelain tile base using Schluter, Jolly stainless steel at all vertical outside corners (thickness to suit tile) installed as per manufacturer's instructions.

5. GROUTING OF PORCELAIN TILE:

1. Pack joints solid with grout at porcelain tile using a plastic or non-staining trowel.

2. Allow joints to stiffen before finishing.

3. Remove excess grout with clean cloths.

4. Grout shall be mixed according to manufacturer's instructions. Colours as selected by Consultant.

5. Clean all surfaces with clean solution specified as per manufacturer's instructions.

6. CAULKING:

1. Install continuous caulking neatly and tool concave around base of all door frames and at all inside corners at 'wall to wall' and 'wall to ceiling' and 'wall to floor' (install at 'floor to wall' locations even where there is a base noted to cover this joint up) transition locations to stop transfer of noise and vibrations. Tiles at plane transitions should not touch, wall tile should start above floor tile with caulking space, etc. typical.

7. CLEANING AND REMEDIAL WORK:

1. Clean tile surfaces upon completion of grouting as per tile manufacturer printed instructions using cleaning agents and procedures recommended by the manufacturers of tile and grout.

2. Remove all grout haze, observing tile manufacturer's recommendations as to use of acid and chemical cleaners. (Do not use muriatic acid on tile work or pavers.)

3. Rinse tile work thoroughly with clean water before and after using chemical cleaners.

4. After setting, all tile surfaces shall be sounded and visually inspected and wherever any hollow backed or damaged tiles are found they shall be removed and replaced with matching tiles.

8. PROTECTION FROM CONSTRUCTION DIRT:

1. Seal cementitious grout joints and unglazed tile with "Aqua Mix Penetrating Sealer" by Aqua Mix Inc. or as recommended by manufacturer.

2. Cover all tile floors with heavy duty non-staining cotton reinforced paper or 6 mil vapour barrier taped into place.

3. Prior to final acceptance of tile work, remove paper and clean with "Aqua-Mix Miracle Cleaner" by Aqua Mix Inc. or as recommended by manufacturer.

9. PROTECTION FROM TRAFFIC:

1. Prohibit all foot and wheel traffic from using newly tiled floors for at least three days, preferably seven days after grouting is completed.

2. Place large, flat boards in walkways and wheel ways for seven days, where use of newly tiled floor is unavoidable.

3. Leave finished installation clean and free of cracked, chipped, brock, unbonded or otherwise defective tile work. Replace damaged or defective work.

4. Provide cardboard walkway using recycled boxes to protect finished work during construction.

END OF SECTION

1. GENERAL

1. GENERAL REQUIREMENTS

    1. Division One is a part of this Section and shall apply as if repeated here.

2. DESCRIPTION OF SYSTEMS

    1. Lay-in Tile System: Exposed suspended tee-bar system accommodating 2'-0" x 4'-0" (610 mm x 1220 mm), 2'-0" x 2'-0" (610mm x 610mm) and other sizings of acoustical panels in areas as indicated drawings and reflected ceiling plans as acoustical tile ceiling.

    2. All tile and suspension systems shall comply to U.L.C. Design as indicated on drawings.

3. SAMPLES

    1. Submit for approval, two samples of each type of tile to be used in the project.

4. WORK INCLUDED

    1. This contractor shall supply and install all acoustic tile and required accessories as indicated on the working drawings, room finish schedule, including the following:

        1. All non-combustible ceiling board.

        2. All exposed "T" grid suspension systems.

5. MAINTENANCE MATERIALS

    1. Deliver acoustical units in packages for maintenance use amounting to 3% of gross ceiling area for each lay-in panel type. Store where directed. Clearly identify packages.

    2. Maintenance materials shall be of same production run as installed materials.

6. ENVIRONMENTAL CONDITIONS

    1. Commence installation only after building has been enclosed and dust generating activities have been completed.

    2. Permit wet work to dry completely before commencement of installation.

    3. Ensure that a uniform minimum temperature of 15 deg. C. and humidity of 20-40% before, during, and after installation is maintained.

7. LETTER OF CERTIFICATION

1. The Contractor, together with manufacturer, shall submit a written confirmation, signed by manufacturer's registered professional engineer, stating that the suspended ceiling system will provide adequate support for electrical fixtures, as required by current bulletin of the ESA of Ontario Hydro. NOTE: all electrical fixtures to have independent supports in fire rated ceilings.

8. WARRANTY

1. Provide 10 year warranty on ceiling tiles for humidity and sag resistance.

2. PRODUCTS

1. Lay-in Tile System:

1. Hangers: Min. No. 12 (2.5 mm) SWG galvanized mild steel hanger wire - 24" (600 mm) o.c. or galvanized steel wire of size capable of safety supporting anticipated ceiling system and loading.

2. Tees: Donn Suspension Systems by C.G.C. (Typical Lay In)

3. Tees: Armstrong Superfine 9/16" suspension Systems for with square-cut lay-in tile system

1. Main Tees: .021" (.53 mm) thick cold rolled steel, double web, with rectangular bulb section at least I 1/2" (38 mm) high. Fabricate with punched cross tee holes at not greater than 16" (400 mm) o.c. and hanger wire holes at 2" (50 mm) o.c. Exposed flange shall be 15/16" (23.8 mm) wide and not less than .009" (.23 mm) thick cold rolled steel.

2. Cross Tees: Double web design with rectangular bulb; web extending to form a positive inter lock with main tees in same exposed flange width.

3. See lay-in panel types for width of Tees to be used with each tile type.

4. Accessories:

1. Miscellaneous approved clips, splicers, screws, nails and other standard types to suit applicable conditions. Provide special accessories as required. Accessories shall be galvanized after forming.

2. Standard edge moulding as manufactured by system manufacturer to suit applicable details. Moulding shall be formed of zinc coated steel.
3. Provide Armstrong Impact Clip System Item No. 414 system at areas where clipped down ceilings are indicated on drawings and

at all vestibule entrances. Provide accessible type clips where access is required.

5. Finish:

    1. Tees, edge mouldings, and exposed accessories shall be finished with baked, non-yellowing, low sheen colour to match colour of lay-in panels.

6. Lay-in Panels:

    1. Install tile types where acoustic tile is indicated on room finish schedule. Mineral tile types are as listed below:

1. **ACT1:** Fine Fissured Square Lay-In #1729A; 24" x 48" x 15/16" (610mm x 1220mm x 24mm), as manufactured by Armstrong or equal by C.G.C. or Celotex.

2. **ACT2:** Fine Fissured Square Lay-In #1713 (to match 1729A); 24" x 24" x 15/16" (610mm x 610mm x 24mm), as manufactured by Armstrong or equal by C.G.S. or Celotex.

3. **ACT-3**: Armstrong "Soundscapes Shapes" Suspension Grid System. Product #5448, Rectangular shape in size 48" x 72" x 7/8", with square edge and colour to be white. Suspended with Hanger Wire to structure as recommended by the manufacturer #5450 Deck hanging kit along with #625530 extended hanging cables if required.

4. **ACT-4**: Armstrong "Soundscapes Shapes" Suspension Grid System. Product #5448, Rectangular shape in size 48" x 96" x 7/8", with square edge and colour to be white. Suspended with Hanger Wire to structure as recommended by the manufacturer #5450 Deck hanging kit along with #625530 extended hanging cables if required.

5. **ACT5:** "Ultima Health Zone High NRC" – 24" x 48" x 1"(610mm x 1220mm x 25mm), with square tegular lay-in edge detail as manufactured by Armstrong.

6. **A.B:** "Acoustic Beam" as manufactured by Hush Acoustics or approved equal. To be installed as per manufacturers recommendations including all components for installation.

    1. On Ceilings & walls: Item – Hush Beam. Ceiling to be suspended with 1800 x 100 x 250 mm, 12mm thick, colour Antique Oak Beams. For walls use Accessories as required & recommended by manufacturer. Same size and thickness to be used on walls

2. Finish: Manufacturer's standard Constants finish, Final colour to be selected by consultant from manufacturer's full list of finishes prior to ordering.

7. Tie Wire: 1.2 mm galvanized annealed steel wire.

8. Inserts and attachments to Structure for Hanger Connections: to suit conditions and loadings, galvanized after fabrication.

3. EXECUTION

1. WORKMANSHIP

1. Installation shall be by skilled mechanics and in strict accordance with system manufacturer's printed directions to produce a first class, flush finished surface in true plane and free from drooping, warped, uneven joints, damaged tile or panels. Butt joints tightly.

2. Consult with mechanical and electrical trades to co-ordinate and arrange work to accommodate recessed fixtures, diffusers, grilles, and other similar items, where indicated on mechanical and electrical drawings. Recessed items shall replace, or be centred in acoustical units.

3. Frame around recessed fixtures, diffusers, grilles and openings and where normally required in good standard practice.

4. Provide all furring required and construct drywall bulkhead, incorporated as part of best standard practice to Consultant's approval.

5. Provide and install protection panels and/or five sided box enclosures at recessed lighting fixtures, speaker boxes, diffusers, duct openings, firestop flaps, etc. as specified in the applicable ULC assembly specification. Approval of enclosures and protection will be by Consultant and/or Municipal Authorities.

2. ERECTION

1. Lay-in Tile System

1. Install ceiling suspension system to ASTM C636-76 and manufacturer's instructions, except where specified otherwise.

2. Supply hangers and inserts to support the grid in time to be installed in structural system if required.

3. Hangers for acoustic systems shall be spaced to comply to U.L.C. Design, approximately 4 ft. (1200 mm) centres both ways and where normally required in good standard practice.

4. Secure hangers firmly.

5. Erect carrying channels for suspended systems of required elevation and level to tolerance of 1/8" (3.2 mm) over 12 ft. (3650 mm). Frame around recessed fixtures, diffusers, grilles and openings and where normally required in good standard practice. Furr around ducts, beams, bulkheads or the like, as shown or required by U.L.C. Standard.

6. Ensure that the suspension system supports the completed assembly, including all superimposed loads, such as lighting fixtures, diffusers and grilles, with a maximum deflection of 1/360 of the span. Provide supplemental hangers within 6" (150 mm) of each corner and at maximum 2'-0" (610 mm) around perimeter of light fixtures.

7. Attach exposed tees at centres required in good standard practice.

8. Install expansion joints in all main beams as required by U.L.C.

9. Provide angle wall mouldings at junctions of ceilings and vertical surfaces.

10. Provide spring clips to ensure tight installation, in rooms having an area less than 20 sq. ft. (1800 mm2).

11. Provide lay-in tile and grid to meet fire rating at all fire rated ceilings.

12. Erect ceiling system at required elevation and level to tolerance of 1/8" (3 mm) in 12'-0" (3660 mm).

13. Cut reveal edges to match factory detail at all reveal edge lay-in ceiling that needs cutting to fit grid size.

3. FIXTURE SUSPENSION

1. Make provisions for carrying flush mounted and recessed fixtures on suspended ceilings, using 4 hangers per fixture. Consult and coordinate with Electrical and Mechanical Trades.

2. The suspended ceiling system must comply with the current bulletin from the Electrical Inspection Department of Ontario Hydro regarding "Lighting Fixtures in Suspended Ceilings".

3. It is the responsibility of this contractor to supply the Consultant with a letter stating that the suspension system is capable of holding the electrical fixtures as shown on the electrical drawings and as required by the above bulletin of the Electrical Inspection Department of Ontario Hydro.

4. MITRED JOINTS

    1. "T" bar ceiling grid to be mitred at the outside corners.

5. ACOUSTICAL UNITS

    1. Install acoustical units parallel to building lines to produce uniform borders and with edge units not less than 50% of unit width.

    2. Accurately scribe and cut acoustical units to fit recessed items and adjacent work. Butt joints tight; terminate edges with moulding.

6. SPECIAL CLEANING

    1. Keep acoustical panel installation and all components clean.

    2. Remove and replace damaged or improperly installed units.

7. MECHANICAL EQUIPMENT ACCESS

    1. Install "T" bar system to allow it to be removed easily at areas where mechanical units occur to allow units to be easily removed. NOTE: Stop main "T" on each side of equipment access.

8. IMPACT CLIPS

    1. Install Impact Clip System at all acoustic tile ceiling areas indicated on drawings including rooms less than 20 sq. ft., (1800 sq. mm.) and all vestibules.

9. CERTIFICATION

    1. Provide at completion of work a written certification that all ceiling conform to the requirements of the ULC design criteria for fire rated assemblies and that the suspended ceiling will provide adequate support electrical fixtures as per current bulletin of the ESA of Ontario Hydro.

END OF SECTION

1. GENERAL

1.1 GENERAL REQUIREMENTS

1. Division 1 General Requirements are a part of this Section and shall apply as if repeated here.

1.2 WORK INCLUDED

1. Provide rubber sports flooring for locations as shown on the Drawings.

1.3 QUALITY ASSURANCE

1. Employ fully trained mechanics who are regularly employed in this field.

1.4 REJECTIONS

1. Defective materials or workmanship whenever found at any time prior to final acceptance of the work shall be rejected regardless of previous inspection. Inspection will not relieve responsibility but is a precaution against oversight and error.

2. Remove and replace defective materials and work of other trades affected by this replacement, at no additional cost to the Owner.

1.5 EXAMINATION

1. Report to the Architect, in writing, all defects of surfaces or work prepared by other trades and on unsatisfactory site conditions.

2. This Contractor shall report in writing to the General Contractor and to the Architect any defects of surfaces or work prepared by other trades and on unsatisfactory site conditions, which affect the quality or dimensions of this Contractor's work. Commencement of this Contractor's work shall imply complete acceptance of all work by other trades.

3. Thoroughly examine all surfaces scheduled to receive work of this Section to see that they are secure, rigid, true and not liable to impair performance or appearance.

4. Commencement of work shall imply total acceptance of surface and site conditions.

1.6 MATERIAL DELIVERY AND STORAGE

1. Deliver and store all flooring and required installation materials in original wrappings, cartons or containers clearly marked as to type, colour and manufacturer.

2. Store in a dry area under cover.

.7 JOB CONDITIONS

1. Co-operate in co-ordinating work of other Sections with work of this Section, in order that the work may proceed in an orderly and effective manner.

1.8 MAINTENANCE INSTRUCTIONS & MATERIALS

1. Deliver 3 sets of maintenance instructions to the General Contractor for the manuals.

2. Provide 2% of total area of rubber tile for Owner's future maintenance use.

1.9 WARRANTY

1. Provide a written wear warranty of work of this Section against defects in material and workmanship for a period of five (5) years from the date of publication of the Certificate of Substantial Performance as per G.C. 12.3 of CCDC Document 2 – 2020.

1.10 SAMPLES

1. Submit duplicate 300 x 300 mm sample pieces of sheet material in accordance with Section 01300 – Submittals.
2. Label each sample with appropriate Code as per drawings.
3. Include in each submittal MSDS & product information.
4. Provide with each submittal list of items that require selection/ review & approval.

1.11 ENVIRONMENTAL REQUIREMENTS

1. Maintain air temperature and structural base temperature at flooring installation area above 21°C (70° F.) for 72 hours before, during and maintain temperature after installation until occupied by Owner.

1.12 1. Substitutions

1. See section 01500. Gerflor, Tarkett & Mondo are acceptable manufacturers for sport Flooring.

2. PRODUCTS

2.1 GENERAL

1. Materials shall be new and in perfect condition, free from defects impairing physical or appearance performance.

2.2 MATERIALS

1. **SF 1 -** Sport floor covering (Border): 0.3" (8.1 mm thick), Omnisport Active+ by Tarkett, colour to be Maple Grey. Available from Advantage Sport. Colour to be confirmed by architect prior to ordering material. Alternates as approved equal.

2. **SF 2 -** Sport floor covering (Pre school): 0.14" (3.5 mm thick), Omnisport Speed by Tarkett, colour to be Natural Oak, Colour to be confirmed by architect prior to ordering material. Alternates as approved equal

3. **SF 3** – Sport floor covering (Gym Field): 0.3" (8.1 mm thick), Omnisport Active+ by Tarkett, colour to be Beech. Available from Advantage Sport. Colour to be confirmed by architect prior to ordering material. Alternates as approved equal.

4. Gym Court Lines to be PBWW inc., **'GYMLINE 1000 Series'**, Low V.O.V. 2-Component Polyurethane Game Line Paint System as recommended by Advantage Sport and Tarkett. Alternates as per section 01500

5. Adhesives: Amtico adhesive No. 529 or No. 530 as recommended by flooring manufacturer for specific material on applicable substrate. Alternates as per section 01500

6. Sub-floor filler and leveller: as recommended by sheet flooring manufacturer for use with their product. Alternates as per section 01500

7. Metal edge strips: aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

3. EXECUTION

3.1 SUB-FLOOR TREATMENT

1. Remove sub-floor ridges and bumps. Fill low spots, cracks, control and expansion joints, holes and other defects with sub-floor filler.

2. Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

3. Machine sand concrete smooth then dry vacuum clean entire floor area.

3.2 FLOORING APPLICATION

1. Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

2. Lay flooring with seams parallel to building lines to produce symmetrical tile

pattern. Border widths minimum 1/2 width of full material.

3. Set tile in pattern as directed by Architect. Distribute tiles having various tones or texture evenly over entire floor area to avoid patches or streaks and to produce a homogenous blend.

4. Make tile joints flush, uniform, in straight lines and as inconspicuous as possible.

5. Cut tile and fit neatly around fixed or excessively heavy objects.

6. As installation progresses roll flooring with a 100 lb. (45 kg) min. steel roller, pushing to ensure full adhesion.

7. Check and immediately wipe off any excess adhesive oozing through the seams.

8. Terminate flooring at centre line of door in openings where adjacent floor finish or colour is dissimilar.

9. Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.3 CLEANING

1. As work progresses, remove excess adhesive from floor, base, and wall surfaces without damage.

2. Clean floor surface to flooring manufacturer's printed instructions.

3.4 PROTECTION OF FINISHED WORK

1. Protect new floors with heavy cotton reinforced paper or polyethylene sheets with taped joints from time of final set of adhesive until final inspection.

2. Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1. GENERAL REQUIREMENTS:

    1. Division One is a part of this Section and shall apply as if repeated here.

2. SAMPLES:

    1. Submit full size tiles in duplicate, in each colour or design to be used, for approval of the Consultant.
    2. Label each sample with appropriate Code as per drawings.
    3. Include in each submittal MSDS & product information.
    4. Provide with each submittal list of items that require selection/ review & approval.

3. MAINTENANCE INSTRUCTIONS:

    1. Submit 3 copies maintenance manual at completion of work in accordance with Section 01015.

4. DELIVERY, STORAGE AND HANDLING:

    1. Deliver materials in original containers with manufacturer's seals and labels intact. Maintain temperature of storage area at 70°F (21°C) for 48 hours prior to installation.

5. ENVIRONMENTAL REQUIREMENTS:

    1. Maintain minimum 70°F (21°C) air temperature at flooring installation area during installation and for 72 hours prior to and until floor area is occupied by Owner.

6. MAINTENANCE MATERIALS:

    1. Leave 2% of each colour, type and size of tile installed, with Owner for replacement purposes. Clearly mark containers. Material shall be from same production run as the material installed.

7. 1. Substitutions, alternates as per section 01500

8. PROTECTION:

    1. General Contractor's Responsibility: In each location immediately following installation, protect new floors, if work is to be done after flooring installed with heavy cotton reinforced paper or polyethylene taped at joints and maintain in place until Consultant gives instructions for the removal of temporary protection. Work shall be handed over to the Owner free of blemishes and in perfect condition.

PART 2 - PRODUCTS

1. MATERIALS:

1. VCT Primers and Adhesives: Environmentally friendly materials as recommended in writing by Flooring tile and base manufacturer, and approved by the Consultant before application, to suit type of sub floor and wall finish for this project. Adhesives produce good and waterproof bond between applicable substrate and tile. Use only Premier #71 by Flextile below all VCT or approved equal.

2. Sub-floor Filler and Leveller: White premix latex requiring water only to produce cementitious paste 2-part latex-type filler requiring no water as recommended by flooring manufacturers for use with their product.

3. **LVP:** - Luxury Vinyl Plank: Manufacturer Polyflor, Expona Commercial pur' series, Everest Oak Product, Color 4134. Size 203.2 X 1219.2 mm (2.5mm Thick). Consultant to approve final color selection prior to ordering and installation.

4. **VCT -1:** - Vinyl Composite Floor Tile: Equal to Tarkett, Series Tarkett VCT II, Color 880, size 12" X 12", 1/8" thick. Colors to be confirmed with consultant prior to ordering material.

5. **SAFT -1:** - Vinyl Safety Flooring: Manufacturer Forbo, Eternal Step' series, Product code Warm Mortar, 172312, (2mm Thick). Consultant to approve final color selection prior to ordering and installation.

6. **B3** Rubber Base: 1/8" (3.2 mm) thick, 4" (100 mm) as indicated, rubber cove base at resilient locations by Tarkett. Color- 20 Charcoal W.G. Use continuous coil rubber base not 4'-0" (1220 mm) lengths. Consultant to approve final colour selection prior to ordering and installation.

7. Floor Transition Strips:

   1. **T1:** Schluter Deco edging profile, Satin Anodized Aluminum finish. Contractor to provide flush transition between 2 finishes as per site condition.
   2. **T2:** Schluter DILEX-AHK , Between wall tile & Floor tile. Contractor to confirm exact model as required for site condition.
   3. **T3:** Schluter Reno-T, Brushed stainless steel finish. From Sport Floor/LVT to VCT. Contractor to confirm exact model as required for site condition.

8. Cleaner: Neutral chemical compound as approved by tile manufacturers that will not damage tile or affect its colour.

9. Sealers and Waxes: Type recommended by flooring manufacturers for material type and location and shall be compatible with Owner's sealer and wax. Obtain Owner's approval of sealer and wax product prior to installing VCT.

10. Reducing Strip: strips in thickness as required. Colour as selected by

Consultant.

11. Metal Edge Trim: Aluminum or brass alloy with lip of edge extending under and with shoulder finishing flush with top of resilient flooring.

12. Concrete Floor Sealer: to C.G.S.B. 25-GP-20m Type 1.

13. Stair Tread Adhesives: Amtico No. 529 Epoxy (2 parts) or approved equal by Consultant.

14. Rubber Stair Treads With Integrated Riser: VIBMTR with Bamboo profile surface pattern. The stair tread shall have tapering thickness gauge of .210" (5.33 mm) to .153" (3.89 mm) across a 13" (330 mm) tread depth; 2" bamboo surface pattern hinged underside square nosing to comply with ADA recommended stair pan angles, tread to have non-slip contrasting color inset at nosing edge; length as required (for full length) Bamboo surface pattern tread by Johnsonite Rubber Co. Canada Ltd., Waterloo, Ontario or Amtico. Colour as selected by Consultant (maximum of 2 colours for treads, each with separate color for inset at nosing).

15. Rubber Stair Landings: Cubis (CRT) pattern rubber flooring by Johnsonite Rubber Co. Canada Ltd., Waterloo, Ontario or Amtico. Colour as selected by Consultant

16. Tactile Walking Surface Indicator (TWSI) Rubber Tile: 12" x 12" x 1/8" (300mm x 300mm x 3mm (5mm where required to match the same thickness as adjacent adjoining flooring) rubber tile by Kinesik Engineered Products (905-330-9233). Tile to have truncated domes conforming to latest OBC requirements. Colour to be Vogue Black, to be determined upon shop drawing review by consultant prior to ordering. Approved alternate manufacturer is Johnsonite Tarkett.

17. Reducers / Transitions: One piece homogeneous polyvinyl chloride, installed using materials and methods per Manufacturer's written installation instructions. Colour: from Manufacturer's complete line. Style: SSR-XX-B by Johnsonite Inc..

PART 3 - EXECUTION

1. INSPECTION:

    1. Maximum surface tolerance: Ensure floor surfaces are smooth and flat to plus or minus 1/8" (3.2 mm) over 10 ft. (3050 mm).

    2. Ensure concrete floors are dry by using test methods recommended by manufacturer, and exhibit negative alkalinity, carbonization or dusting. Ascertain nature of curing and/or sealing compound used on concrete and its compatibility with flooring adhesive. Take all required remedial measures. Remove compounds if necessary to ensure that adhesive bonds to concrete.

    3. Installation of any part shall constitute acceptance of these surfaces as

satisfactory.

2. PREPARATION:

1. Remove sub floor ridges and bumps by light buff grind. Fill low spots, cracks, joints, holes and other defects with sub floor filler.

2. Clean floor and apply trowel and float filler to leave smooth, flat hard surface. Prohibit traffic until filler cured.

3. Split, bumpy or otherwise deformed tile resulting from improperly prepared base, will not be accepted.

4. Prime/seal concrete slab to resilient floor tile manufacturer's printed instructions.

5. Fill all low spots in flooring with high grade latex cement base flashing compound and gently blend in floor level at a rate of 1/8" per 1'-0" (10.5 mm per 100000 mm) to flush resilient flooring with ceramic tile, quarry tile, etc.

6. Power sand concrete floor smooth then dry vacuum clean entire floor area.

3. INSTALLATION - RESILIENT FLOOR TILES:

1. Apply adhesive uniformly to tile manufacturer's directions. Do not spread more adhesive than can be covered by tile before initial set takes place.

2. Lay flooring with joints and seams parallel to building lines to produce a symmetrical tile pattern unless noted otherwise. **Tile pattern shall be checkerboard type with all seams lined up in each direction and tile turned in opposite run directions to form checkerboard pattern.**

3. Install flooring with minimum tile width half full sizes.

4. Distribute tiles having varying tones or texture evenly over entire floor area to avoid patches or streaks, and to produce homogeneous blend. Reject tiles having undue variations in colour, shade and texture.

5. Make tile joints flush, uniform, in straight lines and as inconspicuous as possible.

6. Install tile and colours to form patterns indicated on 9 series drawings.

7. Set flooring in place, press with 100 lb. (45 kg.) minimum roller to ensure full adhesion.

8. Cut tile and fit neatly around fixed or excessively heavy objects.

9. Terminate flooring at centre line of door in door openings where adjacent floor finish is dissimilar.

10. Install metal edge strips at unprotected edges of flooring.

11. Use reducing strips at centre line below doors where resilient flooring meets concrete floor or quarry tile.

12. Allow for random pattern and border in each classroom

4. INSTALLATION – BASE:

1. Layout base to keep number of joints to a minimum.

2. Install straight and level to variation of plus or minus 1/8" (3.2 mm) over 10'0" (3050 mm) straight edge.

3. Fill cracks and level irregularities of surfaces to which base is to be applied with filler approved by adhesive manufacturer so as to provide solid backing over entire area behind base. Cement cove base to vertical surfaces so that gaps do not occur behind base, so that front lip of base cove bears firmly and uniformly on floor surface, and so that good and permanent bond is produced between base and surface to which it is applied. Set base tightly in adhesive by using a 7 lb. (3 kg.) roller against wall and floor surfaces. Make end joints flush with gap.

4. Scribe and fit to door frames and other obstructions.

5. Cope internal corners.

6. Use full length pieces where possible. Accumulated short lengths at base not permitted.

7. Supply straight base for carpeted areas and cove base for resilient flooring areas.

8. Supply rubber base for all millwork bases.

9. Gaps below bottom edge of base will not be accepted.

5. SPECIAL CLEANING AND WAXING OF VINYL COMPOSITION FLOOR TILE:

1. Clean off excess adhesive as work progresses from floor, base and wall surfaces without damage. Upon completion, remove all markings and heel scuffs.

2. Upon completion of laying V.C.T., clean floors in accordance with manufacturer's printed instructions. Install two coats of sealer after installation and then three coats of wax.

6. PROTECTION OF FINISHED WORK:

1. Prohibit traffic on floor for 48 hours after installation.

2. Protect floors as per item 1.7.1 in this Section.

3. Clean floors and wax during final cleaning just prior to Owner occupying building.

END OF SECTION

PART 1 - GENERAL

1. GENERAL REQUIREMENTS

    1. Division One is a part of this Section and shall apply as if repeated here.

2. SUBMITTALS

    1. Submit 24" x 24" (600 mm x 600 mm) sample, in each colour or design to be used, for approval of the Consultant.

    2. Submit 12" (300 mm) long samples of each colour of rubber base.

    3. Submit shop drawings in reproducible form in accordance with G.C. of CCDC Document 2 - 2020 to show layout, treatment at walls, floor drawings, and other objects. Indicate details of proposed treatment, where flooring material meets other floor materials.
    4. Label each sample with appropriate Code as per drawings.
    5. Include in each submittal MSDS & product information.
    6. Provide with each submittal list of items that require selection/ review & approval.

3. SPECIAL PROTECTION

    1. Protect finished floors immediately after installation, using heavy cotton reinforced paper or polyethylene lapped 5" (125mm) with taped joints.

4. EXTRA MATERIALS

    1. Upon completion of work, deliver to Owner where directed, all large scrap cuttings from flooring and a 12'-0" x 12'-0" (3600 mm x 3600 mm) piece of each design in each colour used.

    2. Material to be wrapped packages and fully labelled as to product and colour.

5. ENVIRONMENTAL CONDITIONS

    1. Maintain room, surface and materials at minimum temperature of 68 deg. F. (20 deg. C.), for three days before and during laying and after installation, and until floor area is occupied by Owner.

6. MAINTENANCE INSTRUCTIONS

    1. Submit 3 copies maintenance manual at completion of work in accordance with Section 01015 - General Work.

7. DELIVERY, STORAGE AND HANDLING

    1. Deliver materials in original containers with manufacturer's seals and labels

intact. Maintain temperature of storage area at 70 degrees F. for 48 hours prior to installation.

8. WARRANTY

1. The warranty specified in Article GC 12.3 of CCDC Document No. 2, 2020 is to be extended for all work of this Section, including materials and workmanship for a period of five (5) years from the date of Substantial Performance.

9. COORDINATION WITH MECHANICAL CONTRACTOR

1. Confirm the following mechanical products are being used to allow proper water tightness:

.1 Floor Drains - Must be Zurn ZN401R, ZURN ZN415R, ZURN Z400 "Type R" or ENPOCO E1000FC, ENPOCO E1000R5FC, ANCON FD100FC or similar approved TO ENSURE WATERTIGHTNESS.

.2 Trench Drains - Must be ENPOCO E1000RE/FC-412 or ENPOCO F4060FC or similar approved with integral flashing clamp for use with Altro Safety Sheet Flooring TO ENSURE WATERTIGHTNESS.

.3 Floor Cleanouts - must be ENPOCO E100R5FCST or similar approved TO ENSURE WATERTIGHTNESS.

10. SUBSTITITIONS:

1. See section 01 500. Acceptable alternatives are Polyflor & Interface.

PART 2 - PRODUCTS

1. MATERIALS

1. Primer and Adhesives: Environmentally friendly products as recommended by seamless floor manufacturer for specified material and which will produce good and permanent waterproof bond between applicable substrate and flooring.

2. Welding of Seams: welded to match flooring using products as recommended by sheet floor manufacturer for specified material.

3. Cleaner: Those recommended by flooring manufacturers.

4. Safety Flooring, Stairs & Landings:

1. **SAFT1 -** 2 mm thick x 2000mm width, Eternal Step distributed by Forbo. Installed as per Manufacturer's instructions. Colour to be 172312 Warm

Mortar. Colour to be confirmed by consultant prior to ordering material.

2. Rubber Stair Landings **(RB 1)** – Tarkett Rubber Tiles, Product: BMRTS TA5 1/8, Color- Bamboo Solid TA5, Colonial Grey, Size: 24" x 24". Colour to be confirmed by consultant prior to ordering material.

3. Rubber Stair Treads & Raisers **(RB 1)** - Tarkett Angle Fit Stair Treads w/ Integrated Riser, Product: Bamboo Tread/Riser Visually Impaired, Product Code: Johnsonite Anglefit, Colour: Colonial Grey CG. The stair tread shall have tapering thickness gauge of .210" (5.33 mm) to .153" (3.89 mm) across a 13" (330 mm) tread depth; 2" bamboo surface pattern hinged underside square nosing to comply with ADA recommended stair pan angles, tread to have non-slip contrasting color inset at nosing edge; length as required (for full length) Bamboo surface pattern tread by Johnsonite Rubber Co. Canada Ltd., Waterloo, Ontario or Amtico. Colour as selected by Consultant from manufacturer's full range of colours).

4. Tactile Walking Surface Indicator (**TWSI-R)** Rubber Tile – Tactile Warning Surface from Tarkett Rubber, Product: Tactile Warning Surface – Rubber, Product Code: TG1, Size: 24" x 24", Colour: 08 ICICLE. To be same thickness as adjoining flooring. Tile to have truncated domes conforming to latest OBC requirements.

5. Sub-floor Filler and Leveller:

   .1 Sub-floor Filler and Leveller: Ardex SD-F Feather Finished Portland Cement based filler by Ardex Engineered Cements and distributed by Centura.

   .2 White premix latex requiring water only to produce cementitious paste 2-part latex-type filler requiring no water as recommended by flooring manufacturer for use with their product.

6. Metal Edge Strips: Aluminum extruded smooth, mill finish polished lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

7. Concrete Floor Sealer: to C.G.S.B. 25-GP-20M Type 1.

8. Accessories:

   .1 Compass #901 Fillet Strip

   .2 Compass Stainless Steel Cap-8 strip at cove bases

   .3 Compass GE 25/35 Trench Drain Edging

   .4 Compass Altroseal (matching)

.5 Compass CSL No. 160 Sealant

.6 Tarkett welding rod (matching)

9. Stair Tread Adhesives: Amtico No. 529 Epoxy (2 parts) or approved equal by Consultant.

10. Reducers / Transitions: One-piece homogeneous polyvinyl chloride, installed using materials and methods per Manufacturer's written installation instructions. Colour: from Manufacturer's complete line. Style: SSR-XX-B by Johnsonite Inc.

PART 3 - EXECUTION

1. INSPECTION

1. Ensure floor surfaces are smooth and flat to plus or minus 1/8" (3 mm) over 10'-0" (3000 mm).

2. Ensure concrete floors are dry by using test methods recommended by manufacturer, and exhibit negative alkalinity, carbonization or dusting.

3. Installation of any part shall constitute acceptance of these surfaces as satisfactory.

2. PREPARATION

1. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler.

2. Clean floor and apply trowel and float filler to leave smooth, flat hard surface. Prohibit traffic until filler cured.

3. Split, bumpy or otherwise deformed flooring resulting from improperly prepared base, will not be accepted.

4. Prime/seal concrete slab sheet flooring by manufacturer's printed instructions.

5. Fill low spots in flooring with latex base flashing compound and gently blend in floor level at a rate of 1/8" per 1'-0" (10.5 mm per 10000 mm) to flush sheet flooring with ceramic tile, quarry tile, etc.

6. Machine sand concrete smooth then dry vacuum entire floor area immediately prior to application of adhesive.

3. INSTALLATION

1. Apply adhesive uniformly to manufacturer's directions and recommended trowel. Do not spread more adhesive than can be covered by flooring

before initial set takes place.

2. Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width full material.

3. Run sheets in direction of traffic. Double cut sheet joints and continuously heat weld all joints according to manufacturer's printed directions.

4. Set flooring in place, press with 100 lb. (45 kg) minimum roller to ensure full adhesion.

5. Continue flooring over areas which will be under built-in furniture or appliances where flooring will remain visible. Cut flooring neatly around fixed objects.

6. Continue flooring through areas to receive moveable type partitions without interrupting floor pattern.

7. Terminate flooring at centre line of door in door openings where adjacent floor finish is dissimilar. Ensure smooth transition.

8. Terminate flooring 1.5 mm back from wall substrate and seal with Compass Altroseal in selected areas.

9. Install metal edge strips at unprotected or exposed edges where flooring terminates.

10. Install floor patterns as shown on drawings. Refer to Consultantural drawings 9 series for grain direction.

11. Provide water tight seal to all pipes and projections coming through floor, using Compass Altroseal.

12. At new flush clamp drains remove clamping ring. Fix sheet flooring into body of drain and mechanically clamp with clamping ring. New drains should be surface clamp type; Enpoco E1000 F.C. Type, or similar.

4. INSTALLATION OF LVP

1. Apply adhesive uniformly to perimeter planks of room to manufacturer's directions and recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

2. Loose lay field of flooring with seams parallel to building lines to produce a minimum number of cut planks or seams. Border widths minimum 1/3 width full material.

3. Floor pattern layout of planks to be staggered 1/3rd offset in direction shown on drawings; select planks from multiple different boxes to ensure mottled look and non-detectable dye lot patches.

5. INSTALLATION OF RUBBER BASE

    1. Layout base to keep number of joints at minimum.

    2. Set base in adhesive tightly by using a 7 lb. (3 kg.) hand roller against wall and floor surfaces. Install base tight to surface of flooring avoiding any gaps. Space joints uniformly.

    3. Install straight and level to variation of plus or minus 1/8" (3 mm) over 10'-0" (3000 mm) straight edge.

    4. Scribe and fit to door frames and other obstructions.

    5. Cope internal corners.

    6. Use full length pieces where possible. Accumulated short lengths of base not permitted.

6. SPECIAL CLEANING

    1. Clean off excess adhesive as work progresses from floor, base and wall surfaces without damage.

    2. Upon completion of laying, clean floors in accordance with manufacturer's printed instructions and leave ready for sealing and waxing by Owner.

7. PROTECTION OF FINISHED WORK

    1. Protect new floors from time of final set of adhesive after initial waxing, until final waxing and final inspection.

    2. Prohibit traffic on floor for 48 hours after installation.

End of Section

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of the Contract, Supplementary Conditions, and the General Requirements of Division 1, form part of this Section, and must be read in conjunction with the requirements of this section and all related sections.

.2 The work of this section, and related work specified in other sections shall comply with all requirements of Division 1 – General Requirements.

1.2 ENVIRONMENTAL REQUIREMENTS

.1 Provide materials in this specification section based on but not limited to the following criteria:

.1 Option: Materials of this section may conform to performance standards for recycled material content (7.5% post-consumer + ½ post industrial) and distance to the job site (500 km).

.2 Requirement: Materials of this section and accessory materials such as adhesives used in their installation must conform to performance standards for low VOC content.

.3 Requirement: carpet products must meet or exceed the requirements of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program.

.4 Refer to Section 01560 Environmental Protection for additional criteria not listed above.

1.3 SECTION INCLUDES

.1 Provision of all labour, materials, equipment and incidental services necessary to provide carpet floor finish, including primers, mastics and leveling fillers, adhesives, carpet material, underlay, carpet base, accessories, and protection.

1.4 REFERENCES

.1 CAN/CGSB-4.2- 92, Textile Test Methods.
.2 CAN/CGSB-4.129- 93, Carpets for Commercial Use.
.3 CAN/CGSB-25.20- 95, Surface Sealer Floors.
.4 CAN/ULC-S102- M88, Surface Burning Characteristics of Building Materials and Assemblies.
.5 CAN/ULC-S102.2- M88, Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.
.6 Carpet and Rug Institute (CRI) - Contract Carpet Manual, No.001.
.7 Carpet and Rug Institute (CRI) - IAQ Carpet Testing Program.

.8 ASTM D 1055- 90, Specification for Flexible Cellular Materials - Latex Foam.

.9 ASTM E 84- 95, Test Method for Surface Burning Characteristics of Building Materials.

1.5 QUALITY ASSURANCE

.1 Installer shall have a minimum of five (5) years documented experience in the installation of commercial carpet, and be certified by the Manufacturer. Documentation shall be submitted to the General Contractor.

1.6 SUBMITTALS

.1 Submit control submittals in accordance with Section 01300 - Submittals.

.2 Submit certificate to demonstrate compliance with CAN/ULC S102 and CAN/ULC S102.2.

.3 Submit proof that carpet has been tested and passed the Indoor Air Quality (IAQ) Carpet Testing Program requirements of the Carpet and Rug Institute.

.4 Manufacturer's Instructions: Provide special handling criteria, installation sequence, cleaning procedures.

.5 Label each sample with appropriate Code as per drawings.

.6 Include in each submittal MSDS & product information.

.7 Provide with each submittal list of items that require selection/ review & approval. Substitutions , alternates as per section 01500

.8 Product Data

.1 Submit product data in accordance with Section 01300 – Submittals.

.2 Submit product data sheet for each carpet tile, adhesive, carpet protection and subfloor filler.

.3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada for carpet adhesive and seam adhesive. Indicate VOC content.

.9 Samples

.1 Submit samples in accordance with Section 01300 - Submittals.

.2 Submit duplicate full size pieces of each type carpet tile, duplicate pieces for each selected colour.

.10 Closeout Submittals

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01700 Project Close-Out.

.2 Include information on recycling of carpet including manufacturer's reprocessing program. Indicate which portions of materials are recyclable.

.11 Extra Materials

.1 Provide extra materials of carpet tile and adhesives in accordance with Section 01700 - Project Close-Out.

.2 Provide minimum 2% of each colour, pattern and type of carpet tile. Provide in one continuous full width roll or from same dye lot.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each package of carpet and each container of adhesive.

.5 Deliver and store where directed by Owner.

1.7 REGULATORY REQUIREMENTS

.1 Prequalification: tested to CAN/ULC-S102.2.

.2 Indoor Air Quality: compliance with CRI Indoor Air Quality Program, CRI - IAQ requirements for maximum total volatile chemicals released into air. Label each carpet product with CRI -IAQ label.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Label packaged materials. For tile products indicate nominal dimensions of tile.

.2 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.3 Store carpeting and accessories in location as directed by Owner.

.4 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.5 Maintain temperature of store room at a minimum of 20C, for at least 24 hours immediately before the installation.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01560 Environmental Protection.

1.10 PROJECT/SITE ENVIRONMENTAL REQUIREMENT

.1 Moisture: ensure substrate is within moisture limits prescribed by manufacturer.

.2 Temperature: Maintain ambient temperature of not less than 18°C from 72 hours before installation to at least 72 hours after completion of work.

.3 Relative humidity: Maintain relative humidity between 10 and 65% RH for 48 hours before, during and 48 hours after installation.

.4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.11 VENTILATION

.1 Ventilate area of work as directed by General Contractor by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01560 Environmental Protection.

.3 Provide continuous ventilation during and after carpet application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of carpet installation.

1.12 EXTENDED WARRANTIES

.1 System Warranty

.1 Provide manufacturer's certificate warranting the specified carpet products against defects in materials and manufacture including deterioration of backing, delamination, stretching, wrinkling, fading, or other conditions detrimental to appearance or performance, for a minimum period of 10 years from the date of the Certificate of Substantial Performance. Warranty shall cover complete replacement of affected area including carpet, adhesives, and removal/installation costs.

2. Installation Warranty

.1 Provide a written warranty stating that carpet installation is guaranteed against defects for two (2) years from the date of the Certificate of Substantial Performance.

PART 2 - PRODUCTS

2.1 CARPET TILE

.1 100% nylon loop with bonded monolithic glass backing, carpet squares, anti-microbial and soil/stain resistance treated; CRI certified The Colors below have been indicated for pricing purposes only Final selections to be selected from the Manufacturer's standard range and must be confirmed by Architect / owner prior to ordering material.

1. **CAR1**: Equal to -Interface, Series- Draw Conclusions, Product - Indigo, Color -108786, Size 500 X 500 mm, 3mm thick, Final selection by consultant.

2.2 ACCESSORIES

.1 Adhesive: Acrylic release type: recommended by carpet tile manufacturer; Low VOC content in accordance with CRI requirements.

.2 Carpet protection: non-staining heavy duty kraft paper, or cardboard.

.3 Concrete Floor Sealer/Moisture Barrier: Planiseal™ MRB, by Mapei or approved equal product.

.4 Subfloor Filler and Patch: Portland cement based, premix latex requiring only water to produce cementitious paste; "Planipatch®" by Mapei or approved equal product.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrates for defects and determine level of preparation required prior to commencement of installation.

.2 Report any major defects such as cracks greater than 1.5mm in width, and variations in elevation greater than 6mm in 3m in any direction or excessive moisture content in concrete slabs.

.3 Ensure concrete floors are dry by using test methods recommended by flooring manufacturer, and exhibit negative alkalinity, carbonization or dusting.

.4 Moisture test results shall meet or exceed the flooring manufacturer's warranty requirements but in no instance shall exceed 0.4kg/100m2/24 hours. Alkali readings shall be 5 to 9.

3.2 PREPARATION

.1 Remove ridges and bumps.

.2 Apply sub-floor filler/patch to low spots and cracks to achieve floor level to a tolerance of 1:500. Allow to cure.

.3 Where moisture tests result in values higher than those specified above, apply floor sealer/moisture barrier to concrete floor surface prior to installation. Re-test moisture levels.

.4 Prepare floor surfaces in accordance with Contract Carpet Manual, Standard for Installation of Textile Floorcovering Materials No.001.

.5 Pre-condition carpeting following manufacturer's printed instructions.

.6 Install resilient base before proceeding with carpeting.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's printed instructions and in accordance with Contract Carpet Manual, Standard for Installation of Textile Floorcovering Materials No.001.

.2 Install carpeting after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.

.3 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.4 Use material from same dye lot. Ensure colour, pattern and texture match within any one visual area.

.5 Cut and fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.6 Cut and install carpet tile in pan type floor access covers.

.7 Carpet Tile:

.1 Apply acrylic release type adhesive and install carpet tile in accordance with manufacturer's written instructions.

.2 Lay tiles with butt seams.

3.4 PROTECTION OF FINISHED WORK

.1 Vacuum carpet clean immediately after completion of installation. Protect traffic areas.

.2 Prohibit traffic on carpet until adhesive is cured.

.3 **Install carpet protection to satisfaction of Consultant.**

END OF SECTION

PART1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

1. Fire Hazard Classification as determined by U.L.C. or U.L.I. Testing in accordance with ASTM.E-84 shall not exceed the following:

Flame Spread	0
Fuel Contributed	15
Smoke Developed	10

1.3 QUALIFICATIONS OF APPLICATORS

1. Coating shall be applied by manufacturer's franchised applicators or by applicators having a successful history of such applications and having manufacturer's approval of applications. Submit proof of these qualifications if required.

2. All Applicators shall be from the painters and applicators Union due to the School Boards affiliation with the Union.

1.4 SAMPLES

1. Submit 12" x 12" (300 mm x 300 mm) samples of specified substrate showing stages of application. Submit additional samples if required to secure approval. Identify samples as to job, product, colour and date. Approved sample shall be standard for coating applied on site.

1.5 DELIVERY AND STORAGE

1. Deliver and store materials in original containers with manufacturer's labels and seals intact, in a warm, dry, lockable area until surfaces are ready for application. Store "red label" (fire hazard) materials in locations approved by local fire authorities.

2. Keep thinner soaked rags and other similar combustible materials in closed metal containers and remove from job site at end of each work shift.

1.6 ENVIRONMENTAL CONDITIONS

1. Do not apply coatings at a temperature below 50 degrees F. (10 degrees C.) and to surfaces having moisture content greater than 15%.

1.7 PROTECTION

1. Post legible signs at all points of entry to areas in which work of this Section is being applied. These signs shall warn against smoking and the use of open flame, such as torches, matches and lighters.

2. Erect suitable barriers to prevent traffic and other trades from working in areas during application of coatings.

3. Mask all surrounding adjacent surfaces to provide neat, clean, true juncture lines with adjacent surfaces.

1.8 WARRANTY

1. The work and materials of this Section shall be under warranty in accordance with GC.12.3 of CCA 17-2020, but for a period of three years from the date of Architect's Certificate of Substantial completion.

2. Damage due to structural failure of base, surface water seepage or abnormal abuse excepted.

3. Crazing, blistering, fading, bond failure and softening shall be taken as defects.

1.9 SCOPE

1. Install special coatings at all wall and ceiling surfaces and on all miscellaneous metals at all corridors, washrooms and Gymnasium and all locations where special coating is noted on the tender documents.

2. Install full height at all rooms except Gymnasium. At Gymnasium install to 2200mm above finish floor.

PART 2 PRODUCTS

2.1 MATERIALS

1. Coating: At all areas where special coating is indicated on drawings and on Room Finish Schedule, only those products listed below shall be used, unless approved by the Architect in writing 10 days prior to tender closing:

    1. Glidden Water Borne Epoxy TRU-GLAZE WB 4406 Semigloss.

    2. "Everpoxy", manufactured by Canadian Everspec Surfaces Ltd.

    3. "Epoxal 3:1" manufactured by Niagara Protective Coatings Ltd.

2. Provide approved primers by coating manufacturer for each surface condition coating is to be applied over.

3. Accessories: thinners, glaze, cleaning agents, masking tapes and spraying equipment shall be type recommended by plastic paint manufacturer to suit each specific condition encountered on this project.

4. Colour: Colours and clear glaze to be selected by Architect from manufacturer's full range of colours.

2.2 MIXES

1. Mix coatings in strict accordance with manufacturer's directions based on 100% solid colour for ceiling and wall applications.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

1. Apply manufacturer's recommended block filler on masonry block and on porous concrete surfaces to produce a uniform surface texture free from pits and voids. NOTE: Install sufficient block filler as required by block texture to completely fill block.

2. Note: **Pinholes will not be allowed.**

3. Seal gypsum wallboard and plaster with one coat of manufacturer's primer.

3.2 APPLICATION

1. Apply min. two finish coatings to all walls in all rooms as noted in the room finish schedule. NOTE: all special coated rooms to have special coating installed full height of all walls except gymnasium to be up to 12'-0".

2. Apply coatings before adjacent work is painted.

3. Apply coating before heating grilles, convectors, plumbing fixtures, hardware, resilient floor coverings, carpeting, mirrors, acoustic tile and all other equipment occurring on or adjacent to surfaces scheduled to receive the coating, are installed.

4. Do not apply coating over non-hardening sealants or caulking materials.

5. Apply coatings in strict accordance with manufacturer's instructions.

6. Finished work shall be even, uniform in colour and appearance, free from marks, runs, craters or other defects detrimental to appearance or performance and shall match approved samples.

7. Dry film thickness excluding filler coats shall be minimum 15 mils. (.38 mm).

8. Seal around all fixtures and fittings protruding through coating.

9. Upon completion remove masking and clean adjacent surfaces free of overspray.

3.3 MAINTENANCE MATERIALS

1. Provide two sealed cans, one litre capacity of each product in each colour (max. 4 cans) used in Work for Owner's use in maintenance work.

2. Container to be new fully labelled with manufacturer's name, type of paint, and colour.

END OF SECTION

1. GENERAL

1. GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

2. SUBMITTALS

1. Samples

1. Prepare samples of various finishes for Architect's approval either on site or by submitting samples as directed, at least thirty days before materials are required. Submit samples in triplicate on 8" x 12" (200 mm x 300 mm) material. Identify each sample as to job, finish, formula, colour name, number, sheen name and gloss units, date and name of Subcontractor.

3. PRODUCT HANDLING

1. Delivery and Storage

1. Deliver materials to site in their original containers with label intact and store in spaces directed by Architect. Keep stored materials covered at all times and take all necessary precaution against fire.

2. Provide C02 fire extinguisher of minimum 20 lbs. (9 kg.) capacity in storage area.

4. ENVIRONMENTAL CONDITIONS

1. Do not paint or finish in unclean or improperly ventilated areas. Do not paint in temperatures lower than 50 degrees F. (10 degrees C.) or varnish in temperatures lower than 65 degrees F. (18 degrees C.) for 24 hours before, during and 48 hours after application.

2. Do not undertake exterior painting at temperatures under 50 degrees F. (10 degrees C.) for 24 hours before, during and 48 hours after application or immediately following rain, frost or dew. Safe levels shall be determined by use of an electronic meter.

3. Test for moisture content in each location immediately before commencing application of paint. Do not apply paint on surfaces where moisture content exceeds 14%. Promptly notify Consultant if such conditions are encountered.

4. Provide approved equipment for testing moisture content of surfaces to receive paint finishes and have available on Site at all times during Work of this Section.
5. Do not apply paint finish in areas where dust is being generated

5. PROTECTION

1. Provide metal pans or adequate tarpaulin to protect floors in areas assigned for the storage and mixing of paints.

2. Use sufficient drop cloths and protective coverings for the full protection of floors, furnishings and work not being painted.

3. Leave above areas clean and free from evidence of occupancy upon completion of painting.

4. Protect paint materials from fire and freezing.

5. Keep waste rags in metal drums containing water and remove from building at end of each working shift.

6. RELATED WORK SPECIFIED ELSEWHERE

1. Read carefully all other Sections of the specifications to determine the extent of prime and finish coats applied by others.
2. Asphalt Paving Markings - Section 02610
3. Concrete Floor Sealer - Section 03300
4. Wood preservative for Rough Carpentry - Section 06100.
5. Wood Athletic Flooring – Section 09551
6. See Mechanical and Electrical Sections for extent of baked enamel finish on equipment.

7. FINISH CARPENTRY & ARCHITECTURAL MILLWORK

1. All cabinet millwork must be finished in the shop by Section 06400. All other finish carpentry materials (including miscellaneous brackets for benches) to be finished by Section 09900.

8. SCOPE OF WORK

1. With exceptions noted in 1.6 and 1.7 above or specifically called for in other Sections of the Specification, all paintwork is included in the scope of this Section

2. NOTE: In locations where Drawings do not call for paint or similar finish on walls and/or ceilings, the intent of this Specification is that all exposed unpainted metal surfaces shall be painted.

3. Paint exposed drywall and the like in locations where finish is not otherwise specified or noted. Do not paint such surfaces in mechanical shafts, unless specifically noted.

4. In locations where Drawings do not call for paint or similar finish on walls and/or ceilings, the intent of this Specification is that items such as new

work, including miscellaneous metalwork, shall be painted.

5. Paint pipes, conduit, ducts and related thermal insulation and all prime painted mechanical and electrical equipment and supports located in mechanical and electrical storage and maintenance rooms in allocations where Drawings call for paint or similar finish on walls and/or ceilings.

6. Do not paint pipe, conduit, ducts, insulation and the like where concealed above ceilings (except louvred type ceilings) or in service shafts.

7. Make good paint finish on shop coated work where damaged.

8. Paint visible portions of steel shelf angles, lintels and structural steel.

9. Paint all edges and all faces of doors where primed for paint supplied.

10. Stain all top, bottom and side edges of all plastic laminate doors.

11. Interior of ducts and diffusers visible from exterior on room side.

12. Paint all roof top equipment, stairs, pipes, conduit, vents, ducts, pipe insulation, etc. exposed on roofs (including primed and prefinished items).

13. Allow for fifteen (15) different paint colours to be used in the building - including field, accent walls and bulkheads and four (4) exterior paint colours.

9. QUALITY ASSURANCE AND REFERENCES

1. Paint work shall meet or exceed standards set out in C.G.S.B. Specification No.'s 85-GP-1M to 85-GP-33A and C.P.C.A. Canadian Painting Contractors Association - Painting Manual.

2. Employ fully trained workers who are regularly employed in this field.

3. Manufacturer's sales representative shall perform inspections on the Owner's behalf in order to ensure compliance with product specifications.

10. RETOUCHING

1. Do all retouching, etc. to ensure that the building may be handed over to the Owner in perfect condition, free of spatter, finger prints, rust, watermarks, scratches, blemishes or other disfiguration.

11. TEST AREA

1. A room or area in the building will be designated by the Architect as a test area to establish standard of workmanship, texture, gloss and coverage.
2. Prior to any painting being started, request a meeting on Site between Architect, Contractor, Subcontractor and Material Manufacturer's

Representative to review conditions, surfaces, anticipated problems and to clarify quality of workmanship acceptable to Architect.

3. Apply finishes to each type of surface within room with correct material, coats, colour, texture and degree of gloss in sample area and have same approved prior to providing Work of this Section.

4. Retain test area until after completion of Work. Test area to be minimum standard for the Work.

5. Failure to comply with the above will be cause for Architect to request all Work previously painted to be repainted.

2. PRODUCTS

1. MATERIALS

1. "Top Line" products only are acceptable. Use only products of manufacturers whose best quality lines meet or exceed CGSB Specifications for the particular type of material required. Approved manufacture and product unless specifically indicated otherwise in specification: Substitutions , alternates as per section 01500

1. Paints, stains and varnish:
   a) General Paint
   b) Benjamin Moore
   c) Sherwin Williams
   d) Zinsser
   e) Glidden/Devoe Coatings
   f)Dulux

2. **P1-**Field Paint, Walls, Manufacturer- Sherwin Williams, Color- Drift of Mist, SW 9166
   1. Sheen Level: Walls- Eggshell.
   2. SC Denotes Special Coating.

3. **P2-**Accent Walls, Manufacturer- Sherwin Williams, Color- White Truffle, SW 6029, Application -walls.
   1. Sheen Level: Walls- Eggshell.
   2. SC Denotes Special Coating.

4. **P3-**Accent Walls, Paint, Manufacturer- Sherwin Williams, Color – Aleutain, SW 6241, Application Gym accent line.
   1. Sheen Level: Walls- Eggshell.
   2. SC Denotes Special Coating.

5. **P4-**Accent Walls, Paint, Manufacturer- Sherwin Williams, Color – Vaguely Mauve, SW 6015, Application walls.
   1. Sheen Level: Walls- Eggshell.

2. SC Denotes Special Coating.

6. **P5-**Accent Walls, Paint, Manufacturer- Sherwin Williams, Color – North Star, SW 6246, Application walls.
   1. Sheen Level: Walls- Eggshell.
   2. SC Denotes Special Coating.

7. **P6-**Accent Walls, Paint, Manufacturer- Benjamin Moore, Color – Steely Gray, Steely Gray, SW7664, Application Gym Accent Line
   1. Sheen Level: Walls- Eggshell.
   2. SC Denotes Special Coating.

8. **P7-** Interior Doors, Manufacturer- Dulux, Color – Colour to match Veneer-stained Door, Application- Hollow metal Doors
   1. Sheen Level: Semi-Gloss.

9. **P8-**Interior Door Frame, Manufacturer- Dulux, Color -Stone's throw, DLX 1008-7 Application -Door Frames.
   1. Sheen Level: Semi-Gloss.
   2. SC Denotes Special Coating.

10. **P9-** Learning common ceiling, Manufacturer- Sherwin Williams, Color – Dorian Grey, Sw-6275-**SC**, Application walls.
    1. Sheen Level: Walls- Eggshell.
    2. SC Denotes Special Coating.

11. **P10-** Lower stair wall paint, Manufacturer- Sherwin Williams, Color – Fashionable Grey, DLX 1005-5, Application Stair Stringer
    1. Sheen Level: Walls- Eggshell,
    2. SC Denotes Special Coating.

12. **P11-** Accent walls paint, Manufacturer- Sherwin Williams, Color – Black Swan, SW 6279, Application walls.
    1. Sheen Level: Walls- Eggshell.
    2. SC Denotes Special Coating.

13. **P12-** Ceiling paint, Manufacturer- Sherwin Williams, Color -, High Reflective White, SW 7757, Application ceilings, bulk heads, exposed ceilings, as per drawings.
    1. Sheen Level: Walls- Eggshell.
    2. SC Denotes Special Coating.

14. **P13-** Exposed Ceiling, Manufacturer- Sherwin Williams, Color - Racoon Fur, SW 2126-20, Application ceilings, bulk heads, exposed ceilings, as per drawings.

1. Sheen Level: Walls- Eggshell.
2. SC Denotes Special Coating.

15. Latex Water Based Epoxy
    - Sherwin Williams B70W00211 - Waterbased catalyzed epoxy extra white/
      Tint base A/B60V00025 - Waterbased Catalyzed epoxy Semi Gloss Hardner Part B
    - Glidden - 4420 - True Glaze Waterborn epoxy / 4426 True Glaze semi gloss converter
      Glidden Ultra Interior Latex

16. Latex Supper Adherent Primer,
    - General Paint 51-050 Premium Latex Plastic Primer
    - Benjamin Moore #23-00 Freshstart Acrylic Primer Sealer
    - Zinsser 1-2-3 Acrylic Primer Sealer
    - Sherwin-Williams - B51WQ8850 - Adhesion Prm White
    - Glidden Latex super undercoat 94280

17. Interior Latex Block Filler, C.G.S.B. Standard #-GP-188M
    - General Paint 70-224 Premium Latex Block Filler
    - Benjamin Moore #595-01 Latex Block Filler
    - Glidden #362650 Concrete Block Filler
    - Sherwin-Williams B42W00046 Heavy Duty Block Filler

18. Stain Suppressant Sealer/Primer Hi-Hide, C.G.S.B. #1-GP-119M (where required)
    - General Paint 60-200 X-Terminator 2 Latex Sealer
    - Zinsser BIN Primer, hi-hide (spot prime only)
    - Zinsser Bullseye Odourless
    - Sherwin-Williams - B49WQ8820 Multipur LTX Pr Wh
    - Glidden/Jammer 200

19. Clear Wood Trim and Panel Finish
    - General Paint 25-011 Urethane Semi-Gloss
    - Benjamin Moore & Co. Ltd. #435 Low Lustre Alkyd Urethane.
    - Glidden #90333 Urethane Varnish.

Note: Colours will be selected from Dulux, Sherwin-Williams colour system. Color formulas must be matched if one or other approved alternate manufacturers are being used. Allow for 15 paint colours to be selected. Refer to Interior Finish Schedule for colour information.

20. Fire Retardant Clear Coat at all exposed wood panels: Quantum Safe Coat Clear Fire-Retardant Coating or equal by Ocean Products.

21. Typical Furniture Finish of all Wood Millwork, wood trim, panels, etc. (by Sections 06200 and 06400): shall be polymerizing two component catalytic varnish system equal to "Duravar Plus"

manufactured by M. L. Campbell. The individual components of the system used must be chemically compatible to assure perfect adhesion and a top quality, durable final finish.

22. Thinners, cleaners: Type and brand recommended by the paint manufacturer.

23. Materials to be new and first line of manufacturer. Follow recommendations / Specifications from manufacturer & use product as applicable for each area.

24. Deliver materials to site in original unbroken containers bearing brand and manufacturer's name.

3. EXECUTION

1. CONDITION OF SURFACES

1. Check all surfaces with electric moisture metre and do not proceed if reading is higher than 12-15 without written permission from Architect.

2. Proceed with work only when surfaces and conditions are satisfactory for production of a first class job.
3. Clean and remove dust, grease, rust and extraneous matter from all surfaces (except that rust occurring on items specified to be primed under other sections shall be removed and worked reprimed under these sections).

4. The commencing of work in a specific area shall be construed as acceptance of the surfaces, and thereafter the contractor shall be fully responsible for satisfactory work as required herein.
5. All surfaces shall be prepared in accordance with Chapter 2 for Interior Work of the Master Painters and Decorators Association Painting Manual latest edition.

6. Prepare surfaces in accordance with paint covering manufacturer's instructions.

2. PREPARATION

1. Concrete and Masonry

1. Test surfaces for alkalinity with pink litmus paper or other recognized method.

2. Where extreme alkalinity occurs, wash surface with 4% solution tetrapotassium pyrophosphate (5 oz. per gallon (31 ml./l.) of water) where latex base paint is to be used and with zinc sulphate solution (3 lbs. per gallon (300 g./l.) of water where other paint bases are to be used.)

3. Etch normal concrete surfaces to receive alkyd paint with muriatic acid solution (1 part commercial) 31.45% to 3 parts water. Neutralize and allow to dry before painting.

4. Prepare masonry concrete surfaces to CGSB 85-GP-31M.

2. Metal

1. All metal surfaces to receive coatings shall be cleaned to SSPC-SP1 (solvent washing) prior to painting as specified herein.

2. Touch-up shop primed metal after first removing loose primer, rust, oil, grease and other contaminants.

3. All metal surfaces exposed and/or exhibiting rust shall be cleaned to SSPC-SP2 or SSPC-SP3 standards and primed with an approved rust inhibitive primer prior to recoating as specified.

4. Feather edges to make touch-up inconspicuous when applying new primer.

5. Conform to CGSB 1-GP40d.M to CGSB 85-GP-14M.

3. Galvanized Surfaces

1. For Primer Application Type C Corrosive ensure that all surfaces to be painted are clean, dry, and free of all contaminants.

2. Cleaning of existing surfaces to be conducted according to SSPC-SP-4 Flame Cleaning procedure. Pass high temperature, high velocity, oxyacetylene flames over entire surface and then wire brushing. Primer is to be applied before surface is cool.

3. Phosphatize galvanized metal surfaces using CGSB 31-GP-105M pretreatment or prime with galvanized metal primer.

4. Woodwork

1. Inspect millwork, trim and panels to assure surfaces are smooth, free from machine marks and that nailheads have been countersunk. Seal all knots and sapwood in surfaces to receive paint, with a vinyl sealer compatible with finish specified conforming to CGSB 1-GP-125b.

2. Sand smooth all woodwork which is to be finished and clean surfaces free of dust before applying first coat. Fill nail holes, splits and scratches with non-shrinking filler conforming to CGSB 1-GP-103b after first coat is dry. When these occur on a transparent

surface, filler shall be stained to match the finish as approved by Architect. Between coats, sand lightly with No. 00 sandpaper and remove dust.

3. Prime all wood noted for paint finish immediately on delivery to site.

4. Back paint all wood noted for stain, varnish or Intumescent fire retardant clear coating or natural finish.

5. Prepare all wood surfaces to CGSB-85-GP-1M.

5. Hardware

1. Remove finishing hardware, electric cover plates and accessories, mask any that are not removable. Replace these when paint is dry and clean them. Do not clean hardware with solvent that will remove permanent lacquer finish.

6. Gypsum Wallboard

1. For small holes, scratches or other surface marks fill with patching compound and sand smooth.

2. For larger holes or damaged areas do not proceed until trade for original work has filled or repaired surfaces to acceptable levels.
3. Prepare wallboard surfaces to CGSB-85-GP-33M.

7. Copper

1. Prepare copper piping and accessories to CGSB 85-GP-20M.

8. General

1. Mask specification plates occurring on equipment, switch boxes, and similar items requiring painting.

2. Protect, remove and replace hardware, accessories, lighting fixtures and similar items as required.

3. Conform with Architect's colour schedules and exactly match approved samples.

3. APPLICATION

1. Finishes and number of coats specified in the schedule are intended to cover surfaces perfectly. If they do not, apply further coats until perfect coverage and colour are achieved as required.

2. Any areas exhibiting incomplete or unsatisfactory coverage shall have the

entire plane painted. Patching will not be acceptable.

3. Walls needing repainting, entire wall (plane) shall be painted to the satisfaction of the Architect. See drawings for extent of work.

4. Spray painting will not be permitted (except at metal deck and joist areas) unless specifically approved in writing by the Architect in each instance. Architect may withdraw approval at any time and prohibit spray painting for reasons such as carelessness, poor masking or protection measures drifting paint fog, disturbance to other Trades or failure to obtain a dense, even, opaque finish. Spray painting shall be full double coat, i.e. at least two passes for each coat. Do not use spray or roller on wood or metal surfaces, brush only unless approved in writing by Architect. Spray painting and backroll may be permitted on concrete blocks.

5. Arrange to have traffic barred from completed areas wherever possible.

6. Apply materials in strict accordance with manufacturer's directions and specifications and be familiar with these directions and specifications.

7. Prime woodwork as soon as possible after woodwork is delivered to site. Prime all surfaces, whether exposed or not, before installation. In case of woodwork which is to be stained, apply one coat of penetrating sealer to all finish surfaces of wood having uneven absorption, such as birch. Woods of uniform density such as oak shall be left unsealed. Back prime stained and varnished woodwork with one coat of gloss varnish reduced 25%. Fill open grain woods with filler tinted to match wood when transparent finish is required, and work well into grain. Before filler sets, wipe excess from surface.

8. Apply primer-sealer coats by brush or roller method. All primers and undercoats to be tinted to no more than 25% of intensity of the finish colour.

9. Permit paint to dry before applying succeeding coats, touch up suction spots and sand between coats with No. 00 sandpaper.

10. Where two coats of the same paint are to be applied, the first coat shall be the same colour as the finish coat and be inspected by the Architect before application of final coat, to allow the Architect to make reasonable modification of colour if necessary. Furnish Architect with a schedule showing expected completion of the respective coats of paint for the various areas and surfaces. Keep this schedule current as the job progresses.

11. Exterior paints and deep/intense interior and exterior colours shall be from the nearest factory premixed colour selection and shall be alterable to match required colours.

12. Flat and semi-gloss finishes on gypsum wall board, block and other surfaces of large areas shall be applied by roller and to all other surfaces applied by

brush.

13. Paint shall be uniform in sheen, colour and texture, free from brush or roller marks, sags, runs or other defects.

14. Finish edges of doors (top, bottom, sides and cutouts) with paint or stain treatment as required to match face of door. Stain top and bottom edges a different colour and seal with one coat of shellac and one coat gloss varnish or two coats paint. Refinish tops and edges of wood doors after fitting.

15. Even up stained woodwork in colour as required by nature of wood and as directed by Architect. Apply same finish on trim, fitments, cupboards and other protecting ledges as on surrounding work, disregard sight lines.

16. Carefully hand smooth and sandpaper wood between coats (including priming). Apply one coat sealer before applying first coat paint filler to knots or sap blemishes on wood surfaces to receive paint or stain finish.

17. Remove rust, oil, grease and loose shop paint from metal work by brushing or with wire brushes and make good shop coat before proceeding with final finish. Feather out edges to make touch up patches inconspicuous.

18. After first coat, fill nail holes, splits, and scratches, using putty coloured to match finish.

19. Clean castings with wire brush before application of first paint coat.

20. Do not etch galvanized metal. Prepare prime and paint elsewhere in this section. This includes metal door frames and the like with wiped zinc coating.

21. Remove form oil or parting compounds from concrete surfaces. Use Xylol or approved compound.

22. Paint interior of pipe spaces, ducts, etc. visible through grilles or through metal ceilings in black matt finish.

23. Conform with Architect's colour schedule and exactly match approved samples.

24. <u>Mechanical and Electrical Materials</u>

    1. Refer to Mechanical and Electrical Sections of the Specifications and note the instructions regarding painting and finishing of materials and equipment supplied and installed by those trades. In general paint mechanical and electrical items prime painted as installed.

2. Remove grilles, covers, access panels for mechanical and electrical systems from location and paint separately, if these items are not factory finished.
3. Paint work to match adjacent walls and ceilings unless directed otherwise. Note: This includes trim on fixtures exposed, speaker covers, emergency lights, grilles, diffusers, louvres, vents, fire extinguisher cabinets, electrical panels, etc.

4. Paint interior surfaces that are visible through grilles and louvres with one coat of flat black metal paint to limit of sight line.

5. Where walls and ceilings are not scheduled to be painted, the work described above shall be painted a colour selected by Architect.

6. Unless factory painted, all exposed piping, conduits, ductwork hangers, insulation and mechanical equipment shall be painted.

25. Rooms without finished ceilings will have decks, joists, beams, ducts, etc., painted.

26. Paint graphics as shown on drawings. All graphics to be semi-gloss minimum two coat application.

4. ADJUST AND CLEAN

1. Cracks occurring in walls or ceilings requiring patching during "warranty period" shall be repainted in such a way that the patch is not visible at a distance of 5'-0" (1500 mm).

2. If patch painting not acceptable repaint entire wall or ceiling surface.

3. At completion clean entire area of surplus materials and equipment.

5. FIELD QUALITY CONTROL

1. Locate testing area in building to establish standard of workmanship, texture, gloss and coverage where designated.

2. Apply samples of all finishes on each type of surface to be coated with correct material, number of coats, colour, texture and degree of gloss required.

3. Retain test area until completion of work. Use approved work in test areas as standard for corresponding work throughout building. Correct and refinish work which does not compare with approved finishes.

6. FINISH SCHEDULE

1. General

1. Finish the listed exposed surfaces, wherever they occur unless such surfaces are specifically noted to be left unfinished.

2. Exposed means visible in the completed work and includes the interior of closets, cabinets and drawers.

3. The Architect shall have the option of having wood painted or with transparent finish and of which finish shall be used.

4. In instances where materials specified are not suitable for a particular job application, or are contrary to manufacturer's recommendations for use on a particular surface, such condition shall immediately be brought to the attention of the Architect for clarification and instructions.

5. Finishes shall match approved samples but Architect reserves the right to make reasonable changes to finish specifications to obtain desired results without additional cost or obligation of Owner.

6. Please refer to drawings I-#02 Wall Finish Plans and legends for wall finishes specifications and their associated locations. The final selection of colours and surface textures of all finishes throughout and whether finishes are transparent (natural) or opaque (paint) shall rest solely with the Architect.

7. Where surfaces have been disturbed the entire plane shall be painted.

2. Exterior Schedule

1. Metal (Ferrous): One coat rust inhibitive primer (metal surfaces already primed need not receive a field prime coat except for touch up). Two coats exterior Aura paint by Benjamin Moore.

   Note: All roof top equipment, pipes, conduit, vents, ducts, grilles, pipe insulation, etc. to be painted.

2. Galvanized Steel: One coat galvanized primer. Use a Polyamide converted epoxy primer by Devoe Coatings, "4170-1000 with 4170-999 - catalyst". Two coats of galvanized Finish Coat. Use a single package tough, durable alkyd modified urethane coating with water, chemical and solvent resistance by Devoe Coatings "Devoe" Glid Shield Urethane Gloss Enamel No. 4328-0100 Series (installation within 72 hours of installing primer).

   Note: All exterior areas are to be painted including stairs, masonry lintels, etc.

3. Painted Wood Surfaces: One coat wood primer. Two coats exterior Aura paint by Benjamin Moore.

4. Stained Pressure Treated Wood or Cedar: Two coats solid hide Aborite stain and one Clear Top Coat both by Benjamin Moore.

3. Interior Schedule

1. Metal (Ferrous): One coat latex super adherent primer (metal surfaces already primed need not receive a field prime coat except for touch up). Apply two coats latex water based epoxy 2 coats.

2. Hot Ferrous Metal - (Valve bodies, strainers, etc., on high temperature lines.) - One coat primer, latex super adherent heat resistant - Two coats latex water based epoxy.

3. Galvanized Steel: One coat galvanized primer. Use a Polyamide converted epoxy by Devoe Coatings "4170-1000 with 4170-9999-catalyst". Two coats of galvanized Finish Coat. Use a single package tough, durable alkyd modified urethane coating with water, chemical and solvent resistance by Devoe Coatings "Devoe Glid Shield Urethane Gloss Enamel No. 4328-0100 Series (install within 72 hours of installing primer).

4. Hollow Metal Doors, Metal Ducts, etc.: One coat super adherent primer. Two coats latex water based epoxy.

5. Metal Roof Decks and Joists: One of the approved primer finish combinations as follows:

.1.1 General Paint 10900 Alkyd Dryfall Primer. Apply one coat: spread rate, 250 square feet per 3.78 litre container on smooth surfaces and 75 square feet on corrugated steel. Each coat wet thickness: 4.6 mils. Each coat dry thickness: 2.0 mils.

.1.2 General Paint 6000-Line or 33-Line. Apply two coats: spread rate 400 square feet per 3.78 litre container. Each coat wet thickness: 4.0 mils. Each coat dry thickness: 2.0 mils.

OR

.2.1 Benjamin Moore and Co. Ltd. #597-01 Sweep-Up Spray Latex Flat primer. Apply one coat: spread rate, 255 square feet per 3.79 litre container. Each coat wet thickness: 6.3 mils. Each coat dry thickness: 2.5 mils.

.2.2 Benjamin Moore & Co. Ltd. T-7688 Impervo or T-7721 Satin Impervo. Apply two coats: spread rate, 500 square feet per 3.79 litre container. Each coat wet thickness: 3.0 mils. Each coat dry thickness: 1.3 mils.

OR

.3.1 Glidden #10120 Spraymaster Latex Eggshell primer. Apply one coat: spread rate, 264 square feet per 3.78 litre container. Each coat wet thickness: 6.0 mils. Each coat dry thickness: 2.0 mils.

.3.2 Glidden #4308 Devguard. Apply two coats: spread rate, 320 square feet per 3.78 litre container. Each coat wet thickness: 5.0 mils. Each coat dry thickness: 2.25 mils.

6. Woodwork Painted: One coat super adherent primer. Two coats latex Ultra "94800" by Glidden.

7. Natural or Stained Close Grain Wood: One coat non-bleeding alkyd stain. One coat sanding sealer.
Approved Finish Clear Coats are as follows:

.1 General Paint 25-011 Urethane Semi-Gloss. Apply two coats: spread rate, 350 square feet per 3.78 litre container. Each coat wet film thickness: 4.0 mils. Each coat dry thickness: 1.5 mils.

OR

.2 Benjamin Moore & Co. Ltd. #435 Low Lustre Alkyd Urethane. Apply two coats: spread rate, 575 square feet per 3.79 litre container. Each coat wet thickness: 2.8 mils. Each coat dry thickness: 1.1 mils.

OR

.3 Glidden #90333 Urethane Varnish. Apply two coats: spread rate, 638 square feet per 3.78 litre container. Each coat wet thickness: 2.5 mils. Each coat dry thickness: 1.0 mils.

8. Natural Cedar Slat Ceilings: natural finish.

9. Natural or Stained Open Grain Wood: One coat stain filler. One coat sanding sealer.
Approved Finish Clear Coats are as follows:

.1 General Paint 25-011 Urethane Semi-Gloss. Apply two coats: spread rate, 350 square feet per 3.78 litre container. Each coat wet film thickness: 4.0 mils. Each coat dry thickness: 1.5 mils.

OR

.2 Benjamin Moore & Co. Ltd. #435 Low Lustre Alkyd Urethane. Apply two coats: spread rate, 575 square feet per 3.79 litre container. Each coat wet thickness: 2.8 mils. Each coat dry thickness: 1.1 mils.

OR

.3 Glidden #90333 Urethane Varnish. Apply two coats: spread rate, 638 square feet per 3.78 litre container. Each coat wet thickness: 2.5 mils. Each coat dry thickness: 1.0 mils.

10.1 Concrete Block: One coat latex block filler, applied at the minimum rate of 80 sq. ft per gallon (1.63 m2 per litre), or as required by block texture to completely fill block. **Pinholes will not be accepted.** Apply more block filler if necessary to completely fill the block before applying finish coats. Note that lightweight block requires more block filler to fill than standard weight block does and adjust application rate as required. Two coats interior Latex Semi-Gloss "Ultra 94800" by Glidden.

11. Exposed Insulated Pipes and Ductwork: One coat size. One coat super adherent primer undercoat. Two coats Ultra "94800" by Glidden eggshell.

12.1 Gypsum Wallboard (Base Price): One coat of Latex super adherent primer.. Two coats semi gloss Ultra "94800" by Glidden. Velvet or eggshell at walls and Low gloss at ceilings.

13. Surfaces Behind Grilles and Duct Work Where visible Within 12' (300 mm) of Grille:

1. Two coats vinyl latex matt black.

14. Painted Light Trims, Emergency Lights, Louvres, Diffusers, Vents, Concealed Sprinkler Covers, Fire Extinguisher Cabinets, and Electrical Panels, Etc.

1. One coat super adherent primer. Two coats Ultra "94800" by Glidden to match surrounding wall and ceiling colours or as specified by Architect.

15. Exposed Sealed Concrete Floors to be Painted

1. One coat Sikafloor 2001 Primer

2. One coat Sikafloor polyurethane UV in colour as selected by Architect from complete colour range.

3. Install floor primer and finish coat as per manufacturer's

printed installation instructions.

16. Flame Retardant Coating at Corridor Wood Ceiling and Wall Panels:

    1. One coat stain filler. One coat sanding sealer. Two (4 mil) coats Safe Coat Clear Fire Retardant Coating for a total min. 8 mil thickness.

17. General Notes

    1. See drawings for locations of areas where more than one colour occurs on one wall and one ceiling plane.

    2. Each ceiling bulkhead section or level may be a different colour.

    3. Wall planes may be designated a different colour from surrounding walls such as stairwells, entrances to classrooms, corridor intersections, gym (area below band one colour area above another) and Library. Classrooms to have one wall an accent colour.

    4. At stairwells and metal railings, allow for flatbars, pickets and stringers at stairs to be each painted a different colour. Maximum three colours to be chosen by Architect. Clarification detail will be issued with colour schedule after tender.

    5. Gymnasium walls acoustic sound block to be painted a different colour from surrounding wall. Allow for three colours to be chosen by Architect.

    6. Door frames may be one colour and door another colour.

7. WOOD FURNITURE FINISHES (By Section 06400)

    1. Natural or Stained Transparent Wood Furniture Finish: One coat non-bleeding alkyd stain. One coat sanding sealer. Two coats polymerizing two component catalytic conversion varnish system. "Duravar Plus" manufactured by M.L. Campbell and distributed by W. E. Saunders & Sons Painters Ltd. (519-582-2621). Flat, stain or gloss finish as directed by Architect.

    2. Interior of Wood Drawers: Three coats tinted sealer to inside sides, back and bottom.

    3. Unexposed Millwork Surfaces: Two coats of tinted sealer including backs of all base and wall cabinets, enclosures, etc.

8. MAINTENANCE MATERIAL

1. Provided one sealed can of four litre capacity, of each product in each colour used in the Work for Owner's use in maintenance work.

2. Container to be new fully labelled with manufacturer's name, type of paint, and colour.

3. Provide Owner 3 copies of paint formula for each colour and type of paint for Owner's maintenance manual.

END OF SECTION

PORT ELGIN COMMUNITY SCHOOL

INTERIOR FINISH SCHEDULE

BLUEWATER DISTRICT SCHOOL BOARD
Aug 26, 2026

BLUEWATER DISTRICT SCHOOL BOARD

+VG ARCHITECTS
THE VENTIN GROUP LTD

SUMMARY SCHEDULE :

FLOOR FINISHES:

1	**PT 1**	PORCELAIN TILE 1 (FIELD FLOOR) LOBBY	
2	**PT 2**	PORCELAIN TILE 2 (ACCENT FLOOR) LOBBY	
3	**PT 3**	PORCELAIN TILE 3 (ACCENT FLOOR) LOBBY	
4	**PT 4**	PORCELAIN TILE 4 (WASHROOM WALL) MALE	
5	**PT 5**	PORCELAIN TILE 5 (WASHROOM WALL) FEMALE	
6	**PT 6**	PORCELAIN TILE 6 (WASHROOM LOWER WALL)	
7	**PT 7**	PORCELAIN TILE 7 (WASHROOM WALL)	
8	**LVP**	LUXURY VINYL PLANK	
9	**VCT**	VINYL COMPOSITE TILE, CLASSROOMS	
10	**SAFT 1**	SAFETY FLOORING, LIFT, SERVERY	
11	**SF 1**	SPORTS FLOORING -1, GYM	
12	**SF 2**	SPORTS FLOORING -2, KINDERGARTEN	
13	**SF 3**	SPORTS FLOORING -3, GYM	
14	**RB**	RUBBER FLOORING, STAIRS	
15	**CAR 1**	CARPET TILE -1, LEARNING COMMONS, MEETING ROOM	
16	**C (S)**	SEALED CONCRETE	
17	**B1**	PORCELAIN TILE BASE	
18	**B2**	PORCELAIN TILE BASE	
19	**B3**	RUBBER BASE FINISH	

SUMMARY SCHEDULE :

TRANSITION FINISH :

1	T1	TRANSITION 1, SF/ VCT / LVT TO PORCELAIN	
2	T2	TRANSITION 2, WALL TILE TO FLOOR TILE FINISH	
3	T3	90 DEGREE EDGE PROTECTION PROFILE FOR TILE	

WALL FINISH :

1	**P1**	FIELD PAINT, WALLS (FIELD)	
2	**P2**	ACCENT WALLS, CLASSROOMS	
3	**P3**	GYM, ACCENT LINE	
4	**P4**	ACCENT WALLS, FEMALE WASHROOMS	
5	**P5**	ACCENT WALLS, MALE WASHROOMS	
6	**P6**	GYM, ACCENT LINE	
7	**P7**	INTERIOR DOORS	
8	**P8**	INTERIOR DOOR FRAMES	
9	**P9**	LEARNING COMMONS CEILING	
10	**P10**	LOWER STAIRCASE WALL	
11	**P11**	STAGE WALL	
12	**P12**	EXPOSED CEILINGS	

MILLWORK FINISH :

1	**PLAM 1**	STAGE	
2	**PLAM 2**	PLASTIC LAMINATE FINISH 2, LOBBY PANELS & CEILING	
3	**PLAM 3**	PLASTIC LAMINATE FINISH 3 COUNTER TOPS	
7	**MEL 1**	MELAMINE FINISH 1, MILLWORK CLASSROOMS	
9	**S&V**	STAIN & VARINSH (P.U) TO MATCH ADJACENT MILLWORK (MEL-1)	
11	**T.C**	TOILET CUBICLES	
12	**A.B**	ACOUSTIC BEAM- HUSH, LOBBY WALL CEILING	

PORCELAIN TILE FINISH (PT 1) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	COSMOPOLITAN
PRODUCT #:	
COLOUR:	GHIACCIO MATTE
SIZE:	12" X 24" (9.5MM THICK)
BASE:	As per Drawings
TRANSITION:	-
APPLICATION:	LOBBY FLOOR
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (PT 2) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	COSMOPOLITAN
PRODUCT #:	
COLOUR:	CREMA MATTE
SIZE:	12" X 24" (9.5MM THICK)
BASE:	As per Drawings
TRANSITION:	-
APPLICATION:	LOBBY & COMMON WASHROOM FLOOR
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (PT3) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	COSMOPOLITAN
PRODUCT #:	
COLOUR:	TORTORA MATTE
SIZE:	12" X 24" (9.5MM THICK)
BASE:	As per Drawings
TRANSITION:	-
APPLICATION:	LOBBY FLOOR
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (PT4) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	ANATOLIA
PRODUCT #:	CERMIC TILE- GLAZED, GLOSSY
COLOUR:	CLOUD BLUE
SIZE:	4" X 12" (6 MM THICK)
BASE:	-
TRANSITION:	-
APPLICATION:	WASHROOM WALL – MALE
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (PT5) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	ANATOLIA
PRODUCT #:	CERMIC TILE- GLAZED, GLOSSY
COLOUR:	SOFT SAGE
SIZE:	4" X 12" (6 MM THICK)
BASE:	-
TRANSITION:	-
APPLICATION:	WASHROOM WALL – FEMALE
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (PT6) :

MANUFACTURER	CENTURA TILE
CONTACT	JOHN MOFFIT
P:	613 820 6622
E:	jmoffitt@centura.ca
SERIES	GLOCAL
PRODUCT #:	
COLOUR:	TOFFEE
SIZE:	12" X 24" (8.5 MM THICK)
BASE:	As per Drawings
TRANSITION:	SCHLUTER SYSTEMS - DILEX-AHK, COVE-SHAPED PROFILE - PEWTER (TSG)
APPLICATION:	WASHROOM LOWER WALLS
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (PT7) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	ANATOLIA
PRODUCT #:	CERMIC TILE- GLAZED, GLOSSY
COLOUR:	HALO GREY
SIZE:	4" X 12" (6 MM THICK)
BASE:	As per Drawings
TRANSITION:	-
APPLICATION:	SINGLE WASHROOM WALLS
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

LUXURY VINYL PLANK (LVP) :

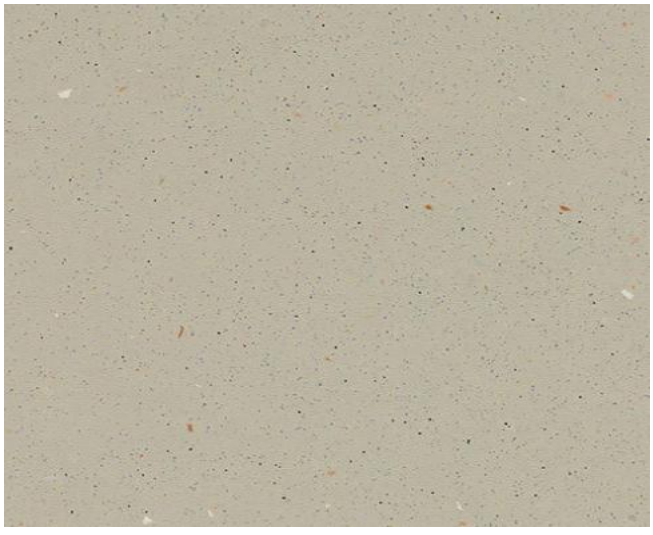
MANUFACTURER	POLYFLOR
CONTACT:	ZENA BITAR
P:	2647 824 7659
E:	zenabitar@plyflor.ca
SERIES	EXPONA COMMERCIAL PUR
PRODUCT #:	EVEREST OAK
COLOUR:	4134
SIZE:	203.2 X 1219.2 mm, (2.5mm thick)
BASE:	As per Drawings
APPLICATION:	REFER RELEVANT FLOORING LAYOUT PLAN
GENERAL NOTES:	

VINYL COMPOSITE TILE (VCT 1) :

MANUFACTURER	Tarkett
CONTACT:	
P:	
E:	
SERIES	Tarkett VCT II
PRODUCT #:	Twilight
COLOUR:	880
SIZE:	12" X 12" (1/8" Thick)
BASE:	As per Drawings
TRANSITION	-
APPLICATION:	REFER RELEVANT FLOORING LAYOUT PLAN
GENERAL NOTES:	

SAFETY FLOORING (SAFT 1) :

MANUFACTURER	FORBO
CONTACT:	PAULA SWANBOROUGH
P:	289 208 0258
E:	paula.swanborough@forbo.ca
SERIES	ETERNAL STEP
PRODUCT #:	WARM MORTAR
COLOUR:	172312
SIZE:	2MM THICK
BASE:	As per Drawings
TRANSITION	-
APPLICATION:	REFER RELEVANT FLOORING LAYOUT PLAN
GENERAL NOTES:	



SPORT FLOORING (SF 1) :

MANUFACTURER	TARKETT
CONTACT:	GREG GIBBONS
P:	416 200 4014
E:	greg.gibbons@tarkett.com
SERIES	OMNISPORT ACTIVE+
PRODUCT :	HETEROGENEOUS VINYL SPORT FLOORING
COLOUR:	MAPLE GREY
SIZE:	8.1 THICK
BASE:	As per Drawings
TRANSITION	-
APPLICATION:	GYM ACCENT FLOORING
GENERAL NOTES:	REFER TO MASTER SPECIFICATION FOR FULL SPEC

SPORT FLOORING (SF 2) :

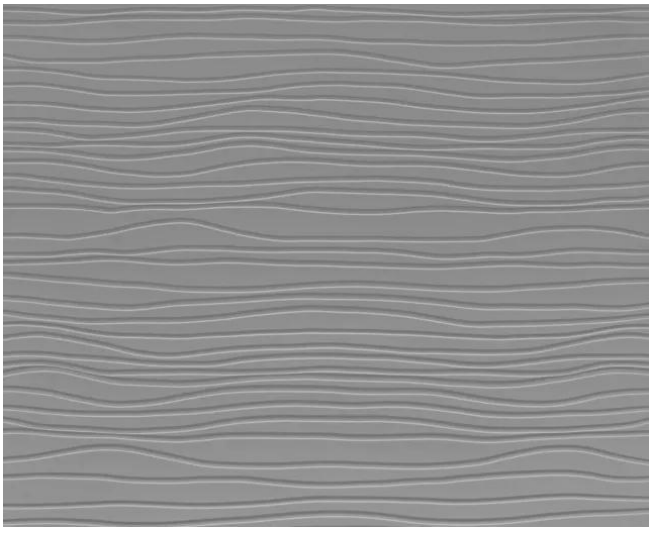
MANUFACTURER	TARKETT
CONTACT:	GREG GIBBONS
P:	416 200 4014
E:	greg.gibbons@tarkett.com
SERIES	OMNISPORT Speed
PRODUCT :	HETEROGENEOUS VINYL SPORT FLOORING
COLOUR:	Nordic Oak
SIZE:	3.5 MM THICK
BASE:	As per Drawings
TRANSITION	-
APPLICATION:	FAMILY, TODDLER & PRESCHOOL FLOORING
GENERAL NOTES:	REFER TO MASTER SPECIFICATION FOR FULL SPEC

SPORT FLOORING (SF 3) :

MANUFACTURER	TARKETT
CONTACT:	GREG GIBBONS
P:	416 200 4014
E:	greg.gibbons@tarkett.com
SERIES	OMNISPORT ACTIVE+
PRODUCT :	HETEROGENEOUS VINYL SPORT FLOORING
COLOUR:	BEECH,
SIZE:	8.1 THICK
BASE:	As per Drawings
TRANSITION	-
APPLICATION:	GYM FIELD FLOORING
GENERAL NOTES:	REFER TO MASTER SPECIFICATION FOR FULL SPEC

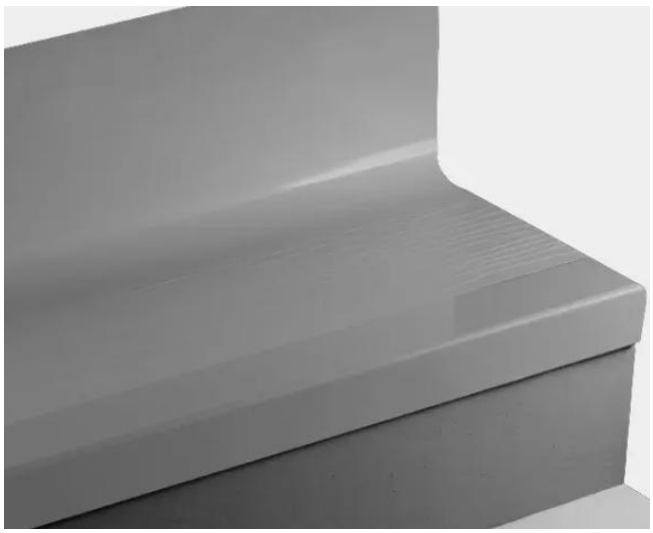
RUBBER FLOORING (RB) : STAIR LANDINGS

MANUFACTURER	TARKETT
CONTACT:	GREG GIBBONS
P:	416 200 4014
E:	Greg.gibbons@tarkett.com
SERIES	TARKETT RUBBER TILES
PRODUCT :	BMRTS TA5 1/8
COLOUR:	BAMBOO SOILD TA5, COLONIAL GREY
SIZE:	24 X 24
BASE:	As per Drawings
APPLICATION:	LANDINGS
GENERAL NOTES:	REFER TO MASTER SPECIFICATION FOR FULL SPEC, TO BE SAME THICKNESS AS ADJACENT FLOORING



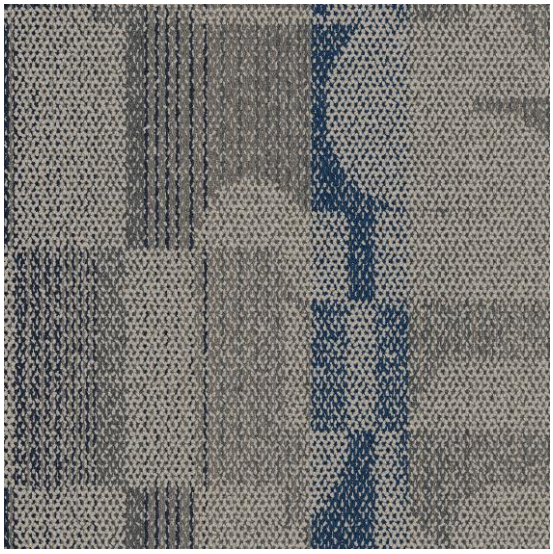
RUBBER FLOORING (RB) : STAIR TREADS & RISERS

MANUFACTURER	TARKETT
CONTACT:	GREG GIBBONS
P:	416 200 4014
E:	Greg.gibbons@tarkett.com
SERIES	JOHNSONTE ANGLEFIT RUBBER STAIR TREAD WITH INTEGRATED RISER
PRODUCT :	BAMBOO TREAD/ RISER VISUALLY IMPARED
COLOUR:	BAMBOO SOILD TA5, COLONIAL GREY
SIZE:	AS PER DRAWINGS
BASE:	
APPLICATION:	STAIRS & TREADS
GENERAL NOTES:	REFER TO MASTER SPECIFICATION FOR FULL SPEC



CARPET TYPE -1 (CAR 1) :

MANUFACTURER	INTERFACE
CONTACT:	SCOTT REYNOLDS
P:	416 580 3063
E:	scott.reynolds@interface.com
SERIES	DRAW CONCLUSIONS
PRODUCT :	INDIGO
COLOUR:	108786
SIZE:	500 X 500 MM (3mm Thick)
BASE:	AS PER DRAWINGS
TRANSITION	
APPLICATION:	LEARNING COMMONS FLOORING
GENERAL NOTES:	REFER TO FLOORING DRAWING FOR LAYOUT PATTERN



SEALED CONCERETE: C(S) :

MANUFACTURER	SIKAFLOR PRODUCTS
BASE:	REFER DRAWINGS
INSTALLATION	REFER TO FLOOR FINISH PLAN & SPECIFICATION SECTION 09900 FOR LOCATION & PRODUCT INFO INSTALL AS PER MANUFACTURERS RECOMMENDATIONS.

PORCELAIN TILE BASE : (B1) :

MANUFACTURER	EURO TILE
CONTACT	MAYME LIN
P:	613 808 7834
E:	mayme.lin@eurotilestone.com
SERIES	COSMOPOLITAN
PRODUCT #:	
COLOUR:	TORTORA MATTE
SIZE:	12" X 24" (9.5MM THICK)
BASE:	
TRANSITION:	T2 & T3
APPLICATION:	4" BASE
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

PORCELAIN TILE FINISH (B2) :

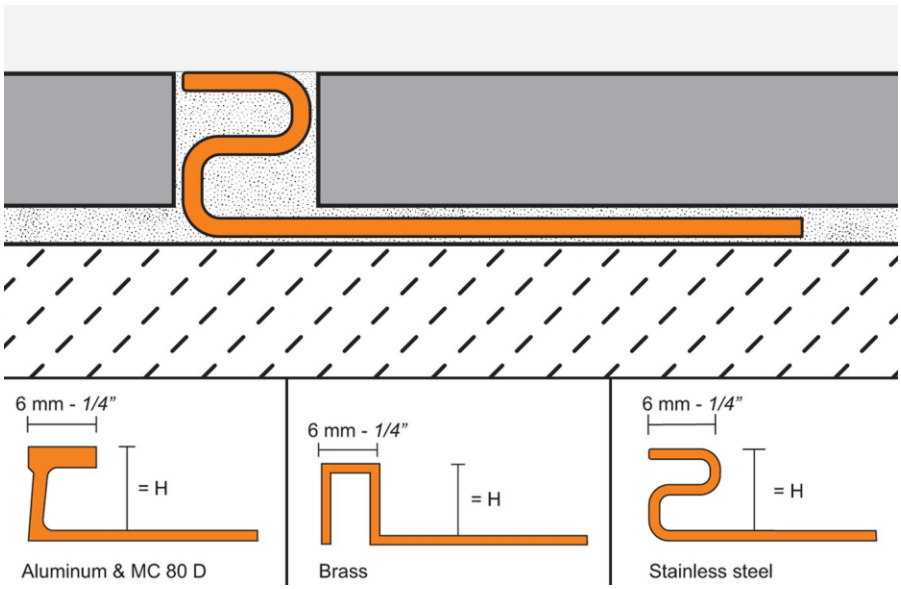
MANUFACTURER	CENTURA TILE
CONTACT	JOHN MOFFIT
P:	613 820 6622
E:	jmoffitt@centura.ca
SERIES	GLOCAL
PRODUCT #:	
COLOUR:	TOFFEE
SIZE:	12" X 24" (8.5 MM THICK)
BASE:	-
TRANSITION:	T2 & T3
APPLICATION:	WASHROOM LOWER WALLS
GROUT :	GROUT COLOR TO MATCH TILES, FROM MAPEI OR APPROVED EQUAL.
GENERAL NOTES:	

RUBBER BASE : (B3) :

MANUFACTURER	TARKETT
CONTACT:	GREG GIBBONS
P:	416 200 4014
E:	greg.gibbons@tarkett.com
SERIES	COLORMATCH NEUTRAL
PRODUCT :	TG4, BASEWORKS 4"
COLOUR:	20 Charcoal W.G
SIZE:	120' COILED LENGTH
BASE:	4"H
APPLICATION:	WALLS & MILLWORK AS PER DRAWINGS
GENERAL NOTES:	REFER TO MASTER SPECIFICATION FOR FULL SPEC

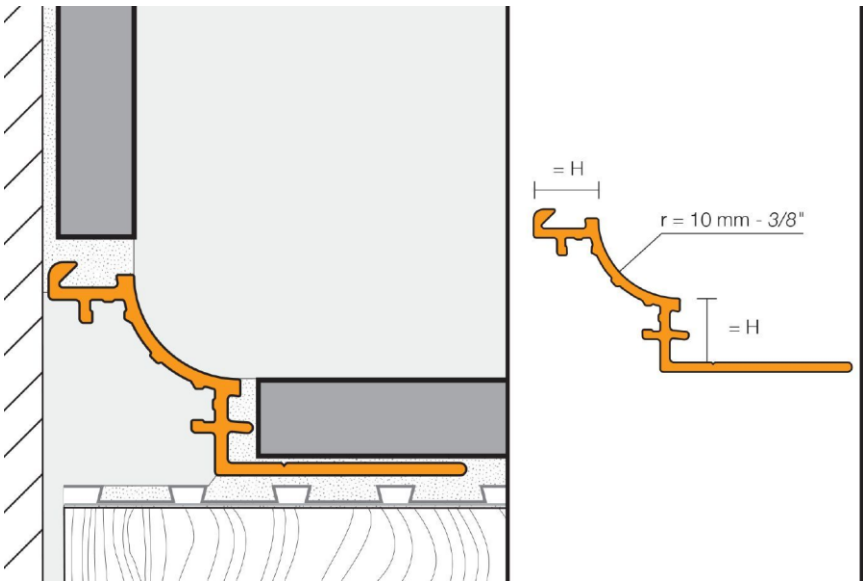
TRANSITION (T1) :

MANUFACTURER	SHLUTER
MODEL	DECO EDGING PROFILE
FINISH	SATIN ANODIZED ALUMNIUM FINISH
CONDITION:	SAME LEVEL EDGING PROFILE
GENERAL NOTES:	
	CONTRACTOR TO CHOOSE APPROPRIATE HEIGHT TRIM



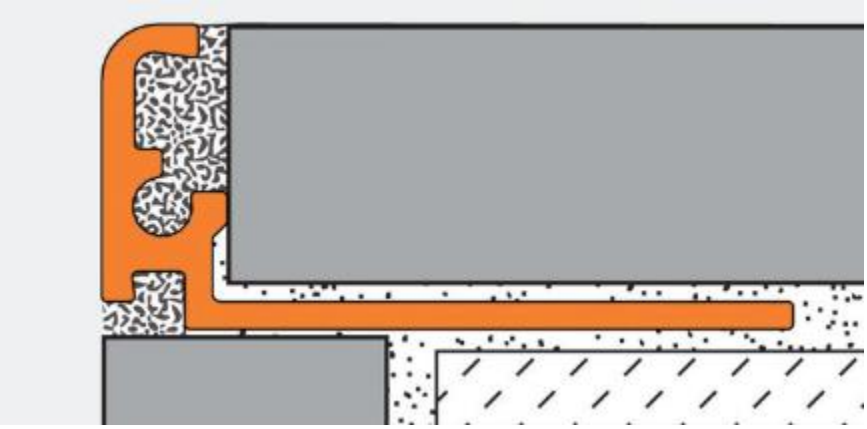
TRANSITION (T2) :

MANUFACTURER	SCHLUTER
MODEL	DILEX-AHK
FINISH	BRUSHED STAINLESS STEEL
CONDITION:	INSIDE WALL CORNERS
GENERAL NOTES:	
	CONTRACTOR TO CHOOSE APPROPRIATE HEIGHT TRIM



TRANSITION (T3) :

MANUFACTURER	SCHLUTER
MODEL	JOLLY
FINISH	BRUSHED STAINLESS STEEL
CONDITION:	90 DEGREE EDGE PROTECTION PROFILE FOR TILE
GENERAL NOTES:	
	CONTRACTOR TO CHOOSE APPROPRIATE HEIGHT TRIM, STAINLESS STEEL FINISH. USE APPROPRIATE CORNER PROFILES FROM THE SAME MANUFACTURER



PAINT FINISH (P1) : FIELD PAINT, WALLS

MANUFACTURER	SHERWIN WILLIAMS
COLOR	DRIFT OF MIST
PRODUCT #	SW 9166
SHEEL LEVEL	WALLS – EGGSHELL, 'SC' DENOTES SPECIAL COATING
APPLICATION:	WALLS –AS PER DRAWINGS
GENERAL NOTES:	

PAINT FINISH (P2) : ACCENT WALLS CLASSROOMS

MANUFACTURER	SHERWIN WILLIAMS
COLOR	WHITE TRUFFLE
PRODUCT #	SW 6029
SHEEL LEVEL	WALLS – EGGSHELL
APPLICATION:	WALLS – AS PER DRAWINGS

GENERAL NOTES:

PAINT FINISH (P3) : GYM ACCENT LINE, LEARNING COMMONS ACCENT WALL

MANUFACTURER	SHERWIN WILLIAMS
COLOR	ALEUTIAN
PRODUCT #	SW 6241
SHEEL LEVEL	WALLS – EGGSHELL,
APPLICATION:	WALLS – AS PER DRAWINGS
GENERAL NOTES:	

PAINT FINISH (P4) : ACCENT WALLS-FEMALE WASHROOMS

MANUFACTURER	SHERWIN WILLIAMS
COLOR	VAGUELY MAUVE
PRODUCT #	SW 6015
SHEEL LEVEL	EGGSHELL 'SC' DENOTES SPECIAL COATING
APPLICATION	WALLS – AS PER DRAWINGS

GENERAL NOTES:

PAINT FINISH (P5) : ACCENT WALLS-MALE WASHROOMS

MANUFACTURER	SHERWIN WILLIAMS
COLOR	NORTH STAR
PRODUCT #	SW 6246
SHEEL LEVEL	EGGSHELL 'SC' DENOTES SPECIAL COATING
APPLICATION	WALLS – AS PER DRAWINGS

GENERAL NOTES:

PAINT FINISH (P6) : GYM ACCENT LINE

MANUFACTURER	SHERWIN WILLIAMS
COLOR	STEELY GRAY
PRODUCT #	SW 7664
SHEEL LEVEL	EGGSHELL 'SC' DENOTES SPECIAL COATING
APPLICATION	WALLS – AS PER DRAWINGS

GENERAL NOTES:

PAINT FINISH (P7) : INTERIOR DOORS

HOLLOW METAL DOORS

MANUFACTURER	SHERWIN WILLIAMS
COLOR	TO MATCH STAINED VENEER DOOR
PRODUCT #	
SHEEL LEVEL	SEMI-GLOSS 'SC' DENOTES SPECIAL COATING

WOODEN DOORS

MANUFACTURER	AS PER SUBMITTAL BY G.C
COLOR	STAIN COLOR TO BE SELECTED FROM MANUFACTURERS FULL RANGE
PRODUCT #	STAIN AND VARNISH ON QUARTER SWAN MAPLE VENEER DOORS
SHEEL LEVEL	AS PER SAMPLE/ SATIN

PAINT FINISH (P8) : INTERIOR DOOR FRAMES

MANUFACTURER	DULUX
COLOR	STONE'S THROW
PRODUCT #	DLX1008-7
SHEEL LEVEL	SEMI-GLOSS 'SC' DENOTES SPECIAL COATING
APPLICATION	INTERIOR DOOR FRAMES

GENERAL NOTES:

PAINT FINISH (P9) : LEARNING COMMONS CEILING

MANUFACTURER	SHERWIN WILLIAMS
COLOR	DORIAN GREY
PRODUCT #	SW 7017
SHEEL LEVEL	CEILINGS -MATTE.
APPLICATION	AS PER DRAWINGS

GENERAL NOTES:

PAINT FINISH (P10) : LOWER STAIR WALL

MANUFACTURER	SHERWIN WILLIAMS
COLOR	FASHIONABLE GREY
PRODUCT #	SW 6275, - SC
SHEEL LEVEL	MATT 'SC' DENOTES SPECIAL COATING
APPLICATION	LOWER STAIR WALL - AS PER DRAWINGS.

GENERAL NOTES:

PAINT FINISH (P11) : STAGE WALL

MANUFACTURER	SHERWIN WILLIAMS
COLOR	BLACK SWAN
PRODUCT #	SW 6279
SHEEL LEVEL	EGGSHELL,
APPLICATION	STAGE WALL AS PER DRAWINGS

GENERAL NOTES:

PAINT FINISH (P12) : EXPOSED CEILINGS, GYPSUM CEILINGS, BULKHEADS

MANUFACTURER	SHERWIN WILLIAMS
COLOR	HIGH REFLECTIVE WHITE
PRODUCT #	SW 7757
SHEEL LEVEL	CEILINGS - MATT
APPLICATION	UNDERSIDE OF EXPOSED CEILINGS.

GENERAL NOTES:

PAINT FINISH (P13) : EXPOSED CEILINGS,

MANUFACTURER	BENJAMIN MOORE
COLOR	RACOON FUR
PRODUCT #	2126-20
SHEEL LEVEL	MATT, GYP CEILINGS,
APPLICATION	UNDERSIDE OF EXPOSED CEILINGS AT **LOBBY AREA ONLY**
GENERAL NOTES:	

PLASTIC LAMINATE FINISH (PLAM 1) :

MANUFACTURER	FORMICA
CONTACT	ISABELLE PROULX
P:	
E:	iproulx@designspecrep.com
COLOR	ASHWOOD OAK
COLOR CODE	5768
GENERAL NOTE:	

PLASTIC LAMINATE FINISH (PLAM 2) :

MANUFACTURER	FORMICA
CONTACT	ISABELLE PROULX
P:	
E:	iproulx@designspecrep.com
COLOR	BEIGE ELM
COLOR CODE	05794
GENERAL NOTE:	

PLASTIC LAMINATE FINISH (PLAM 3) :

MANUFACTURER	FORMICA
CONTACT	ISABELLE PROULX
P:	
E:	iproulx@designspecrep.com
COLOR	STORMY NIGHT GRANITE
COLOR CODE	009537
GENERAL NOTE:	

MELAMINE FINISH (MEL 2) :

MANUFACTURER	FORMICA
CONTACT	ISABELLE PROULX
P:	
E:	iproulx@designspecrep.com
COLOR	Aged Ash
COLOR CODE	08844
GENERAL NOTE:	

SOLID SURFACE 1 (SS 1) :

MANUFACTURER CORIAN

CONTACT

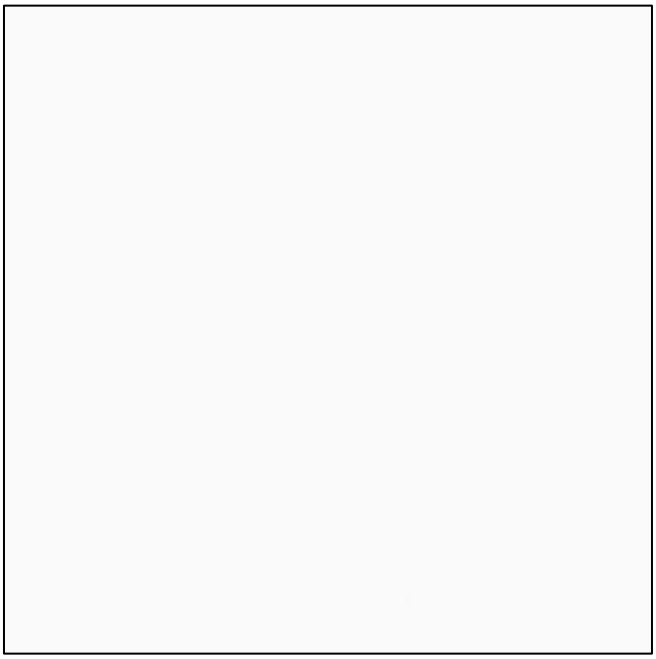
P:

E:

COLOR DESIGNER WHITE

COLOR CODE

GENERAL NOTE:



TOILET CUBICLES :

MANUFACTURER	SCRANTON PRODUCTS
CONTACT	
P:	
E:	
COLOR	GREY
COLOR CODE	GREY ORANGE PEEL
GENERAL NOTE:	

AB: ACOUSTIC BEAM

MANUFACTURER	HUSH
CONTACT	GARRICK DEAYTON
P:	
E:	garrick.deayton@hushacoustics.ca
PRODUCT	ACOUSTIC BEAM ON CEILINGS & WALLS
COLOR	ANRIQUE OAK
GENERAL NOTE:	

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 – Submittals.

1.3 SAMPLES

1. Submit to the Architect for approval prior to fabrication, samples of chalkboard, tackboard and trim in the form of a fabricated model showing jointing methods.

1.4 MAINTENANCE MANUALS

1. Provide maintenance brochures for insertion in maintenance manual in accordance with Section 01300 – Submittals.

1.5 SCOPE

1. Provide whiteboards and tackboards at all locations where indicated on the drawings.

PART 2 PRODUCTS

2.1 MATERIALS

1. Whiteboards: "Rite-on, Wipe Off" Vit-Rite boards by Architectural School Products. The board surface shall be porcelain enamel on steel.

2. Tackboards: Natural cork, fine grain, ¼" (6.35 mm) thick Bulletin Board.

3. Plywood: Fir Plywood conforming to C.S.A. 0121.

4. Trim: Series 200 extruded aluminum trim, 2 3/4" (69.9 mm) chalk trays and display rails, Model 206, as manufactured by Architectural School Products Ltd. Finish to be clear anodized aluminum. Chalkboard tray to be #No. 212 with end caps, at all areas without millwork below and chalkboard tray No. 264 at all locations with millwork below. Chalk tray to be full length. Where more than one whiteboard is installed continuously, each whiteboard will have its own individual trim, and chalk tray complete with end caps.

5. Marker Pens for Markerboards: Dry Erase Marker Pens as supplied by Architectural School Products or Equal 4 Colours - Black, Purple, Green, and Red. Provide 48 boxes of 4 assorted markers in each box and 48 boxes of black markers with 4 in each box. Dry Erase Marker Pens for

Owner's start up.

6. 2" (50mm) Tackstrips: Model no. 74. Extruded aluminum map rail with cork insert complete with end stops and combination kwic grip/hooks at 2-0" on centre. Provide these continuous tackstrips above entire length of all whiteboards and where tackboards are in combination with whiteboards on the same walls.

7. Adhesive: Type recommended by whiteboard and tackboard manufacturers

2.2 UNFRAMED TACKBOARD WALL

1. Forbo Bulletin Board Cork: ¼" thick, burlap backed unframed cork laminated to ¼" hardboard backing. Sizes as shown on millwork drawings, colours as selected by Architect from manufacturer's full colour range, including custom colours.

2. Submit samples for approval.

3. Refer to Architectural drawings for extent of tackboard wall where shown on Elevations or noted on plans.

2.3 APPROVED EQUAL MANUFACTURER'S:

1. Global School Products Inc.

2. Cveti Products Inc.

3. Forbo

PART 3 EXECUTION

3.1 INSTALLATION

1. Install whiteboards and tackboards in sizes and locations indicated on interior layout drawings all in accordance with manufacturer's directions. Review heights of chalkboards, whiteboards and tackboards with Architect and Owner prior to installing. Coordinate installation to avoid conflict with any adjacent millwork.

2. Do not set whiteboards or tackboards until final coat of wall finish has dried.

3. All whiteboard units shall be equipped with chalktrays and display rails Model #74. Provide display rails at tackboards where specifically indicated on drawings. Install kwikgrip/map hook devices at a rate of four for every 8'-0" (2400 mm) board or less.

4. Mitre corners of trim with tight fitting hairline joints.

5. Install tackboards in a single piece without joints. Factory laminate

tackboards to 1/4" (6.35 mm) plywood with adhesive.

6. Mechanical Attachment Only:

    1. To concrete or solid masonry use lag screw and expansion bolts, or screws and fibre plugs as appropriate for stresses involved.

    2. To hollow masonry, use toggle bolts or equivalent.

    3. To wood or sheet metal use screws secure into framing members in stud walls.

    4. Do not adhere tackboards to any walls.

3.2 CLEANING AND BREAKING-IN WHITEBOARD SURFACES

1. Upon completion, clean whiteboard surfaces and leave in perfect ready-to-use condition.

2. Advise client on proper markers and cleaning procedures to use with whiteboards.

END OF SECTION

1. GENERAL

1. GENERAL REQUIREMENTS

1. Division One - General Requirements, is part of this section and shall apply as if repeated here.

2. RELATED WORK SPECIFIED ELSEWHERE

1. Masonry - Section 04200
2. Rough Carpentry - Section 06100

3. QUALIFICATIONS

1. Manufacturers approved for the work of this section are:

1. Model 1082 by Bobrick Washroom Equipment of Canada Ltd. - Scarborough, Ontario, (416) 298-1611.

2. Solid plastic toilet compartments, Acceptable Manufacturer: Scranton Products, Eclipse partition systems.

3. Solid phenolic core model by Buddsteel Architectural Products, Teeswater, Ontario, (519) 392-6060.

4. "Phenolic Core Compartments", Ampco Products Inc., distributed by W.G. Wood Sales Ltd.; (416) 222-1187.

5. "Rail Braced Series 130" as manufactured by ASI Global Partitions; 866-858-0083.

6. Series 400 Solid Phenolic Toilet Compartments by Bradley Corporation distributed by Wentworth Associates Ltd., (905) 627-7070.

2. Approval of proposed equal products by other manufacturers must be confirmed by addendum from Architect following submittal of technical information 7 days prior to tender close.

4. SHOP DRAWINGS

1. Submit shop drawings in reproducible vellum form in accordance with GC 3.10 of CCDC Document 2, 2020.

2. Before shop drawings and fabrication are started, take critical measurements of the site to facilitate installation and fitting of work.

5. SAMPLES

1. Submit samples of hardware, color and finish to be selected by Interior designer.

6. STANDARDS

1. To establish a standard for tendering purposes, the drawings and these specifications are based on partitions manufactured from solid phenolic core with 0.05" (1.25 mm) decorative laminate surfaces fused to the core, Model 1082 by Bobrick.

7. SCOPE OF WORK

1. Provide solid phenolic core compartments and cubicles.

2. PRODUCTS

1. MATERIALS

1. Toilet Partitions: Overhead Headrail braced Scranton Products, Eclipse Partition systems.

2. Solid Core Laminate: to CAN3-A172-M79 Grade SS, 19 mm and 13 mm thick with solid panels with textured laminate on both sides. Grey ,Orange peel, Anti Grafiiti color, Final color to be selected by Interior designer, subject to client review. Products may be selected based upon manufacturer's full standard range of colours, patterns and textures including (stippled) textured finish.

3. Stainless Steel: Conforming to ASTM A66-72-1979, Type 302 or 304, satin finish.

4. Aluminum: Anodized with satin finish.

5. Slide Bolt and Keeper: Stainless steel with emergency access.

6. Robe Hook: Stainless steel combination robe hook and door stop complete with rubber insert.

7. Door Pull: Stainless steel for handicapped units.

8. Hinges: three gravity type hinges per door

9. Fasteners: Stainless steel tamperproof type. One-way theft-proof thru-bolt on all door hardware and mounting brackets.

10. Anchors: as recommended by partition manufacturer.

11. Laminated Plastic Adhesive: urea formaldehyde resin adhesive to CSA 0112 Series-M1977, contact adhesive to CGSB 71-GP-20M, resorcinol adhesive to CSA 0112 Series-M1977, polyvinyl resin adhesive to CSA 0112 Series-M1977, two component epoxy thermosetting adhesive.

2. FABRICATION

1. Toilet compartments shall be floor mounted and overhead braced.

2. Doors, partitions and pilasters shall be faced both sides with flush melamine panels which are flat and free from distortion.

3. Cores of doors, partitions and pilasters shall be solid phenolic core, thermally fused to plastic laminate faces.

4. Work shall include three (3) panel brackets per panel, pilaster attachments, three (3) gravity type hinges per door, two (2) door stops per door, latches, pilaster shoes, coat hooks and bumpers.

5. All metal and plastic laminate shall be thoroughly cleaned.

3. EXECUTION

1. INSTALLATION

1. Work shall include installation of all components of toilet compartments, including a modesty screen adjacent to urinals and sinks where indicated with floor to ceiling and support post.

2. Fasten pilasters to floor by fitting over an internal floor channel. Fasten channel, which allows pilasters to have vertical adjustment, to floor with two connections. Fasten a 3" (76 mm) high polished stainless steel base to floor channel and bottom of pilaster.

3. Set partitions and doors 12" (300 mm) above the finished floor.

4. Partitions and doors shall be 58" high (1470 mm). Pilasters shall be 85" (2175 mm) high.

5. Doors shall be 24" (600 mm) wide and 2'-10" (864 mm) in handicapped areas.

6. Toilet and shower compartments shall be width indicated by 5'-0" (1525 mm) deep, or as required. Provide closure pilasters as required at end units of compartment banks. Handicap compartment minimum size to be as current Ontario Building Code requirements.

7. Fasten all pilasters and partitions to masonry walls with three (3) "U" brackets.

8. Compartments shall conform to Barrier Fee Design requirements of the Ontario Building Code as currently amended.

End of Section

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this section and shall apply as if repeated here.

1.2 SECTION INCLUDES

1. Materials, fabrication and installations of aluminum tapered flagpoles with internal halyard, linked chain.

1.3 RELATED SECTIONS

1. 01300 Submittals
2. 01015 General Work
3. 01500 Substitutions
4. 01545 Safety Requirements
5. 01560 Environmental Protection
6. 03 10 00 Concrete Forming and Accessories
7. 03 30 00 Cast-in-Place Concrete

1.4 REFERENCES

1. The Aluminum Association (AA)
2. DAF 45, Designation System for Aluminum Finishes.
3. American Society for Testing and Materials International (ASTM)
4. ASTM B241/B241M, Standard Specification for Aluminum and Aluminum - Alloy Seamless Pipe and Seamless Extruded Pipe.
5. The Masters Painters Institute (MPI): Architectural Painting Specification Manual.

1.5 DESIGN REQUIREMENTS

1. Flagpole, bases and anchorage devices to resist minimum wind velocity of 145 km/h unflagged, 100 km/h flagged.

1.6 SUBMITTALS

1. Submit manufacturer's technical data and installation instructions for each type of flagpole.

2. Indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials, and base collar for flagpoles.

3. Submit Shop Drawings of flagpoles and bases, showing general layout, jointing and complete anchoring and supporting systems.

4. Submit sample of flagpole 900 mm long.

1.7 QUALITY ASSURANCE

1. Provide each flagpole as complete unit produced by single manufacturer, including fittings, accessories, bases and anchorage devices.

1.8 DELIVERY AND STORAGE

1. Deliver, store, handle and protect materials in accordance with Section 01016.

2. Spiral wrap each flagpole with heavy kraft paper, wood strip and steel band, or polyethylene wrap and pack in tubing for shipment.

PART 2 PRODUCTS

2.1 GENERAL

1. Subject to compliance with requirements, provide the specified products and/or materials from indicated manufacturers. Other comparable products may be submitted as substitution requests.

2. Submit product information and test data showing that products are equal or better within ten (10) days prior to bid for Architect and/or Owner's review and approval.

3. Requests for substitutions will be considered in accordance with provisions of Sections 01016 - Products and Section 01500 - Substitutions.

2.2 MATERIALS

1. Aluminum: Aluminum Association Alloy 6351-T6 seamless extruded aluminum tubing.

2. Supply quantities and install where indicated on drawings.

2.3 BASIS-OF DESIGN

1. John Ewing & Co. Limited – www.ewinggroup.ca
   1445 Hopkins Street
   Whitby, ON L1N 2C2
   1.800.268.3524 | 905.666.5600

2. Model: **Ewing- HTA-40** with 40'-0" (12192mm) exposed height above ground.

   1. The outside butt diameter of the pole shall be 7 inches (178 mm) with minimum butt wall thickness of .0156 inches (4.0 mm). Base shall be model no. B7 tilting type. Install concrete foundations in accordance with their standard details.
   2. Provide 2 units where located on the Architectural Site Plan A1.1

3. Flagpole Construction: Flagpole to be fabricated in sections of new, standard, seamless extruded aluminum pipe, alloy 6351-T6. All joints shall be of the telescoping type, heli-arc welded and ground smooth. The pole shall be heavily spiral wrapped with waterproof polyethylene, wood stripped, and steel banded for protection during transit.

4. Internal Halyard System: Supply and install an "Econoline" internal halyard consisting of revolving finial; flag attachment arrangement with stainless steel neoprene covered counterweight and flag retaining loop; internal single line with internal cleat arrangement, stainless steel cable for flag halyard, stainless steel locking cover plate with reinforcing frame.

5. Ball Top: Provide spun ball top 8" (203 mm) in diameter and constructed of 14 ga. aluminum, clear, anodized.

6. Finish: Standard finish of sectional shaft aluminum flagpoles is clear anodized, CE/An/0.0006.

2.4 FIELD FABRICATION

1. Fabricate ground-set foundation assembly for sleeve installation of flagpole as recommended by Flagpole manufacturer for wind loads as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

1. Shop apply isolation coating to metal surfaces of flagpole and base that will be encased in concrete.

2. Install flagpoles, base assemblies and fittings to shop drawings and manufacturer's instructions.

3. Provide lightning rods for grounding of each flagpole installation as indicated.

3.2 COMMISSIONING

1. Check and adjust installed fittings for smooth operation of halyards and instruct Owner on adjustment and maintenance procedures.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is part of this Section and shall apply as if repeated here.

1.2 SHOP DRAWINGS

1. Submit shop drawings in reproducible vellum form in accordance with CCDC Document 2-2020 and Section 01300 – Submittals.

2. Submit catalogue illustrations as required by Architect.

3. Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details anchors for grab bars.

1.3 SUBMITTALS

1. Submit samples of all accessories for approval by the Architect.
2. Approved manufacturers are ASI

1.4 DELIVERY, STORAGE AND HANDLING

1. Package accessories and label with description of contents and installation location. Each accessory to be individually wrapped complete with all fixings as required.

2. Deliver accessories where designated at Site by Contractor.

1.5 MAINTENANCE AND OPERATING INSTRUCTIONS

1. Provide for inclusion in data book, three (3) printed copies of maintenance and operating instructions of all accessories.

PART 2 PRODUCTS

2.1 MATERIALS

1. Sheet Steel: Commercial grade, stretcher levelled sheet steel to ASTM A526-71 (1975) with G90 zinc coating to ASTM A525-79.

2. Stainless Steel Sheet: To ASTM A666-72 (1979) type 302 with No. 4 finish, minimum 0.9 mm (0.036"/20 gauge).

3. Stainless Steel Tubing: AISI Type 304, commercial grade, seamless welded, 1.2mm (0.047") wall thickness.

4. Fasteners: Screws and bolts hot dip galvanized. Expansion shields fibre, lead or rubber as recommended by fixture manufacturer for component and its intended use.

5. Fasteners: Screws and bolts stainless steel. Expansion shields, lead or

rubber as recommended by fixture manufacturer for component and its intended use.

2.2 FINISHES

1. Chrome and Nickel Plating: to ASTM B456-79 satin finish.

2. Stainless Steel: to AISI No. 4 satin lustre finish.

3. Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107a, apply one coat Type 2 primer to CGSB 1-GP-81M and bake apply two coats Type 2 enamel to CGSB 1-GP-88e and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by Architect.

2.3 KEYING

1. All accessories to be keyed alike. Provide six keys.

2.4 TRADEMARKS AND LABELS

1. Trademarks and labels shall not be visible in the finish exposed surfaces.

2.5 MANUFACTURER

1. Provide accessory items manufactured by companies as noted or approved equal; Bobrick, Frost and ASI are approved manufacturers. Manufacturers must comply with the Provincial Procurement Restriction Policy. Refer to the General Requirements Section for additional information.

2.6 ACCESSORIES

1. Hand dryers, toilet paper, sanitary and soap dispensers will be supplied by the board but installed by the contractor. All other items to be supplied by contractor and installed by them.

2. **CCH** - Collapsible Coat Hooks: Bobrick Model No. B-983 surface mounted collapsible coat hook, satin finished stainless steel. Provide one in each universal washroom, barrier free washroom and unisex / single washroom unless otherwise indicated on drawings.

3. **SHELF** - Utility Shelf with Mop / Broom Holders and Rag Hooks: Bobrick Model No. B-239 surface mounted Utility shelf, satin finished stainless steel. Provide one at each mop sink location (installed as to drip into mop sink below) unless otherwise indicated on drawings.

4. Grab Bars: Refer to Architectural drawings for locations.

    1. At Barrier Free Accessible Water Closets:

        1. 1 1/2" (38 mm) dia. peened satin finished stainless steel, 24" (610 mm) long straight bar, standard flange position at back

of water closet.

2. L-shaped bar 1 1/2" (38 mm) dia. peened satin finished stainless steel, 30" (760 mm) long horizontal and vertical 30" (760 mm) at side of water closet.

3. Install item 1 and 2 grab bars noted above at each universal / barrier free water closets.

5. Grab bars to be 18 (1.2 mm) gauge stainless steel tubing, with Mandrel bends. Knurled grab bars to be peened grip full length of the tubing to within 4" (100 mm) of ends of bends. Secure concealed fastening grab bars with 2 1/2" (64 mm) No. 14 screws to solid backing, capable of supporting a 500 lb. (225 kg) pull. All accessories must comply with the 2012 January 1, 2015 Ontario Building Code as currently amended.

6. Fold down Grab Bars: Healthcraft P.T.Rail Hinged, flip-up grab bar, type 304 stainless steel satin finish with mounting hinge bracket, 38mm (1.5") bar diameter & 790mm (32") length. Install structural steel studs on edge for mounting bracket to withstand physical loading stresses. Provide one in every universal washroom beside toilet opposite of wall grab bars.

7 **SD** Manual Soap Dispensers: Foam Eese #9326-42195 to be provided by and installed by this contractor. Install one at each washroom lavatory location unless otherwise indicated on drawings.

8. Mirrors: Provide at least one for every lavatory. Provide one handicapped tilt mirror in every washroom with a handicapped accessible water closet, the remainder to be fixed mirrors. All mirrors to be tempered glass. Install one per each washroom lavatory location unless otherwise indicated on drawings.

1. Fixed Mirror (M1): Bobrick Model No. B-165-1836, stainless Steel Channel Frame Mirror, 18" (456mm) wide x 36" (914mm) high.

2. Fixed Mirror with Shelf (M3): Bobrick Model No. B-166-1836, stainless Steel Channel Frame Mirror, 18" (456mm) wide x 36" (914mm) high.

9. **SHF** - Shelf: Equal to Franke shelf STRX624. Wall mounted stainless steel shelf 4-¼" x 24" (110mm x 600mm). Provide one in each Universal Washroom unless otherwise indicated on drawings.

10. **SND** - Surface Mounted Sanitary Napkin Disposal: Marino #H260 to be provided and installed by this contractor. Install one in each universal washroom, barrier free washroom, unisex / single washroom and for each

stall in female gang washrooms unless otherwise indicated on drawings. Where the recessed B-35303 model is not able to be installed, this surface mounted product is to be used in lieu.

11. **PTD** - Surface Mounted Paper Towel Dispenser: Kimberly Clark CT #09990 to be provided by the school board and installed by this contractor. Provide one in each unisex / single washroom and f in female and male gang washroom and at each sink in classrooms areas unless otherwise indicated on drawings.

12. **GD** - Surface Mounted Waste Receptacle: To be provided and installed by this contractor. Install where indicated on drawings; minimum one in each washroom.

13. **TPD** - Toilet Paper Roll Dispenser: Kimberly Clark CT #09507 to be provided and installed by this contractor. Install one at each toilet location.

14. Toilet Backrest: Frost Model #1028 stainless steel surface mounted for use on tankless toilet installations, at each toilet location where toilets do not have toilet seats.

15. Deodorizer: Model 1100 by Frost. One will be provided in each universal washroom, barrier free washroom, unisex washrooms and for female and male gang washrooms unless otherwise indicated on drawings.

16. Contractor to install any and all washroom accessory items supplied by owner.

2.7 FABRICATION

1. Weld, ground flush and smooth joints of fabricated components. Use mechanical fasteners only when approved.

2. Form exposed surfaces from one sheet of stock, free of joints.

3. Brake form sheet metal with 2 mm radius bends.

4. Form flat surfaces without distortion. Maintain flat surfaces without scratches or dents.

5. Paint back of components where contact is made with building finishes to prevent electrolysis.

6. Hot dip ferrous metal anchors and fastening devices to conform with CGSB G164.

7. Shop assemble, and package components complete with anchors and fittings.

8. Deliver inserts and rough-in frames to site at appropriate time for building in. Provide templates or rough-in measurements as required.

9. Provide steel anchor plates and components for installation on studding

and building framing.

10. All exposed stainless-steel edges to be hemmed.

11. All stainless-steel units to be double panned.

PART 3 EXECUTION

3.1 INSTALLATION

1. Installation of all miscellaneous specialties by this Section. Install all items to secure backing.

2. Securely fasten accessories level and plumb in the locations shown on the drawings and as specified herein. Mounting heights as shown on drawings, or as directed by Architect.

3. Co-ordinate installation with the work of trades providing adjacent construction as required to achieve the reveals or other edge conditions shown where front faces of units are flush with the finished wall surfaces.

4. Perform drilling of steel, masonry and concrete necessary to install the accessories.

5. Insulate accessory surfaces to prevent electrolysis due to contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper or other approved means.

6. Clean all accessories in conformance with Division 1.

3.2 LOCATION AND QUANTITY

1. Provide washroom accessories as noted as indicated on drawings and/or called for within this section. Installations shall meet the minimum requirements of the O.B.C., as currently amended.

END OF SECTION

PART1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements are part of this section and shall apply as if repeated here.

1.2 SUBMITTALS

1. Submit shop drawings in reproducible vellum form in accordance with GC of CCDC Document 2-2020.

2. Submit maintenance manuals for products listed under Part 2.

1.3 SPECIAL PROTECTION

1. Provide adequate protection of materials and work of this Section from damage by weather and other causes.

2. Protect the work of other Subcontractors from damage resulting from work of this Section. Make good such damage to the satisfaction of the Consultant.

1.4 WARRANTY

1. Extend the warranty for work of this section to a period of two years, covering material and workmanship but not to include damage due to vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Basis-of-Design Products: Subject to compliance with requirements, provide the following products by or a comparable product by another manufacturer approved by consultant ten (10) days prior to bid closing, giving preference to products manufactured within a 500-mile (800 Km) radius of the Project Site.

2. Requests for substitutions will be considered in accordance with provisions of Sections 01016 - Products and Section 01500 - Substitutions.

2.2 ROOF TOP ACCESS LADDERS, ELEVATOR PIT ACCESS LADDERS, ROOF TOP GUARDRAILS

1. Manufacturer: Skyline Group - www.skylinegroupintl.com
19896 Highway7, Perth, ON K7H 3C9
1.613.267.4493

2. Install exterior (hot dipped galvanized for metal material and anodized for aluminum material) and interior (painted).

3. Access Ladder: 7000 **Ladder Series**

1. 7000 Vertical Access Ladder,

2. 7001 Vertical Access Ladder with Handrails,

3. 7002 Vertical Access Ladder with Parapet Mount

4. 7003 Vertical Access Ladder with Lead on Handrails)

5. Provide access ladder cage where required as per Health & Safety Act, including lockable cage doors & lockable ladder doors to prevent unauthorized access and all other accessories including but not limited to handrails, wall fixing brackets, ladder stile and rung, stile end caps, splice joints, base support angle, change of direction platform, etc.

2.3 BARRIER FREE PUSH BUTTON PEDESTAL

1. Manufacturer : Camden Door Controls (or equal)
www.camdencontrols.com/reps/Camden_ISR_Ontario
1.877.226.3369

2. Model: **Express CM-48**

3. Finish to be clear anodized. Locate where indicated on drawings.

2.4 TIME CAPSULE

1. Manufacturer: Heritage Time Capsules - www.heritagetimecapsules.com
5373 Transit Road
Williamsville, NY 1422
716.868.0057 | Email: Sales@HeritageTimeCapsules.com

2. Stainless Steel material, Medium Size, with Heritage Preservation Kit and Heritage Ceremony Kit.

2.5 DISPLAY CABINET GLASS SHELVES

1. Manufacturer: eurOptimum - wweuroptimum.com
320-720 King Street West
Toronto, ON M5V 2T3
1.800.607.3879

2. **Shelving and Cubes Product Line**

1. 10mm tempered glass shelves with chamfered edges suspended on aircraft cable and grommets.

2. Flat shelving suspension system; including all horizontal connectors, drilled connectors and ceiling hung cable system. Provide as a complete system.

2.6 CLASSROOM CONTROL PANELS

1. Provide surface mounted modular control panels as manufactured by:

   Interspec Systems Limited - www.interspecsystems.com
   Rosemont, ON L0N 1R0
   1.866.888.8981 | 705.435.3770

2. Model: **ClassMate Classroom Control Panel**

3. Modular console panels shall be constructed of structurally sound 6063 T3 alloy satin anodized aluminum frame, 0.80 mm (1/32") thick, with high pressure plastic laminate faced panels of lightweight particle core and 0.50 mm (1/64") thick plastic laminate backing sheet. Plastic laminate colour as selected by the Architect from Formica, Arborite, Pionite or Wilsonart, furniture finish, from Manufacturer's standard colour range. Complete assembly to meet flame spread ratings in area used.

4. Units to be complete with back boxes fabricated from heavy gauge stain coat steel with suitable barriers and continuous knockouts. Satin anodized face plates shall be pre punched to accepted detailed components.

5. All panels shall be vandal resistant and removable with special tools for service access.

6. Fabricate units in accordance with reviewed shop drawings with extruded aluminum frames and solid plastic laminate face panels.

7. Panels to be removable from aluminum frames.

8. Panels to have all openings, mounting hardware, etc., for services as required for installation of mechanical and electrical services by Mechanical and Electrical Sections.

9. Units to be full height from 100mm (4") off floor to underside of ceiling panels (units can extend beyond ceiling if required but with no functions above ceilings.

10. Select from manufacturer standard range of laminates. Architect to make final selection.

2.7 REMOVABLE BOLLARD

1. Provide steel bollard in quantity as shown on Site Plan Drawing A1.1 and floor plans.

2. Product to be Model R-7901 by Reliance Foundry Co. Ltd., with dome top, three annular rings, recessed receiver with cover plate and lock system. Height: 91.4cm (36")

   1. Base diameter: 11cm (4 1/3")

2. Weight: 38 lbs. (17.2 kgs)

3. Material: Steel

4. Finish: Powder Coated Black

5. Provide electrical wire to each for lighting.

PART 3 EXECUTION

3.1 INSTALLATION

1. Delivery to the job site shall be coordinated by General Contractor.

2. Coordinate with mechanical and electrical for final connection

3. Install at locations indicated on drawings all in accordance with manufacturer's written instructions and directions.

3.2 CLASSROOM CONTROL PANELS

1. Supply and install units in accordance with Manufacturer's recommendations and reviewed shop drawings including coordination with Mechanical and Electrical Sections for provision of all frames, cutouts, face panels, etc., to provide a complete installation.

2. Coordinate with Mechanical and Electrical Sections for complete installation of all mechanical, electrical and miscellaneous services in all control panels. Components within control panels will vary from room to room.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Comply with the conditions of the Contract and Division 1 - General Requirements.

1.2 SECTION INCLUDES

1. Work of this section includes the design, supply and installation of fixed point anchors for a travel restraint system. See Roof Plan Drawings A2.3. **There is no intent to provide a complete fall arrest or travel restraint system beyond what is shown on the drawings**.

1.3 REFERENCES

1. Ontario Occupational Health and Safety Act (OHSA)
2. CAN/CSA-Z259.10-M90(R2003) Full Body Harnesses
3. CAN/CSA-Z259.11-05 Energy Absorbers and Lanyards
4. Ontario Building Code 2006, 4.4.4.1. Anchor Systems on Building Exterior - to be provided where any portion of the roof is more than 8 m (26'-3") above adjacent ground level.

1.4 DESIGN REQUIREMENTS

1. Design travel restraint system to suit building and in accordance with plans, specifications, standards, and regulations/codes contained in sections 1.4
2. Design all anchor components to provide adequate attachment to the building and suited to current fall protection system practices.
3. Ensure all anchor components conform to proper engineering principles and have been designed by a Professional Engineer qualified in the design of fall protection systems, their application and safety requirements.
4. Design travel restraint system safety anchors supports to comply with the following structural requirements:
    1. Safety Anchors: travel restraint safety anchors and horizontal life line are designed to support a minimum force of 450 lbs (2.0 kN) when wearing a body harness with a factor of safety of 2 without any permanent deformation and to 2000 lbs against fracture or detachment.

1.5 SHOP DRAWINGS AND ENGINEERING CERTIFICATION

1. Submit shop drawings showing complete layout and configuration of complete fall protection system, including all components and accessories. Clearly indicate design and fabrication details, hardware, and installation details.

2. Shop drawings to include fabrication and erection. Include plans, member profiles, sizes, elevations, and details for anchorages and connections.

3. Shop drawings to be reviewed by a professional engineer, and upon request, complete with calculations and/or test reports.

4. Submit Test Certificate indicating completion of proof load testing on installed system.

5. Note that the Roof Plan Drawing A2.3 shows a schematic layout of the intended tie-off points and extent of life lines. The manufacturer is to confirm if additional tie-off points are required, or positions altered to comply with requirements of the Ontario Occupational Health & Safety Act.

1.6 QUALIFICATIONS

1. Manufacturer:

    1. Work of this Section to be executed by manufacturer specializing in the design, fabrication and installation of Fall Protection Systems having a minimum of 5 years documented experience. A minimum of four (4) installations of the size and type comparable to the unit specified shall have been installed by this manufacturer in the past two (2) years.

    2. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these specifications that all equipment called for under this section shall be supplied by a single source. The equipment supplier shall, in addition to the Contractor, assume the responsibility for proper and complete installation.

2. Loading and safety assurance: Work of this Section to meet the requirements of governing codes and jurisdiction and to comply with properly engineered loading and safety criteria for the intended use.

3. Insurance: Manufacturer to carry specific liability insurance (products and completed operations) in the amount of $5,000,000.00 to protect against product/system failure.

4. Welding to be executed by certified welders in accordance with CSA W59 and CSA W47.2 requirements.

1.6 MAINTENANCE DATA

1. Submit 1 copy of parts list and maintenance requirements for all equipment.

2. Submit 2 copies of a reduced plastic laminated as-built shop drawing showing equipment locations and details. This drawing is to be posted near exits onto the roof.

3. Submit 1 copy of proper procedures and equipment for safe operation of the system.

1.7 DELIVERY, STORAGE AND HANDLING

1. Deliver materials in manufacturer's original, unopened protective packaging.

2. Store materials in original protective packaging. Prevent soiling, physical damage or wetting.

1.8 PROJECT CONDITIONS

1. Perform field dimensions and confirm location of anchors with Architect prior to preparation of shop drawings and fabrication drawings to ensure required fit and dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURER

1. This specification is based on the **Latchways ManSafe Constant Force Post system**.

2. Distributed by Unistrut Canada. Telephone: 1-800-267-4959, 905-683-8131,

3. Approved alternative manufacturers include:

    1. Pro-Bel and Ankor Systems.

4. Other manufacturers or suppliers wishing to bid products other than the product specified herein, shall submit to the Architect te (10) days prior to the bidding:

    1. List of three (3) past installations of products similar to those listed.

    2. Complete catalogue data along with deviations from the product specified shall be noted in the submittal to the Architect.

    3. The manufacturer guarantees the proposed substituted product to comply with the product specified and as detailed on the drawings unless the deviations are so noted in the submittal for approval.

4. Other manufacturers must provide proof of product insurance. Companies, such as miscellaneous metal fabricators, who are not normally engaged in the design and manufacture of fall protection systems are not permitted to bid.

2.2 MATERIAL

1. All materials shall be new, and the completed Travel Restraint System shall be essentially the product of one manufacturer regularly engaged in the production of such equipment.

2. Stainless steel plates and bars: ASTM A666, Type 304, or 316.

3. Fasteners:

    1. The Travel Restraint System shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the safety restraint system of 2 times the maximum design load without failure.

    2. Where through-bolting is not possible, practical or desirable, the listed fastening systems are acceptable:

        1. Hilti

        2. Lindapter

        3. Or approved others

2.3 FABRICATION

1. General:

    1. System components shall be of the same material unless otherwise indicated.

    2. Exposed work shall be true to line and level with accurate angles, surfaces and with straight square edges.

    3. Coordinate anchorage system with supporting structure. Fabricate and locate anchoring devices as recommended by manufacturer to provide adequate support for intended use. Confirm design with Structural Consultant.

    4. Fabricate joints in a manner to discourage water accumulation. Provide weep holes to drain any water which could accumulate in the exposed joints

2.4 SYSTEM DESIGN

1. Is based on the Constant Force Post system. All components shall be

designed by the Fall Protection System supplier and shall meet the applicable requirements of WHSCC. See Roof Plan Drawings A2.3. There is no intent to provide a complete fall arrest system beyond what is shown on these drawings.

2. Description:

1. Brackets and supports shall be attached to the structure with appropriate anchors of proper size and embedment, as per 2.02 C., to adequately support the intended load.

2. Lanyard: Provide two (2) shock absorbing, nylon lanyards with double locking snap assemblies at each end meeting CAN/CSA-Z259.11-05 and as recommended by the Safety Restraint System supplier.

3. Support Harness: Provide TWO (2), full-body harnesses with back "D" ring, meeting CAN/CSA-Z259.10-M90 (R2003).

PART 3 EXECUTION

3.1 INSTALLATION

1. Install in accordance with approved shop drawings and manufacturer's instructions.

2. Travel Restraint System shall be installed by manufacturer's authorized trained and certified personnel.

3. Install anchorages and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification.

1. Do not load or stress Travel Restraint System until all materials and fasteners are properly installed and ready for service.

2. Anchorages drilled into concrete.

1. Follow manufacturer's recommendations.

2. Do not cut or damage reinforcement

3. Clean drill hole and remove debris and contaminants in accordance with manufacturer's instructions.

4. Install anchorages at indicated locations, clearances and embedment depth.

5. When clearance and spacing of anchorage is not indicated on drawings, install at location recommended by manufacturer to obtain maximum working loads and in accordance with the

following:

1. Anchorage clearance to edge of concrete: Not less than 7 bolt diameters.

2. Anchorage spacing center to center: Not less than 10 bolt diameters.

4. When embedment depth is not indicated on drawings, install with embedment depth not less than 6 bolt diameters.

3.2 FIELD QUALITY CONTROL

1. After the Travel Restraint System is installed and properly tensioned, the safety system manufacturer's approved authorized representative shall inspect and operate the system and shall make all final adjustments for proper operation.

2. After the system has been placed into operation, the manufacturer's q authorized representative shall perform proof testing and issue a certificate attesting to the systems ability to withstand the proof load.

3.3 OPERATOR TRAINING

1. Provide a maximum of 4 hours of operator training after system has been installed and proof tested. Training is to take the form of a single class conducted at the installation site.

3.4 CLEANING

1. Remove all loose materials, crating and packing materials from premises.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 SHOP DRAWINGS

1. Submit shop drawings in sepia form in accordance with GC3.11 CCDC-2 2020.

2. Before shop drawings and fabrication is started, take critical measurements of the site of facilitate installation and fitting of work.

1.3 SAMPLES

1. Submit samples of colour and finish approval by the Architect.

PART 2 PRODUCTS

2.1 SHELVES

1. Four ¾" (19 mm) O.D. square 18 gauge (1.2 mm) steel tubes closed and protected with form fitting plastic end caps. Supply one shelf per unit equal to Architectural School Products Model STL 1001.

2.2 BRACKETS

1. Two-piece heavy duty die cast aluminum designed with an integral backplate that provides a sure grip fastening. All screw fasteners shall colour match bracket finish.

2.3 DOVETAIL

1. Mounting shall be heavy gauge extruded aluminum engineered for a slide fitting vertical adjustment of one full shelf with length to suit. Spacing as per manufacturer's standard but shall not exceed 1016mm (40").

2.4 COAT HOOKS

1. Manufacturer's standard double prong moulded ABS high-impact plastic formed to be non-turning, positive gripping and adjustable. Supply and install one hook per every 6" of length of shelf (a min. of 18 hooks per shelf length). Two colours to be selected by Architect from manufacturer's standard colour range to match existing.

2.5 FINISHES

1. Shelves, brackets and channel mounts shall be baked on enamel on rust proofed steel. Colour to be selected by Architect from manufacturer's standard colour range.

2.6 MANUFACTURERS

1. Unit shall be equal to:

    1. Architectural School Products Model STL 1001.

    2. Approved equal by Vogel-Peterson, CPE or Global School Products Inc.

PART 3 EXECUTION

3.1 INSTALLATION

1. Channel mounts and brackets spaced as per manufacturer's standard but shall not exceed 40" (1000mm).

2. Install units where indicated on drawings.

3. Height of shelves to be as instructed by the Architect.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One, General Requirements is a part of this Section and shall apply as if repeated here.

1.2 SHOP DRAWINGS

1. Submit Shop Drawings in reproducible vellum form in accordance with GC of CCDC Document 2 - 2020.

2. Clearly indicate fabrication details, plans, deviations, hardware and installation details in layout and locations.

3. Take measurements on site of spaces and conditions to which work must conform.

4. Color samples to be submitted with shop drawings for selection by Architect.

1.3 PROTECTION

1. Protect work from damage during storage, handling, installation and until building is turned over to the Owner.

PART 2 PRODUCTS

2.1 BASIS-OF-DESIGN

1. **Hussey Seating Co. Ltd.** has been used for specification purposes, Gym and Health Equipment and
Forum Athletic Products are approved alternative manufacturers for basketball backstops products specified in this section.

3. All other products to be as specified or approved alternative.

2.2 BASKETBALL BACKSTOPS

1. Basketball Backstop Type "A":

    1. Equal to suspended forward folding **Porter Model 917** by Hussey Seating Co. Ltd.

    2. Supply and installation of Porter #00208-000 rectangular glass backboards complete with and #00223-000 power flex goal and regulation nets and #326 pro-pad bolt-on backboard padding.

    3. Approved equal Gym & Health BB-17A with BB-29-RGII backboard.

    4. Base Bid: Provide 2 Type “A” units located at main court only.

2. Basketball Backstop Type "B":

    1. Equal to *suspended forward folding* **Porter Model 917** by Hussey Seating Co. Ltd.

    2. Supply and installation of Porter fan shaped cast aluminum backboard #00234-300, with #00233-000 power flex goal and regulation nets.

    3. Approved equal is Gym & Health BB-17A and BB-22 fan shaped steel backboard.

    4. In base bid amount provide 4 Type "B" Units.

3. Install #798 "Saf-Strap" and hoist cable retractor reel at all type A & B basketball backstops.

4. For basketball backstops Type "A" and "B" use electric winch equal to Porter Model #707, 3/4 HP motor, 115V, 60 Hz with remote wall mounted 3-position key switches at all locations noted above. (Locate controls in one panel.)

5. All steel and wood members to be painted to special colours selected by Architect. Provide Masonry Section 04200 with mounting locations and thru bolts for backstop locations. Co-ordinate and ensure blocks filled solid at thru bolts. Design steel framing for roof mounted units to allow mounting tight to steel structure. Swing up mechanism to be designed to permit raised backstops to highest maximum extent possible.

2.3 FLOOR SOCKETS:

1. Equal to **Model No. 209 by Spieth Anderson deep brass floor socket** to receive 3.060" I.D. Complete with brass inserts and hinged cap for volleyball and badminton posts.

    1. In Base bid provide 8 sockets total for Gymnasium.

2. For storage of posts in Gym Storage Room provide **Model No. 209 by Spieth Anderson sockets** with hinged caps.

    1. In base bid, provide 8 sockets total in Gym Storage Room

    2. Locate sockets per drawings and confirm location with Architect on site prior to installation. Coordinate with structural for support for additional concrete depth required.

3. Confirm diameter of sockets with owner prior to ordering /shipping. All sockets equal to Spieth Anderson.

4. OUTDOOR BASKETBALL BACKSTOPS

1. Gymnasium and Health Equipment model BB-19 with gooseneck single post with model BB-23 fan shaped aluminum backboard and model BB-30-5 basketball goal.

2. Provide 4 outdoor basketball backstops, hoops and nets. Confirm locations with owner/architect prior to installation.

5. Net Storage Hooks

1. Draper wall **storage hooks 501017**. Provide eight (8) total. Install in Gym Storage room in location as directed by the Architect

6. WALL PADDING

1. Provide wall padding equal **to Gymnasium & Health WP-2002 Velcro 2 sides**. In sizes and locations as indicated on the A7 Gym Elevation drawings.

PART 3 EXECUTION

3.1 EXAMINATION

1. When the job is sufficiently advanced to permit curtain, installation, visit the site and check conditions to ascertain preparation work by previous trades.

2. Check and record all dimensions that affect the manufacturing and installation of the curtain.

3.2 FABRICATION

1. Fix and assemble work in shop where possible.

2. File and grind exposed welds, smooth and flush. Make exposed welds continuous.

3. Workmanship shall be best grade of modern shop and field practice known to recognized manufacturers specializing in this work. Accurately fit joints and intersecting members and made in true planes with adequate fastening.

3.3 INSTALLATION

1. Assemble components and install in accordance with stop drawings and manufacturer's recommended specifications.

2. Install work square, plumb, straight, true and accurately fitted and well secured to prevent displacement.

3. Included anchors, dowels and fastenings necessary to anchor work together or to work of other trades.

4. Where installing in masonry, centre equipment between masonry block joints. Verify location mounting heights, and dimensions of all units before installation. Anchor in accordance with manufacturer's printed instructions. Co-ordinate with Section 04200.

5. Insulate where necessary to prevent electrolysis between dissimilar materials.

6. Co-ordinate installation of floor sockets with Athletic Flooring 09624.

3.4 ADJUSTING AND CLEANING

1. Ensure curtain functions properly and operates freely. Adjust as required.

2. Clean all soiled surfaces. Exercise care to avoid damage to finished surfaces.

3. Remove debris and packaging materials.

END OF SECTION

PART 1 GENERAL

1.1 Description

A. Scope

1. Retractable Stage – recessed retractable platform stage system. The platform shall be constructed of an aluminum modular substructure to receive 3/4" thick T&G plywood. Stage shall be complete with heavy duty electrically operated winching mechanism controlled by a key operated safety switch and concealed limit switches. Retractable Stage shall automatically and positively lock in the extended position without the use of floor locks. Stage to be complete with hardwood skirt board and detachable, portable safety-tred steps with handrails.

B. Manufacturer's Design Criteria

1. The structures are designed to the following loads, in addition to the self weight of the assembly:
   A vertical live load of 100 lbs./sq.ft. (4.8 Kpa) over the platform area with a vertical live load of 120 lbs. per linear ft. (1.75 kN/m for each linear metre), or a concentrated load of 500 lbs. (2.2 kN).
2. The design is in accordance with the Ontario Building Code (O.B.C.) 2006 and therein listed relevant standards. These include the following:
   a) CSA S-16-1 Limit States Design of Steel Structures
   b) CSA S136-01 Cold Formed Structural Steel Members
   c) CSA 086.1-01 Engineered Design in Wood
   d) CSA S157-05 Strength Design in Aluminum
   e) CSA W59-03 Welded Steel Construction (Metal Arc Welding)
   f) CSA W-47.1-03 Certification for Fusion-Welding of Steel
   g) ASTM-A-475 Air Craft Cable

C. Related Work

1. Final floor finishes to be commercial quality carpet tile as specified. Supplied and installed by flooring subcontractor.
2. Electrical rough-in, power and hook up to all stage components provided by Electrical Contractor.
3. Typically, wall through bolts are supply only and are to be installed by the Contractor during wall construction.
4. General Contractor to coordinate the above with respective subcontractors prior to tender close to ensure inclusion in the base bid tender.

1.2 Quality Assurance

A. Acceptable Manufacturer:
Approved products are recessed mounted retractable stage Masden RS-2 by Sheridan or RS-2 by Gym & Health Equipment Ltd.

1. The manufacturer shall be a firm with at least ten years experience in the manufacturing of retractable stages.
2. The manufacturer shall assume responsibility for the design of the retractable stage specified in accordance with the applicable regulatory requirements.

3. The manufacturer shall ensure that the stage is structurally sound and that component parts and assemblies are capable of supporting super-imposed loads without deflection detrimental to function, appearance and safety.

B. Acceptable Installer
1. Installers to be recognized and certified by the Retractable Stage manufacturer.

1.3 Submittals

A. Submit required number of copies of each of the following:
1. Manufacturer's shop drawings
2. Manufacturer's standard 2-year guarantee
3. Manufacturer's Operation and Maintenance instructions

B. Submit material finish samples, as required.

1.4 Warranty

Submit manufacturers standard warranty form for Retractable Stage.
1. The manufacturer shall guarantee all work performed under these specifications to be free from defects for a period of two (2) full year.
2. The guarantee shall be limited to the fair use of the Retractable Stage and shall not include acts of vandalism, fire, flood or other situations that do not fall into the general use requirements of the stage.
3. A yearly inspection and required maintenance is recommended.

PART 2 PRODUCT

2.1 Manufacturers

1. The basis of design for the Retractable Stage detailed in these specifications is the RS-2 Recessed (Posi-Stage) as manufactured by Gymnasium & Health Equipment Ltd., 416-291-5545, gym-health.com. Other manufacturers must submit technical information to the architect for review minimum 8 days prior to closing. Acceptance of alternative manufacturers will be confirmed via addendum.
2. Model: RS-2 Recessed (Posi-Stage), to include code compliant detachable ST2 portable stage steps with handrails.
3. CSA Approved. Meets CSA C22.1 and applicable standards.
4. Operation: Electric winch assembly with minimum 208v 3ph 1 hp instant reverse motor, magnetic starter, overload protection device, spring loaded key switch, and three limit switches.
5. Product Requirements: Posi-Stage (Recessed Pocket). Width = [7010mm] or [23'-0"]. Depth = [406mm] or [1'-4"]. Height = [4724mm] or [15'-6"]. First three (3) courses of wall to be filled with [3000 psi.] or (20.4 MPa.) strength concrete. Minimum Block Wall Ht. = [190mm] or [8"]. Floor to be "SUPER FLAT" ⅛" in 8' tolerance. Finished floor to be fully glued or blocked as per G&H recommendations. Custom sizes are also available to suit the client's needs.

6. Accessories: 1 set of moveable stairs with handrails on both sides.

2.2 Fabrication

1. Fabricate Retractable Stage in accordance with reviewed, accepted, shop drawings.
2. Vertical steel columns shall be structural steel tubing.
3. Provide 5" x 1 2" non-marking urethane wheels and non-marking adjustable rubber bumpers.
4. Provide three (3) fully automatic braking systems: two (2) "Posispool" drum assemblies with built-in inertia devices, and one (1) "BB-48 Autolock" inertia device. These devices will bring the stage to an immediate stop in case of drive system failure. The braking mechanisms are activated by both inertia (quick jerk) and centrifugal force (faster than normal rotation speed).
5. Provision shall be made for stage to automatically and positively lock in the extended position without the use of floor locks.
6. Each rolling frame will be permanently coupled to its adjacent frame which insures positive engagement and alignment of vertical frames.
7. Provide minimum 3/4" (19mm) nominal CD grade T&G with solid cross band plywood sub floor, fastened to sub frame with countersunk screws, with hardwood nosing on exposed edges.
8. Provide solid, premium grade, White Birch (AWMAC) skirt board along front of stage. Fabric skirt board is also available.
8. Provide paint grade plywood, primed and painted, for vertical shroud around stage, complete with support framing and hardwood corner trim. Provide removable panel at center, top for access to motor.
9. Provide electric winch assembly - 208v, 3ph, 1 HP, instant reverse motor, magnetic starter, overload protection, flush-mounted key switch and three safety limit switches.

PART 3 EXECUTION

3.1 General

A. Manufacturer's representative or Retractable Stage installer shall demonstrate the proper method of operation of the stage to the Owner and Architect upon completion of the work.
B. Retractable Stage Subcontractor shall verify that all areas are free of impediments interfering with the installation and that substrates are acceptable to receive the stage in accordance with the manufacturer's recommendations.
C. Electrical wiring within the building as required for power operation of the stage shall be provided by others.

3.2 Installation

A. Retractable Stage shall be installed in accordance with the manufacturer's instructions and final shop drawings.
B. Adjustment and Cleaning: Upon completion of installation, Retractable Stage Subcontractor shall adjust assembly to operate in compliance with

manufacturer's recommendations. Retractable Stage Subcontractor shall clean installed stage on exposed or semi-exposed surfaces.

C. The manufacturer reserves the right to incorporate design changes and material substitutions as it sees fit to improve the overall product.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Gymnasium Centre Roll Divider Curtain/

1.2 CODES AND BYLAWS

1. Comply with all national and local building Bylaws and Regulations, and all Fire Marshal requirements applicable to this section. A label confirming the firebreak homologation tests shall be fixed permanently to the curtain.

1.3 PROTECTION

1. Protect the work of this section and that of the other trades from damage due to these operations. The Contractor shall make good any such damage at his own expense and to the approval of the Consultant.

1.4 SUBMITTALS

1. Shop Drawings
   1.1 A complete set of shop drawings shall be submitted for approval prior to fabrication indicating construction and installation details.

2. Colour Samples
   1.1 Colour samples shall be submitted with the drawings for selection by the Architect.

1.5 WORK BY OTHERS

1. Electric conduits, wiring, disconnect and boxes to connect to power supply and key switches at hand height. Permanent connections from disconnect to control box.

1.6 WARRANTY

1. Gymnasium Divider Curtain shall be warranted free of defects in material and workmanship for a period of five (5) years.

2. Installation shall be guaranteed for a period of one (1) year against all defects of material and workmanship.

PART 2 PRODUCTS

2.1 GYM DIVIDER CURTAIN

1. Supply and install one electrically operated **roll up** divider curtain as manufactured by QUED and distributed by Gymnasium & Health Equipment in Canada (protected by patents) to be complete in all respects with operating motor and controls.

2. Other suppliers or manufacturers wishing bid products other than specified herein shall submit to the Architect 7 days prior to the bidding a list of 3 past installations

similar to the proposal, complete catalogue data along with deviations from the product specified. The manufacturer guarantees the proposed substitute product to comply with the product specified and as detailed on the drawings unless the deviations are so noted in the submittal for approval.

2.2 MATERAL AND FABRICATION

1. Curtain shall consist of two (2) panels separated at mid height by a 76.2mm (3") diameter exposed continuous anodized aluminum extrusion. Panels are horizontally welded with 32mm (1 1/4") overlapped joints that are double sewn on the lower portion. Top and bottom panels are independent from one another and can be of different materials as required.

2. Curtain to have top and bottom pocket to accommodate 38 mm (1 1/2") support pipe and 32mm (1 1/4") bottom ballast pipe.

2.3 DESIGN CRITERIA

1. The Vinyl shall be continuous the entire length (width) of the curtain and have the following characteristics:

Lower Portion	**Upper Portion**
Vinyl	Flexmesh
Weight 0.85kg/sq.m (25oz/sq.yd)	0.24kg/sq.m
(7 oz/sq.yd) Embossed both sides	5mm (1/4")
Apertures	

Finish Colour to be selected by Architect
Lower panel to extend wall to wall less the manufacturer's recommended clearances.

2.4 RAISING AND LOWERING MECHANISM

1. The tubular motor(s) mounted in the end of the mid height aluminum extrusions is 1/2 hp,110 V, 1-phase thermally protected complete with planetary reduction, electric disc brake, and travelling limit switches. The motor torque is transmitted to a travelling car mounted on the wall at end(s) of curtain. Torque can also be transmitted to a ridged arm and belt mounted to overhead. Type of reactor is decided by curtain contractor and clearly shown.

2. A safety brake(s) is attached directly to the torque mechanism (arm or car system).

3. Operating control shall be spring loaded type key switch flush mounted: provide two key activated switches, wired in series; locate switches where indicated by Consultant. Provide up, down, and stop controls.

4. All exposed hardware is to be zinc plated or painted to colour match as required by the Architect.

PART 3 EXECUTION

3.1 EXAMINATION AND MEASUREMENT

1. When the job is sufficiently advanced to permit the installation of the gymnasium divider curtain, visit the site and check the actual conditions where the partition is to be installed, to ascertain whether or not the preparation work by the preceding trades is acceptable.

2. Check and record all dimensions that affect the manufacture and installation of the units. Incorporate these dimensions into the Shop Drawings.

3. Delivery to the job site shall be coordinated by Contractor. Proper storage of the curtain before installation and continued protection during and after installation shall be the responsibility of the Contractor.

3.2 INSTALLATION

1. Install gymnasium divider curtain straight and level and adjust movable parts for smooth operation.

2. Clean soiled surfaces with cleaners compatible with finished surfaces.

3. A GYM & HEALTH factory trained installer(s) shall carry out this installation.

4. Electrical Contractor will provide electrical connections and power.

3.3 OPERATION

1. The gymnasium divider curtain shall be capable of being stacked at the top of the opening between joists or under joist as required.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

1. Drawings and general provisions of the contract apply to this Section.
   Review these documents for coordination with additional requirements and information that apply to work under this Section

1.2 SUMMARY

1. Work of this Section includes all labor, materials, installation equipment, and services necessary to complete the Work as shown on the drawings and specified herein, including, but not limited to, the following:

   1. Ceiling recessed electrically operated projection screen

   2. Provide accommodation in ceiling for suspended mounting of projection screen as well as projectors.

1.3 RELATED SECTIONS

1. Related requirements specified elsewhere include:

   1. Section 05500 – Miscellaneous Metals

   2. Section 06100 – Rough Carpentry

   3. Section 06200 – Architectural Woodwork

   4. Electrical raceway and wiring to monitor locations – Division 26, Electrical.

   5. Data raceway and cabling to monitor locations – Division 25, Integrated

1.4 CERTIFICATIONS

1. Manufacturer's specifications and recommendations.

2. UL / ULC certified

1.5 SUBMITTALS

1. Installation drawings and wiring diagrams.

2. Equipment / Product literature.

1.6 DELIVERY, HANDLING AND STORAGE

1. Deliver products/equipment in manufacturer's unopened packaging, labeled to identify each product/equipment. Products/equipment shall be opened at time of installation.

2. Include installation, programming and maintenance instructions in package.

3. Handle and store products/equipment in accordance with manufacturer's recommendations.

1.7 OPERATION AND MAINTENANCE DATA

1. Manufacturer's manual / instructions.

1.8 WARRANTY

1. Parts and labour manufacturer's standard warranty unless indicated otherwise by Owner.

PART 2 PRODUCTS

2.1 GENERAL

1. Subject to compliance with requirements, provide the specified products and/or materials from indicated manufacturers. Other comparable products may be submitted as substitution requests.

2. Submit product information and test data showing that products are equal or better within ten (10) days prior to bid for Architect and/or Owner's review and approval.

3. Requests for substitutions will be considered in accordance with provisions of Sections 01016 - Products and Section 01500 - Substitutions

2.2 BASIS-OF DESIGN PRODUCTS

1. Electrically operated Projection Screen by **Da-Lite Screens**

    1. Type: Ceiling recessed

    2. Model: **Advantage Deluxe Electrol (DAL88155)**

        1. Approved equal Da-Lite Screen, Model "Class Rite.

    3. Diagonal Size: 200 inches (5080mm)

    4. Viewing area: Video format – 120 inches H x 160 inches W (3050 mm x 4060mm).

    5. Screen Material: Seamless matte white fabric, mildew resistant, and flame retardant.

    6. Black backed screen material

    7. Allow 2'-0" (600mm) extension.

2. Projector (s): Short Throw projectors to be supplied by Owner and installed by Contractor.

PART 3 EXECUTION

3.1 PREPARATION

1. Site confirm stage opening dimensions and notify Architect of any discrepancies.

2. Coordinate with work specified in Division 26 for electric circuits to equipment locations.

3. Coordinate with work specified in Divisions 25, and for data cabling to equipment locations.

4. Provide 10" (254mm) wall mount brackets at all projection screen locations.

5. Provide structural backing if/when required for fire-retardant plywood as specified in Section 06100.

6. Coordinate with projection screen contractor to determine exact size, type and configuration of structural backing.

3.2 INSTALLATION

1. Install in accordance with manufacturer's recommendations.

2. Clean, adjust and test equipment.

3. Protect installed equipment from damage during construction.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1. Division One - General Requirements is a part of this section and shall apply as if repeated here.

1.2 DESCRIPTION

1. Work included: Provide as a separate price option (refer to supplementary tender form) manually operated rolling shade systems in all classrooms, offices. Library and wherever else indicated on drawings. Provide motorized rolling shade systems in the Gymnasium. Provide Privacy screens for doors and sidelights into all classrooms. Provide all components as needed for a complete and proper installation.

1.3 RELATED WORK

1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Masonry - Section 04200

3. Wood Blocking - Section 06100

4. Finish Carpentry - Section 06200

5. Aluminum Window Curtain Wall System - Section 08900

6. Electrical – Refer to Electrical Sections

1.4 QUALITY ASSURANCE

1. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 SUBMITTALS

1. Product Data: Within 60 calendar days after the General Contractor has received the Owner's Notice to Proceed, submit:

    1. Materials list of items proposed to be provided under this Section.

    2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
    3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this Section with the work of

adjacent trades.

4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

2. Construct one complete light proof window shade with attachments and accessories for approval by the Architect.

1.6 WARRANTY

1. Three-year written warranty against mechanical and fabric failure (including fabric fading) under normal conditions.

1.7 ACCEPTANCE

1. All manual and motorized shades remain the property of the supplier until accepted in place by the Architect.

1.8 SCOPE

1. Supply and installation of Manual Rolling Shades with 3% opening weave in all Classrooms, Library and Offices. Supply and install motorized black out rolling shades in the Gymnasium.

2. Provide privacy screens at glazing in all doors and sidelights into all classrooms. Product equal to Velo PS and Velo PSL by Activar Inc. 1-800-554-6077.

PART2 PRODUCTS

2.1 MOTORIZED SHADE SYSTEM

1. ElectroShade motorized shading system. Specifications are based on products manufactured by:

1. Sun Project Canada Inc. – www.altex.com
500 Applewood Crescent
Vaughan, ON, Canada L4K 4B4
1.888.836.6980 | 905.660.3117

2. Provide Moduline Electra Tandem 105 120VAC where required for layout of multiple blinds.

3. Approved equal product/manufacturer is Solarfective Products Ltd.

4. Motorized Sunshades locations: Gymnasium.

2.2 ELECTROSHADE MOTOR SYSTEM

1. Switches: Internal limit switches are adjusted by two external thumbscrews to allow exact setting of travel in both the raised and lowered positions.

Micro switches provide circuit braking at the end of the run. The limit-switch setting cannot be disturbed by the action of the roller tube.

2. Brake: A soleroid activated disc brake mechanism stops and holds in any position. The brake automatically disengages when the motor is operating.

3. Motor: An asynchronous motor with built-in reversible capacitor start-and-run is made to be operated with 95 to 125 V. A.C. at 60 hz., single phase, temperature Class-A (maximum temperature rating of 140 degrees C.), thermally protected, totally enclosed, maintenance free with locking disconnect plug assembly furnished with each operator. Provide Electra tandem 105 120VAC where required for multiple blinds.

4. Gear Box: Three levels of satellite gears are provided for load distribution (planetary gears) and machined to close tolerance of tempered steel.

5. Installation: A single pin locks the drive end of the motor to the tube. A notched section in the tube turns the ring which counts the turns and activates the limit switch. To interchange motors, the pin is pressed out of the tube and the motor slides out.

6. Sizes: The motors are available in torques of 35-435 in lbs. (lifting capacity), 12-30 r.p.m. speed, to meet specified requirements and shall not exceed 60 mm in diameter.

7. Warranty: The manufacturer provides warranty that the motor is free of manufacturing defects for three (3) years from the date of installation. This warranty is void if the products have been improperly installed or subjected to improper care.

2.3 HARDWARE AND ACCESSORIES REQUIRED FOR A TOTAL INTEGRATED SYSTEM

1. Shade Roller: Extruded aluminum tube, 6063-ST6 alloy, 2.55 in. OD with internal keyway to receive tubular motor. The tube is extruded with two fabric-mounting channels designed so that the shade cloth does not disengage from the tube itself.

2. Mounting Spline: Extruded vinyl with asymmetrical locking channels and embossed fabric guide for use with 2.55 in. OD tube. Spline has sufficient capacity to hold shade and additional weight without disengaging from the tube.

3. End Brackets: Consist of 1/8" in. thick sheet steel. Wall, jamb or ceiling mounted as required and permanently installed.

4. Centre Support Brackets: supplied to meet span or weight requirements. Ceiling or wall mounted.

e. Weights: Mill-finished aluminum, flat bars, single lengths for each shade panel.

5. Fascia: Extruded aluminum 6063T5 with clear anodized finish. Used for surface mounted applications at east wall cafetorium 128. Snap on with concealed fastenings that hide the bracket assembly and appears to be a continuous unit when mounted side to side.

6. Recessed Housing: is specifically designed for acoustical or plaster ceilings with removable closure plate for access to the recessed and concealed roller system.

7. Finishes: All exposed aluminum parts have a clear anodized finish. Steel parts are either cadmium plated, satin finished or have been bonderized prior to painting with a baked enamel finish.

8. Exterior hembars shall be rectangular 6 mm x 37 mm, with internal grooves to accommodate a fabric guide carrier at each end.

9. Side channel shall be a heavy-duty two-piece Snap-On 75 x 22 side channel for inside or frontal mount.

10. Fabric shall be hot laser cut and reinforced at the edges with a high frequency thermoweld seal. Fabric is reinforced with heat sealed spring tempered stainless steel batten stiffeners positioned approximately every 900 mm insuring that fabric cannot escape or be pulled out of the side channel.

2.4 BLACKOUT SHADE FABRIC

1. To be located at Gymnasium only. Lightproof shades to be 100% opaque blackout flame retardant. Architect to choose colour when shop drawings are submitted. Seams shall be equally spaced vertically to form equal widths. Note two levels are required to mount above and below the horizontal beam located as a brace to the curtain wall system in the Gymnasium.

2.5 SUNSHADE FABRIC

1. Provide manual rolling shades in all other areas fabric to be 3% open weave flame retardant. Architect to choose colour when shop drawings are submitted. Seams, if required, shall be equally spaced vertically to form material in equal widths.

2.6 AUTOMATIC OPERATOR

1. 3 position remote control switch with "up", "down", and "stop" control. Mount operator in shade frame with control switch located where indicated. Include all components for proper unit operation. Control each shade in one room from individual control stations for each shade.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

1. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

1. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interfaced with the work of this Section.

2. Install the work of this section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of government agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

3. Install the work plumb, level, and in proper operating condition.

4. Upon completion of the installation, put each operating component through at least five complete cycles, adjusting as required to achieve optimum operation and complete blackout at all edges (at blackout locations).

5. Touchup scratches and blemishes to be completely invisible to the unaided eye from a distance of five feet (1500 mm) or replace item.

END OF SECTION

1. GENERAL:

1. GENERAL REQUIREMENTS:

1. Conform to Division General Requirements and all related sections.

INSTRUCTIONS:

1. This Contractor shall report in writing to the General Contractor and to the Architect any defects of surfaces or work prepared by other trades which affect the quality or dimensions of this Contractor's work. Commencement of this Contractor's work shall imply complete acceptance of all work by other trades.

2. QUALIFICATIONS:

1. STANDARDS:

1. To establish a standard for tendering purposes, the Drawings and Specifications are based on **DELTA Elevator Co Ltd – Holeless Electro Hydraulic Limited Use, Limited Application (LULA) Elevator(s): See specifics below**.

1. Approved alternates:

1. Savaria Orion MRL, Otis Elevator, Montgomery Kone Elevator, Schindler Elevator and Federal Elevator.

2. QUALITY ASSURANCE:

1. Employ fully trained mechanics who are regularly employed in this field and elevator contractors who have been satisfactorily supplying and installing similar elevator installations over a period of at least the immediate past five years.

3. SHOP DRAWINGS:

1. Submit five (5) copies of all shop drawings for the Architect to review. Do not commence work until reviewed drawings have been returned.

4. WARRANTY:

1. The Elevator Contractor shall warranty the work and materials and will make good any defects, not due to ordinary wear and tear, or to improper use or care, which may develop within one year from the date of completion provided same has been properly used, oiled and cared for, and provided all payments due by the terms of this contract shall have been made in full when due.

2. Workmanship and any materials supplied and used in this work to be in strict

accordance with this specification.

5. LEED PROJECT:

1. Composite wood resins laminate adhesives shall not contain added urea-formaldehyde.

6. MEASUREMENTS:

1. General Contractor to confirm all hoist way measurements and plumbness as per Elevator shop drawings.

7. MAINTENANCE:

1. A quality maintenance service consisting of regular examinations at least once a month, adjustments and lubrication of the elevator equipment shall be provided by the Elevator Contractor for a period of **twelve (12)** months after the elevator has been turned over for the owner's use and this service shall not be subcontracted. All work shall be performed by competent employees during regular working hours of regular working days and shall include emergency 24 hour call back service. This service shall not cover adjustments or repairs due to negligence, misuse, abuse or accidents caused by persons other than the Elevator Contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided. This service shall be supplied by the elevator contractor and shall not be subcontracted.

8. WORK NOT INCLUDED UNDER THIS CONTRACT BUT SUPPLIED AND/OR INSTALLED BY OTHER SECTIONS:

1. A properly framed and enclosed legal hoistway, including adequate guards and protection of hoistway during the erection period.

2. Access to the machine room and machinery space as required by the governing code or authority.

3. Suitable machine room / control room with legal access and ventilation, with concrete floor and applicable fire ratings in accordance with elevator, safety electrical and building codes. Temperature in machine room to be maintained between 15 degrees C (60 degrees F) and 32 degrees C (90 degrees F).

4. No conduit, wiring, or piping other than that pertaining to the elevator(s) is permitted in the hoist way, or control room / control space / machine room.

5. Suitable light and convenience outlets in machine room with light switches located within 450 mm (18") of lock jamb side of machine room door.

6. A lockable fused disconnect switch or circuit breaker with auxiliary contact for each elevator in the control room / machine room per the Canadian Electric Code with feeder or branch wiring to controller or starter.

7. A fused 120 Volts, A/C, 15 amp., single phase, power supply to each controller.

8. Venting of the hoist way as required by the governing code or authority, Temperature control is required to be maintain between 10 degrees C to 32 degrees C. Maximum allowed humidity is 95% non-condensing.

9. Adequate supports for rail brackets, buffers, hydraulics including spreader beams between multiple hoistway if required. Maximum bracket spacing as required by elevator contractor, but not to exceed 3050 mm (10'). Design for the reaction forces shown on elevator drawings.

10. Entrance partition walls are not to be constructed until after door frame and sills are in place. If entrance walls are poured concrete bearing walls, rough openings are to be provided to accept entrance frame and filled in after frames are set. Entrance frames are not designed to support overhead wall loads. Suitable supports for these loads must be provided. If decorative material is applied to listed/certified frames it shall conform to the requirements of the certifying organization.

11. Recesses, as required, to accommodate hall signal fixtures.

12. Dry pit reinforced to sustain normal vertical forces from rails and impact loads from buffers and hydraulic jack systems, cylinder heads and earth loading. Concrete cylinder head and buffer support not to be poured until cylinder is set in place.

13. Continuous chemical applied pit waterproofing, install Volclay Water stop-RX on all footings to foundations and other concrete forming joints.

14. Convenience outlet and light fixture in pit with switch located adjacent to the access door.

15. At access to a pit is by means of the lowest hoistway entrance, vertical iron pit ladder extending 1220 mm (4'-0") minimum above sill of lowest access door with centreline of rung 115 mm from wall with 300 mm vertically between rungs. Ladder width is 400 mm. Ladder location as shown on elevator shop drawings. Ladder and attachments shall sustain a minimum load of 135 kg.

16. Any cutting, patching, and painting of walls, floors, or partitions together with finish painting of entrance doors and frames.

17. Necessary electric power for light, tools, hoists, etc., during erection as well as electric current for starting, testing and adjusting the elevator.

18. A hoisting beam suitable for lifting a fully loaded elevator car.

19. General Contractor to pay for the elevator licence at time of inspection.

20. Backfill around pit.

21. Provide sand.

9. CODES:

1. Installation, elevator, components, accessories and operation must comply with CSA B44 Elevator Code currently in effect and all governing Codes and By-Laws.

2. All welding of elevator components shall be done by a CWB certified company according to CSA Standards W47 and W59.

10. PERMIT AND INSPECTIONS:

1. The elevator contractor shall furnish all licenses and permits and shall arrange for and make all inspections and tests required thereby.

2. The General Contractor must complete the TSSA pre-inspection checklist prior to an initial inspection being scheduled.

3. Submit T.S.S.A. Inspection Report at Owner takeover time indicating all work is complete and accepted or listing work still outstanding. All items outstanding to be completed within 30 days and submit an updated T.S.S.A. report at that time.

11. KNOW SITE CONDITIONS:

1. The Elevator Contractor to be familiar with job conditions on the site.

12. MAINTENANCE CONTROL PROGRAM

1. The Elevator Contractor must provide and leave on site a Maintenance Control Program in compliance with the requirements of the CSA B44 Elevator Code. The procedures and logbook of records must be available to the TSSA upon request.

13. SCOPE OF WORK:

1. The Elevator Contractor shall do all work for elevator from main power disconnect controller to finish installation of elevator and accessories except finish flooring.

2. Electrical Contractor to provide main power disconnect and install wire connection into controller.

3. Elevator Contractor shall obtain and pay for all inspections by T.S.S.A. and other local authorities.

3. PRODUCTS:

1. ELEVATOR:

    1. Hole-less Electro-Hydraulic Limited Use, Limited Application:

        1. Model 4854F, Wide Orientation, Front Door Only

    2. Rated Load:

        1. 635 kg

    3. Rated Speed:

        1. 0.15 m/s

    4. Car Inside Dimensions:

        1. 1220 mm wide x 1372 mm deep – (Model 4854)

    5. Hoistway Size:

        1. Model 4854F, Wide Orientation, Front Door Only
           1752 mm W x 1854 mm D

        2. Coordinate with Architectural drawings.

    6. Operation: Automatic

    7. Car Controls: Illuminated type with faceplate, stainless steel #4 finish.

    8. Hall Call Stations: Illuminated type, stainless steel #4 cover plates.

    9. Hoist way Entrances Size: Coordinate with shop drawings.

    10. Type: Two Speed Sliding (left or right)

    11. Door Operator: Automatic ECI operator for hoistway and car. Opening and closing speed to suit handicapped requirements.

    12. Travel: Coordinate with Architectural Drawings

    13. Stops: Coordinate with Architectural Drawings

    14. Openings: Coordinate with Architectural Drawings

    15. Power Supply: 208 Volts, 3 phase, 60 Hertz / 220V, 1 phase, 60 Hertz – Elevator supplier to confirm this before closing of tender

    16. Lighting Supply: 120 Volts, 60 Hertz, 15 amp.

17. Elevator must comply with CSA-B44 (Latest Version Including Supplements) Code for Passenger and Freight Elevators. Elevators must meet the appendix E handicapped requirements.

18. Emergency Monitoring: Provide 24 hours / 7 days emergency monitoring service for the extent of the 1-year warranty period.

2. CAR CAB SPECIFICATIONS:

1. Shell Enclosure:

1. Car Top: 14 ga. (l.9mm) furniture steel, blk. enamel finish

2. Shell Walls: 16 ga. (l.52mm) furniture steel - cage frame type construction

3. Strike Column: 16 ga. (l.52mm) Stainless steel #4.

4. Fascia: 16 ga. (l.52mm) Stainless steel #4, full width, straight type.

5. Car Doors: 16 ga. (l.52mm) Stainless steel #4 clad car door.

2. Architectural Features:

1. Side Walls: raised hang-on vertically applied panels removable from inside the car of 19mm (3/4") plywood with Type 304 stainless steel with #4 (satin) finish on all exposed faces and edges. Reveals between panels shall also be Type 304 satin finished stainless steel #4

2. Front Return: Stainless steel #4

3. Car Door: Stainless steel #4

4. Base: Stainless Steel #4

5. Reveals: Stainless Steel #4

6. Flooring: Flooring shall be supplied and installed by flooring contractor. (coordinate with shop drawings for thickness and weight)

7. Hoistway Doors and Frames: Stainless Steel #4

3. Supplementary Features:

1. Lighting: Stainless Steel #4 panels with LED down lights, 6 panel drop ceiling

2. Ventilation: Two speed fan

3. Emergency Exit: Top exit in car in accordance with CSA B44 Elevator code.

4. Car Sills: Extruded Aluminum

5. Overall Height: 2134mm (7' 0") (2134mm clear inside)

6. Car Operating Station Buttons: Top row of buttons located in compliance with CSA B44 Elevator Code Appendix E for accessibility, maximum 1420mm (4' 8") from floor for accessibility by the handicapped.

7. Handrail: Located on all non-entrance walls: 38mm Round exterior diameter, Stainless Steel #4.

8. Pad Hooks: Required / included

9. Protective Pads: One set

4. Other Control Features:

1. Other Buttons: Battery emergency power for lowering of elevator and door opening, door open button, independent service key switch, phone button to activate conversation, light key switch, run stop key switch, access key switch

5. Emergency Car Lighting: An emergency power unit employing a 6 volt sealed rechargeable battery and totally static circuits shall be provided that shall illuminate the elevator car and provide current to the alarm bell in the event of normal power failure. The equipment shall comply with the requirements of the current CSA B44 Code.

6. Labels: Entrances shall be manufactured in accordance with procedures established by Under-Writers laboratories and shall be so labelled.

7. Sight Guards: Sight guards shall be furnished on the leading edge of the doors to conceal the hoistway beyond the doors. Finish to match door panels.

8. Car Floor Indicator: One (1) to be installed in car as part of the car station

9. Hall Floor Indicator: One (1) to be installed at each landing

10. Certificate Frame: Stainless Steel #4, mounted on elevator cab wall

11. Car Lantern and Gong: A directional lantern visible from the corridor shall be provided in the car entrance on the same side as the car operating station.

12. Low Pressure Switch

13. Firefighters emergency Operation: Provide all requirements for FEO Phase 1 and Phase 2 in each elevator.

14. Emergency Power Sequencing: Automatic Standby Building Emergency Power Operation to conform to CSA B44 Elevator Code to allow automatic and manual selection of individual cars to run on emergency power.

15. Braille floor designation tags placed beside corresponding floor buttons on the car station.

16. Independent service operation

17. Battery Powered Lowering

3. CYLINDER AND PLUNGER (JACK UNIT):

1. The jack shall be designed and constructed by Delta Elevators in accordance with the applicable requirements of the CSA B44 Code. It shall be of sufficient size to lift the gross load the height specified, and shall be factory tested to insure adequate strength and freedom from leakage.

2. The jack unit shall consist of the following parts: A plunger of heavy seamless steel tubing accurately turned and polished; a stop ring electrically welded to the plunger to prevent the plunger from leaving the cylinder; a packing seal of suitable design and quality; a drip ring around the cylinder top; a cylinder constructed of steel pipe complete with a pipe connection and air bleeder.

4. PUMPING UNIT :

1. The pumping unit shall be a Delta Elevator unit of integral design and shall include an electric motor connected to a pump, a hydraulic control system, a storage tank, necessary piping connections, and a controller, all compactly designed as a single self-contained unit. The motor and pump assembly shall be mounted on a rubber isolated inner base.

5. PUMP:

1. The pump shall be a positive displacement screw type to give smooth operation and shall be especially designed and manufactured for elevator service.

6. MOTOR:

1. The motor shall be of the alternating current, polyphase squirrel cage induction type and shall be of a design especially adapted to electro-hydraulic requirements.

7. HYDRAULIC CONTROL SYSTEM:

    1. The hydraulic control system shall be of compact design suitable for operation under the required pressures. The control valve shall be a manifold with up, down, and check valve sections. A control section including solenoid valves will direct the main valve and control up and down starting, transition from full speed to levelling speed, up and down stops, pressure relief and manual lowering. Down speed and up and down levelling will be controlled at the main valve sections. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. All control systems shall be pre-adjusted at the factory.

    2. The manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.

8. LEVELLING DEVICE:

    1. The elevator shall be provided with an automatic levelling device which will bring the car to a stop within 6mm (1/4") of the landing level regardless of load or direction of travel. Landing level will be maintained within the levelling zone irrespective of the hoistway doors being open or closed.

9. STORAGE TANK:

    1. The storage tank shall be constructed of steel, and shall be provided with a cover, a protected vent opening and oil fill, a filter screen mounted over the suction inlet and a drain connection. Tank design shall incorporate a reserve capacity of no less than 45 litres (10 gallons). An initial supply of oil sufficient for proper operation shall be provided. A heater, thermostatically controlled, shall be provided in the storage tank to maintain proper oil temperature.

10. PIPING:

    1. Pipe of adequate size and thickness shall be installed between the pumping unit and the cylinder head. A shut off valve shall be provided for maintenance and adjusting purposes.

11. CONTROLLER:

    1. A Delta Elevator microprocessor controller shall be provided. Including necessary starting switches of adequate size together with all relays, switches and hardware required to accomplish the operation specified. Overload protection shall be provided to protect the motor against overloading.

12. CAR STALL PROTECTIVE CIRCUIT:

    1. A protective circuit shall be provided which will stop the motor and the pump and return the car to its lowest landing in the event the car does not reach its designed landing with a predetermined time interval. This circuit

will permit a normal exit from the car but prevent further operation of the elevator until the trouble has been corrected.

13. WIRING:

1. All wiring and electrical interconnections shall comply with the governing codes. Insulated wiring shall have flame retardant and moisture proof outer covering, and shall be run in conduit, tubing or electrical wireways. Travelling cables shall be flexible and suitably suspended to relieve strain on individual conductors.

14. HOISTWAY OPERATING DEVICES:

1. Normal terminal stopping devices shall be provided. When an emergency terminal stopping device is also required, it shall be furnished and the controller switches and circuitry arranged in accordance with the requirements of the Code.

15. PIT SWITCH:

1. An emergency stop switch shall be located in the pit.

16. PIT MAINTENANCE STAND

1. Provide a non-removable means to mechanically hold the car above the pit floor to provide an area in the pit for maintenance and inspection as per requirements of the CSA B44 Elevator Code.

17. PLATFORM:

1. The car platform shall have a fabricated frame of formed and structural steel shapes, rigidly welded. Sub-flooring shall be min. 75mm (3/4") G1S fir plywood sub floor. The underside of the platform will be fireproofed. The platform shall be manufactured by a CWB certified shop and be equipped with an aluminum threshold.

18. CAR FRAME:

1. A suitable car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosure. The car frame shall be isolated from the platen plate by means of rubber isolation mounts. Shoe or slipper guides shall be mounted on top and bottom of the car frame to engage the guide rails. The crosshead shall be of sufficient strength to lift the fully loaded car when slung in the centre.

19. GUIDES:

1. Steel elevator guide rails shall be furnished to guide the car, erected plumb and securely fastened to the building structure.

20. DOOR OPERATION:

1. Doors on the car and at the hoistway entrances shall be power operated by means of a quality operator mounted on top of the car. The motor shall have positive control over the door movement for smooth operation. The car door shall have a safety shoe to cause instant re-opening should contact be made with any obstruction during the closing cycle.

2. Door operation shall be automatic at each landing with door opening being initiated as the car arrives at the landing and closing taking place after expiration of a time interval. A car door electric contact shall prevent starting the elevator away from the landing unless the car door is in its closed position.

3. An approved positive interlock shall be provided for each hoistway entrance which shall prevent operation of the hydraulic unit unless all doors for that elevator are closed and shall maintain the doors in their closed position while the elevator is away from the landing. Provide emergency access to the hoistway as required by governing codes.

4. The elevator contractor shall install at each landing served, a hoistway entrance of the type and size as previously described. Each entrance shall consist of flush hollow metal doors with build in hanger assembly, frames assembled for one piece unit installation, extruded aluminum sill, fascia, toe guard, hanger cover, header, hanger track assembly, and formed structural strut supports. Entrance design and construction must be in compliance with NBC 2005 requirements for fire labels.

5. Sill supporting angles required for flush hoistway construction shall be furnished by the elevator contractor.

21. TELEPHONE:

1. An ADA-approved AUTODIAL telephone shall be furnished and installed as part of the car station. A separate phone line to the elevator controller shall be provided and located in the elevator machine room under another section of the specifications.

22. PAINTING:

1. All exposed metal work furnished under this section shall be properly painted after erection by the elevator contractor unless otherwise specified. All painting to conform to Section 09900.

23. OPTIONAL FEATURES

1. Provision for Security System in car operating panel (space in panel for card reader (Card Reader Provided and Installed by Others) and travelling cable wiring from elevator to controller).

2. Standby Building Emergency Power generator Operation
Manual – selective lowering and running of elevators

3. Battery Powered Emergency Lowering Operation

4. Oil Heater

5. Oil Cooler

6. Oil Interceptor

7. Provide equipment according to Seismic zone.

8. Roller Guides

3. EXECUTION

3.1 EXAMINATION

1. Pre-inspect the construction and all requirements for work by others before the installation commences.

3.2 INSTALLATION

1. Install all components of the elevator system that are specified in this Section to be provided and that are required by jurisdictional authorities to licence the elevator.

2. All installation work of this Section will be performed by trained employees of the manufacturer.

3. Obtain and pay for all inspections by T.S.S.A. and other local authorities.

3.3 ARRANGEMENT OF EQUIPMENT

1. Arrange equipment in machine room so that equipment can be removed for repairs or replacement without dismantling or removing other equipment components.

2. Accommodate equipment in space indicated.

3.4 GUIDE RAILS AND BRACKETS

1. Erect guide rails plumb and parallel with maximum deviation of 3 mm.

2. Use material shims only and provide lock washers under all nuts and tapped bolts.

3. Compensate for expansion and contraction of guide rails.

4. Use splice plate and guide rails with contact surfaces accurately machined to form smooth joints.

5. Include steel reinforcement and backing for car guide rails where necessary.

3.5 ERECTION

1. Set entrances in perfect alignment with car openings and true with plumb hoistway lines.

2. Erect elevator closures to labelling requirements.

3.6 PROTECTION

1. Provide protective coverings for finished surfaces.

3.7 TOUCH-UP

1. Upon completion, touch-up and restore to new condition, damaged or defaced factory finished surfaces.

2. Remove protective coverings and clean exposed surfaces after completion and leave in first class condition.

3.8 FIELD QUALITY CONTROL

1. Perform and meet tests required by latest issue of CAN3 B44.

2. Submit test and approval certificates issued by jurisdictional authorities.

3. Demonstrate complete operation of elevator to Owner's representative.

3.9 MACHINE ROOM

1. The machine room will be located on the third floor adjacent to the elevator shaft as indicated on the drawings.

END OF SECTION

Division 21 Fire Suppression

Common Contract Requirements for Fire Suppression

21 02 51 Fire Protection General Requirements
21 02 61 Fire Protection Occupancy Requirements

Facility Fire Suppression Water Service Piping

21 05 19 Pressure Gauges

Fire Suppression Sprinkler Systems

21 13 13 Wet Pipe Fire Suppression

Division 22 Plumbing

Contract Requirements for Plumbing

22 02 21 Plumbing Supplemental Tender Form
22 02 51 Plumbing General Requirements
22 02 61 Plumbing Occupancy Requirements

Common Work Results for Plumbing

22 05 11 Plumbing Work Requirements
22 05 19 Thermometers and Pressure Gauges
22 05 31 Plumbing Expansion Joints, Anchors, and Guides
22 05 34 Plumbing Bases, Hangers, and Supports (Indoor)
22 05 49 Plumbing Vibration and Noise Control Measures
22 05 53 Identification of Plumbing Services

Commissioning for Plumbing

22 05 65 Plumbing Contractor Commissioning Requirements

Plumbing Insulation

22 07 19 Plumbing Piping Insulation

Facility Water Distribution

22 11 11 Site Services - Water Mains
22 11 16 Domestic Water Piping – Copper
22 11 20 Backflow and Cross Connection Measures
22 11 31 Potable Water Auxiliary Equipment

Facility Sanitary Sewerage

22 13 13 Sanitary Drains
22 13 11 Site Services - Sanitary Sewers
22 13 16 Sanitary Waste and Vent Piping – Cast Iron and Copper
22 13 17 Sanitary Waste and Vent Piping – Plastic

Facility Storm Drainage

22 14 11 Site Services - Storm Sewers
22 14 16 Storm Drainage Piping - Plastic
22 14 26 Storm Drains

Fuel-Fired Domestic Water Heaters

22 34 36 Fuel-Fired Domestic Water Heaters

Plumbing Auxiliary Equipment
22 36 13 Plumbing Auxiliary Equipment
Fire Extinguishers
22 37 13 Portable Fire Extinguishers
Plumbing Fixtures Combined With Drawing Schedule
22 44 13 Plumbing Fixtures Combined With Drawing Schedule

Division 23 Heating, Ventilating, and Air Conditioning (HVAC)

Common Contract Requirements for HVAC
23 02 21 HVAC Supplemental Tender Form
23 02 51 HVAC General Requirements
23 02 61 HVAC Occupancy Requirements
Common Work for HVAC
23 05 11 General HVAC Work Requirements
23 05 19 Thermometers and Pressure Gauges
23 05 31 HVAC Expansion Joints, Anchors, and Guides
23 05 34 Bases, Hangers and Supports (Indoor)
23 05 35 Bases, Hangers, and Supports (Outdoor)
23 05 49 HVAC Vibration and Noise Control Measures
23 05 53 Identification of HVAC Services
Testing, Adjusting, and Balancing
23 07 11 Testing, Adjusting, and Balancing (TAB) of HVAC Systems
Commissioning for HVAC
23 08 11 HVAC Contractor Commissioning Requirements
23 08 12 HVAC System Commissioning by Agent
HVAC Insulation
23 10 13 Duct Insulation
23 10 19 HVAC Piping Insulation
Facility Fuel Piping
23 11 23 Facility Natural-Gas & Propane Piping
Refrigerant Piping
23 23 13 Refrigerant Piping and Specialties
HVAC Ducts and Casings
23 31 13 Metal Ducts
Air Plenums and Chases
23 32 13 Fabricated, Metal Air Plenums
Air Duct Accessories
23 33 13 Duct Accessories
23 33 14 Volume-Control Dampers
23 33 16 Fire Dampers
23 33 17 Smoke Control Dampers

23 33 18 Operating Dampers
23 33 46 Flexible Ducts
23 33 53 Duct Liners

HVAC Fans

23 34 23 Packaged Exhausters

Air Terminal Units

23 36 16 Variable-Air Volume Units

Air Outlets and Inlets

23 37 13 Diffusers, Registers, and Grilles
23 37 23 Louvres, Intakes, and Exhaust

Air-To-Air Energy Recovery Equipment

23 72 13 Heat-Wheel Air-to-Air Energy-Recovery Ventilators (Enthalpy)

Custom Outdoor HVAC Equipment

23 75 12 Semi-custom Outdoor Heating and Cooling Air Handling Units

Decentralized Unitary HVAC Equipment

23 81 26 Wall Hung Split System Air Conditioning

Division 25 Integrated Automation

Building Automation System

25 20 01 Building Automation Systems – General Requirements
25 20 02 Building Automation System – Network Architecture and Wiring
25 20 03 Building Automation System – Operator Interface
25 20 04 Controllers
25 20 05 Field Devices and Sensors
25 20 06 Application and Systems Sequences of Operation

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 Conform to Division 1 General Conditions and to all sections of Mechanical Division.

.2 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

.3 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

.4 The term “Mechanical Contractor” shall remain active and shall mean a “single contractor” performing plumbing, drainage, heating, cooling, ventilation, and control services.

.5 When quoting as a subcontractor this contractor shall explicitly state the services, they are providing i.e. Mechanical (all services), Plumbing (water and drainage systems) or HVAC (including hydronic and air systems).

.6 Contractors shall be explicit to identify whether Fire Protection is included or omitted from the mechanical scope.

1.2 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for fire protection work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 REGULATIONS, PERMITS, AND FEES

.1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes, and by-laws in force in the area of the project.

.2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.

.3 In the event that changes, or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor’s expense.

.4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.

1.4 DRAWINGS

.1 The drawings and this specification have been assembled together as a responsibility of the consultant. The same is true for the other consultants, i.e. architect, structural engineer, civil engineer, fire protection engineer, electrical engineer, etc.

.2 The drawings and specifications are not assembled together for responsibility/division between subcontractors. The division of work between subcontractors remains the responsibility of the buildings' contractor (also known as the prime contractor or general contractor).

.3 All subcontractors are encouraged to perform work amicably utilizing all of the drawings and specifications published by all of the consultants.

.4 Fire protection drawings do not show architectural, structural, plumbing, mechanical and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes, or additions to runs of piping, conduits, and ducts to accommodate structural conditions. Location of pipes and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.5 As work progresses and before installing piping and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings, or obtain directions for exact location of such equipment and fitment's.

.6 Install piping clear structural members and any fireproofing. Locate work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.

.7 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels, and dimensions to ensure proper and correct installation.

.8 Locate all fire protection piping and equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.9 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.10 Relocate equipment and/or material installed but not coordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.11 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.5 INTERFERENCE AND COORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant's request submit copies of interference drawings to consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, plumbing, mechanical, and electrical systems for the consultant's review prior to fabrication.

.2 Detailed layout drawings, clearly showing fasteners and hangers.

.6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

1.6 QUALITY ASSURANCE

.1 Perform work in accordance with applicable provisions of local Code and NFPA requirements. Ordinances, and adoptions thereof for all fire protection systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

.2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

1.7 EXAMINATION

.1 Site Reviews

.1 Examine premises to understand conditions which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.8 SEQUENCING, SCHEDULING, AND COORDINATION

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of fire protection items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Fire Protection Division caused by neglect to do so shall be made at no cost to Owner.

.3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Fire Protection Division.

.5 Be responsible for required cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.6 Adjust locations of pipes, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe prior to fabrication.

.1 Make offsets, transitions, and changes in direction of pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.7 Slots and openings through floors, walls, and ceilings shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.9 REQUEST FOR INFORMATION (RFI) PROCEDURES

.1 RFIs shall be submitted to the consultant a minimum of two (2) weeks prior to answer being required. Failure to submit an RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.

.2 All RFIs will be submitted with the following information:

.1 RFI number
.2 Name of project
.3 Date of initiation
.4 Date response required by (minimum two (2) weeks)
.5 Subject
.6 Submitter's name
.7 Drawing/specification reference
.8 Photograph of the issue (if applicable)
.9 Description of the issue
.10 Contractor's proposed resolution

1.10 SHOP DRAWINGS AND PRODUCT DATA

.1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 14 days after award of Contract.

.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.

.3 Provide a complete list of shop drawings to be submitted prior to first submission.

.4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.5 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.

.6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.7 Submit all shop drawings for the project as a package. Partial submittals will not be accepted.

.8 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or their Engineer shall not supersede Contract Documents.

.9 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. e.g., access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 Shop drawings shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.

.2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (1) copy of the “reviewed” shop drawings in a binder as noted above.

.6 Contractor to print copies of “reviewed” shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

1.11 EQUIPMENT NAMEPLATE DATA

.1 Between the manufactures design published literature, the shop drawing submission literature, and the nameplate data on the equipment, they can all read differently.

.2 Most of the confusion and differences are coming out of the electrical power installation.

.3 The contractors installing and connecting the equipment are responsible for the coordination of this data through the construction period.

.4 The contractors shall share and/or request this information through out the project and monitor/make adjustments, provide recommendations accordingly based on any discrepancies.

.5 The contractors are responsible for any cost associated with the changing data.

.6 The final installation must meet the “Nameplate Data” on the equipment on site.

1.12 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as in submittals’ requirements.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

.3 Submit one (1) copy of Operation and Maintenance Manual to Consultant for review and approval. Submission of individual data will not be accepted unless directed by Consultant. Submission can be done electronically in PDF format or as a hard copy.

.1 Electronic submission/pdf file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.

.2 Hard copy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as ‘Operation and Maintenance Manual’ with project name and location. Dividers are to be used for binder organization.

.4 Make changes as required and re-submit as directed by Consultant.

1.13 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible fire protection drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing fire protection systems, control systems, and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

1.14 WARRANTIES

.1 In addition to guarantee specified in General Conditions, guarantee fire protection systems to be free from defects that may develop from failure to construct system in accordance with Contract Documents.

.2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation and Maintenance Manual.

.3 Warranty period shall start from date of ready for takeover. Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.3 Warranty Duration:

.1 One (1) year warranty period applies unless otherwise noted.

.4 Warranty Coverage:

.1 Applies to parts and labour.

1.15 READY FOR TAKEOVER

.1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover:

.1 As-built Drawings

.2 Maintenance Manuals

.3 System Start up

.4 Instructions to Owners.

1.16 REVISION TO CONTRACT

.1 Provide the following:

.1 Itemized list of material with associated costs.

.2 Labour rate and itemized list of labour for each item.

.3 Copy of manufacturers/supplier’s invoice if requested.

1.17 DELIVERY, STORAGE, AND HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, chemical, and other environment damaging conditions but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

.3 Remove any damaged materials from site.

1.18 TESTS

.1 Give 48 hours written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Bear costs including retesting and making good.

.1 Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.

.5 Test fire systems in accordance with authorities having jurisdiction (AHJ) NFPA requirements and as specified elsewhere.

.6 Equipment: test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.19 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to all fire protection.

1.20 ELECTRICAL

.1 Electrical work to conform to Electrical Division including the following:

.1 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems. Follow Electrical Division for installation methods, quality of materials, and workmanship.

.2 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.21 PIPING AND EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer shall follow the manufacturer's recommendation.

.2 Piping and equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

1.22 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.3 Through fire rated walls and floors.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

.7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

1.23 FIRE STOPPING

.1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.

.2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.

.3 Do not use cementitious or rigid seals around penetrations for pipe or other fire protection items piercing walls, floors, etc.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

.5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.

.6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide “fire wrap” blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.

.8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.

.11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.12 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.

.14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.

.15 Acceptable alternate manufacturers to approval of local authority:

- .1 Minnesota Mining and Manufacturing
- .2 Fryesleeve Industries Inc.
- .3 General Electric Pensil Firestop Systems
- .4 International Protective Coatings Corp.
- .5 Rectorseal Corporation (Metacaulk)
- .6 Proset Systems
- .7 3M
- .8 AD Systems
- .9 Hilti

.16 Ensure firestop manufacturer representative performs onsite inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.24 ESCUTCHEONS

.1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

1.25 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Apply two coats of paint to exposed piping service in mechanical room, electrical, and service rooms. Base colour shall be red.

.4 Prime and touch up marred finished paintwork to match original.

.5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.26 ACCESS DOORS

.1 Provide access doors to concealed fire protection equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.3 Fire rated areas: provide ULC listed access doors.

.4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.5 Acceptable Manufacturers:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.27 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.28 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 Fire protection systems in this building, including but not limited to flow switches, valves, fire pumps, etc. will be subject to Integrated Life Safety Systems testing.

.2 The Fire Protection Contractor shall co-ordinate with the Integrated Life Safety Systems Testing Agent as follows:

.1 Confirm which fire protection systems are to be included as part of the testing process.

.2 Verify in writing to the Integrated Life Safety Systems Testing Agent that fire protection commissioning of the affected systems/devices is complete prior to the scheduled testing date(s).

.3 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all associated systems.

.4 This Contractor shall work with the Integrated Life Safety Systems Testing Agent to reset all systems back to normal operating mode after the testing is complete.

.3 Include all costs associated with Integrated Life Safety System Testing in the tender value.

.4 Refer to Division 1/Division 26 Integrated Life Safety Systems Testing specifications for additional information/requirements.

1.29 IDENTIFICATION OF SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend, direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR MARKING	LEGEND
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

1.30 FUNCTIONAL PERFORMANCE TESTS

.1 This Contractor shall be responsible for the Functional Performance Tests. These tests ensure that all equipment and systems operate in accordance with design intent. Test the systems through all possible modes of operation.

.2 The function performance test shall be:

.1 Test piping systems.

.2 Test all valves and flow switches.

.3 Test flow and record flow from end of inspector's test port.

.4 Test flow thru all backflow preventors.

.5 Other test that maybe a requirement of NFPA.

.3 All test shall be recorded and presented to the Consultant and Owner.

.4 Include all test results in the Operation and Maintenance Manuals.

Part 2 **Not Used**

Part 3 **Not Used**

END OF SECTION

Part 1 General

1.1 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant's satisfaction prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter):

.1 NFPA-13 Contractors Material and Test Certificate (sprinkler)

.2 NFPA-13 Fire Protection Bypass Flow Test

.3 Sprinkler Design Engineers' Letter

.4 System has been tested with the Integrated Testing Contractor.

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit manufacturer's product data for following items:

.1 Pressure gauges

.2 Stop cocks

.3 Siphons.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

.2 Ranges: suitable for application.

2.2 PRESSURE GAUGES

.1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Acceptable Manufacturers:

.1 Winters

.2 Trerice

.3 Wiess.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Gasketed pressure relief back with solid front.

.3 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 PRESSURE GAUGES

.1 Install in following locations:

.1 Upstream and downstream of PRV's.

.2 Upstream and downstream of backflow preventors.

.3 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

3.3 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 NFPA 13 latest edition, Installation of Sprinkler Systems.

.3 Ontario Fire Code.

.4 Ontario Building Code.

.5 Factory Mutual guidelines.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements in accordance with NFPA 13, working plans and design requirements.

.2 Shop drawings shall be approved by authority having jurisdiction prior to submission.

.3 Submit to Consultant for general review and information only.

.4 Submitted drawings shall be reproducible. Do not submit marked up prints.

.5 Drawings shall be in AutoCad format.

1.3 SAMPLES

.1 Submit samples in accordance with general requirements.

.2 Submit samples of following:

.1 Each type of sprinkler head.

.2 Signs.

1.4 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with Ontario Fire Marshall, local authority having jurisdiction, Owner's underwriters as required, and NFPA 13, NFPA 20, and NFPA 45 using following parameters:

.1 To suit occupancy as indicated.

.2 Pipe size and layout: Hydraulic design.

.3 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with NFPA 13. Indicate location and flow on shop drawings.

.4 System zoning as indicated in accordance with NFPA 13.

.5 Provide complete drawings and calculations stamped by a qualified professional engineer registered in the Province of Ontario.

.6 Professional Engineer shall provide on site review and certification for local building code review.

.2 System shall be approved by Ontario Fire Marshall, local authority, and Owner's underwriter prior to shop drawing submission.

1.5 COMMISSIONING AND INTEGRATED TESTING OF FIRE PROTECTION AND LIFE SAFETY SYSTEMS

.1 Sprinkler Contractor to perform services with the Fire Commissioning Agent (FCA) to meet their requirements for administration, verification, and final sign-off.

.2 The Fire Commissioning Agent (FCA) is being retained by the Electrical Contractor, however; this Contractor's work to satisfy the FCA requirements shall be included in the tender price.

.3 The Sprinkler Contractor at a minimum must include for:

.1 Providing FCA with all documentation of design and shop drawings.

.2 Provide documents for sequence of operation and maintenance of system.

.3 Movement of all valves and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.

.4 Create flow at all initiating devices to verify detection at the fire panel.

.5 Testing and operation of any fire pumps.

.6 Other items that may be requested by the FCA.

.7 Re-commissioning of any items that may have failed.

.8 Putting the system back into proper operation after tests are completed.

.4 All work is to be performed in accordance with NFPA 3 2010 Edition. Special consideration to be given to Figure A3.3.16 (b) for Sequence of Operation Form required to be completed in conjunction with the FCA and submitted to the Consultant's prior to occupancy.

.5 The work to be performed by this Contractor is also described in NFPA 3 table A.5.1.1 as labelled "Construction Stage" and "Occupancy Stage".

1.6 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

.2 Provide spare sprinklers and tools as required by NFPA 13.

1.8 QUALIFICATIONS

.1 Contractor to be specialist in performing work of this section and have **at least 3 years'** successful experience in this size and type of project.

1.9 PERMITS AND FEES

.1 Obtain and pay for all permits, fees, and inspections as required by authority having jurisdiction.

1.10 EQUIPMENT

.1 ULC listed and labeled.

1.11 STORAGE

.1 Store in original packaging with manufacturers' labels and seals intact.

.2 Store in dry secure location.

.3 Damaged material and/or equipment shall be replaced.

1.12 INSURANCE

.1 Confirm with owner prior to submitting quote.

1.13 UNDERWRITERS REQUIREMENTS

.1 Confirm with owner insurance underwriters prior to submitting quote.

Part 2 Products

2.1 PIPE, FITTINGS, AND VALVES

.1 Pipe and Fittings:

- .1 25 mm (1"): Schedule 40 steel pipe with screwed fittings.
- .2 32 mm (1¼") to 50 mm (2"):
  - .1 Schedule 40 steel pipe with screwed fittings or,
  - .2 Schedule 10 steel pipe with roll grooved fittings.
- .3 65 mm (2½") and larger: Schedule 10 steel pipe with roll grooved fittings.

.2 Valves:

- .1 ULC listed for fire protection service.
- .2 Up to NPS 2: bronze, screwed ends, OS&Y gate.
- .3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve.
- .4 Swing check valves.
- .5 Ball drip.

.3 Pipe hangers:

- .1 ULC listed for fire protection services.

.4 End switches:

- .1 Provide on all isolating valves.
- .2 Coordinate voltage and location with Fire Alarm Contractor.

.5 Flow switches:

- .1 Provide where indicated and required.
- .2 Coordinate voltage and location with Fire Alarm Contractor.

2.2 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Indicate type and location of sprinkler heads on drawings. Co-ordinate sprinkler heads location with other trades.

.3 Locate sprinkler heads in acoustic tile ceiling in centre of tile.

.4 Provide sprinkler heads as follows:

.1 Upright bronze: Exposed with no ceilings.

.2 Concealed fusible link type brass pendent with ring and cup in ceiling and brass coverplate. Coverplate finish selected by Consultant. Concealed heads installed in unsupervised areas (corridors, washrooms).

.3 White semi-recessed fusible link type brass pendent with adjustable, recessed escutcheon ring and cup. Sprinkler and escutcheon cup. Finish selected by Consultant. Semi-recessed heads installed in supervised areas (classrooms, offices, seminar rooms, etc.).

.4 Sprinkler heads with O-ring design shall not be used.

.5 Provide guards on upright sprinkler heads in all storage rooms, in the gymnasium and on heads below 1800 mm AFF.

.5 Provide sprinkler heads under all equipment/ductwork over 1200 mm wide.

2.3 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.

.4 Pressure alarm switch:

.1 With normally open and normally closed contacts and supervisory capability.

2.4 WATER GONG

.1 To NFPA 13 and ULC listed for fire service. Location as indicated.

2.5 FIRE DEPARTMENT CONNECTION

.1 To NFPA 13 and ULC listed, siamese type, location as indicated. Thread specifications to be compatible with local fire department.

.2 Polished chrome plated recessed with identifying sign cast on plate. Threaded metal caps and chains.

2.6 PRESSURE GAUGES

.1 ULC listed.

.2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

2.7 SIGNS

.1 Signs for control drain and test valves: to NFPA 13.

.2 Provide exterior signage for Fire Department connection. Location of signage and text shall be to the approval of the local authority having jurisdiction.

2.8 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Include all types and temperature ratings of sprinkler heads installed.

.3 Construct to sprinkler head manufacturers standard.

.4 Install where directed on site or next to alarm valve.

2.9 DOUBLE CHECK VALVE ASSEMBLY (DCVA)

.1 The double check backflow preventer shall be ASSE 1015 approved and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276), and the seat disc elastomers shall be EPDM.

.2 The checks shall be accessible for maintenance without removing the device from the line.

.3 Complete with supervisory switches for connection and monitoring by the fire alarm.

.4 Install to manufacturer's requirements and not higher than 1200 mm (4'-0") AFF.

.5 Acceptable Manufacturers:

.1 Watts 709 2½" - 10"

.2 Wilkins 950 2" - 10", 350 4" - 6"

.3 Conbraco 40-100 Series

2.10 INSPECTORS TEST CONNECTIONS

.1 Provide where indicated and to requirements of local authority.

.2 Discharge to building exterior to acceptance of Consultant.

.3 Provide suitable signage to satisfaction of authority having jurisdiction and Consultant.

2.11 DOCUMENTATION

.1 Prepare documentation as indicated.

.2 Provide documentation based on tender documents. Coordinate sprinkler drawings with all trades.

.3 Provide one hard copy and one electronic copy of As Built drawings acceptable to Consultant prior to final payment.

2.12 UNIT PRICES

.1 Provide unit prices as follows.

.1 Additional sprinkler head including hangers, 3.6 m piping and two elbows.

.2 Delete sprinkler head including hangers, 3.6 m piping and two elbows.

Part 3 Execution

3.1 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13 and FC 403.

.2 Pipe a bypass complete with indicating valve, between Fire department connection and sprinkler main downstream of DCVA. Bypass shall be sized to allow flow test of system demand as per NFPA 13 forward flow test through the backflow preventor.

.3 Testing to be witnessed by authority having jurisdiction.

.4 Space hangers and support of sprinkler piping in accordance with N.F.P.A. regulations.

.5 Hydrostatically test systems at 350kPa in excess of normal working pressure, but not less than 1.4 MPA for two hours without loss under supervision of authority having jurisdiction and NFPA requirements.

.6 Provide hydraulic pump, temporary connections and labour required for tests.

.7 Protect exposed work, in accordance with 'Painting' section.

.8 Do not cover or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction.

.9 Adjust equipment to satisfaction of authority having jurisdiction and Consultant.

.10 Protect equipment during painting. Replace damaged and painted components.

.11 Co-ordinate the sprinkler piping and equipment with that of other trades on the job. Mains and branches shall be run so as not to interfere with building's structure, mechanical, or electrical installations. Branch piping above ceilings is to run in joist space or minimum 300 mm above ceiling. Provide drops at head locations only. All exposed piping to run in joist space.

.12 Guarantee that the systems and equipment be installed in accordance with all Local and Provincial by-laws and the rules and regulations of the Insurance Underwriters and the Building Code of Ontario.

.13 Provide a flow test for each system on the remote inspectors test connection using methods approved by the local fire department and local water commission. Report the test results in writing to the Consultant.

3.2 WATER FLOW TEST

.1 Provide a flow test to approval of local fire department and local water commission at nearest fire hydrant adjacent to building to determine water flow rate and pressure. Provide written test results with shop drawing submission.

.2 Provide a forward flow test through the bypass to prove system demand can be provided through the backflow preventer.

END OF SECTION

Part 1 General

1.1 INSTRUCTIONS TO BIDDERS

.1 The Supplemental Tender Form must be submitted to the architect and consultant (admin@deiassociates.ca) within 2 hours after tender closing. Contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.

.2 Should the Plumbing Supplemental Form not be submitted then the contractor shall use Base Bid manufacturers as listed.

.3 CONTRACTOR

I/We certify that I/We have the authority to bind the company.

COMPANY NAME	AUTHORIZED SIGNATURE
ADDRESS	PRINTED SIGNATURE
CITY	TITLE
TELEPHONE NUMBER	DATE

.4 SUB-CONTRACTORS

The Contractor shall state below the name of the Sub-contractors he intends to use, which shall not be changed without the consent of the Consultant.

Site Services _____

Insulation _____

BAS Controls _____

.5 The Stipulated Bid Sum shall be for the base bid manufacturer or supplier equipment only, unless otherwise indicated. Where a choice of this equipment is given, this Contractor shall indicate the supplier or manufacturer he intends to use. Where no choice is indicated, the base bid supplier or equipment shall be used.

.6 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The Plumbing Contractor shall not indicate equipment, materials or suppliers which are not listed. If this is done, the base bid supplier shall be used.

.7 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.8 Submit the following list of Base Bid and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	**Equipment**	**Base Bid**	**Acceptable Alternate Manufacturer Or Supplier**	**Indicate Manufacturer Or Supplier**
22 05 19	Direct Reading Thermometers	Trerice	Winters 91T Wiess	
22 05 19	Pressure Gauges	Winters 91T	Trerice Weiss	
22 05 31	Expansion Compensators (EXP) (2"-4")	Metraflex HP	Mark David Canada Senior Flexonics	
22 05 34	Plumbing Bases, Hangers, and Supports (Indoor)	Grinnell	Anvil Myatt Taylor	
22 07 19	Thermal Insulation for Plumbing Piping	Johns Manville	Knauf Manson Owens Corning	
22 11 20	Backflow Devices	Watts	Wilkins	

22 11 31	Non Freeze Wall Hydrants (Recessed, Encased)	Zurn Z-1300	Mifab MHY-20 Ancon HY-725 Contour C7100	
22 11 31	Interior Hose Bibb	Watts SC-3 series (exposed on wall)	Watts SC-3 series (surface mounted (piping in wall)) Waltec Wilkins Emco	
22 11 31	Water Hammer Arrestors	Zurn Z-1700	Mifab MWH-100 Ancon No. 15	
22 11 31	Back Flow Preventors Reduced Pressure Principle Type up to 65 mm (2 ½") to 250 mm (10") (RP)	Watts 909 2 ½" - 10"	Wilkins 975 2 ½" - 10" or 375 4" – 6" Conbraco 40-200 Series	
22 11 31	Hose Bibbs and Sediment Faucets	Watts BD Series	Emco Chicago Zurn	
22 11 31	Water Filters	Aqua Puro AP11B		
22 11 31	Solenoid Valves	Asco		
22 13 13	Drainage Supplies	Zurn	Ancon Smith Mifab Watts Contour Enpoco Jay R. Smith Polydrain	
22 14 26	Storm Drains	Zurn	Mifab Watts Jay R. Smith Ancon Contour Smith	

22 44 13	Fixture Carriers	Zurn	Smith Ancon	
22 44 13	Plumbing Fixtures	Delta	McGuire	
22 13 13	Trap Seal Stations	Mifab	Watts Zurn	
22 36 13	Domestic Hot Water Expansion Tank	Amtrol ST-12C	Well-X-Trol	
22 37 13	Fire Extinguishers	Wilson & Cousins	National	
22 37 13	Fire Blanket	National	Wilson & Cousins	
22 34 36	Fuel Fired Domestic Water Heaters	A.O. Smith	Ruud Bradford White J. Wood Clemmer McDonnell Miller	
22 36 13	Domestic Hot Water Circulating Pumps	Bell & Gosset	Armstrong Taco	
22 36 13	Thermostatic Water Controller (3 Port)	Symmons 7-1000A-ASB-W	Powers	
22 36 13	Automatic Urinal Flushing System	Water Matrix UTC Sentinel		

1.2 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Superintendent	$_____/hr
Journeymen	$_____/hr
Labourers	$_____/hr
Plumbers	$_____/hr
Insulation	$_____/hr
Other	$_____/hr

1.3 PLUMBING TENDER PRICE (EXCLUDING HST)

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: $_____

_____

(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

Part 2 Products

2.1 NOT USED

Part 3 Products

3.1 NOT USED

END OF SECTION

CONTRACTOR'S NAME:_____ DATE:_____

Part 1 General

1.1 GENERAL PROVISIONS

.1 This section covers items common to all sections of Plumbing Division.

.2 Conform to Division 1 General Conditions.

.3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

.4 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

.5 The term “Mechanical Contractor” shall remain active and shall mean a “single contractor” performing plumbing, drainage, heating, cooling, ventilation, and control services.

.6 When quoting as a subcontractor this contractor shall explicitly state the services they are providing i.e. Mechanical (all services), Plumbing (water and drainage systems) or HVAC (including hydronic and air systems).

.7 Contractors shall be explicit to identify whether Fire Protection is included or omitted from the mechanical scope.

1.2 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for plumbing work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 TENDERS AND BONDING

.1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.

.2 Submit Supplemental Tender Form as noted.

.3 Submit tender based on specified described equipment or Alternates listed.

.4 State in Tender, names of all Subcontractors proposed for work under this Division.

.5 No bonding required for this contractor.

1.4 REGULATIONS, PERMITS, AND FEES

.1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes, and by-laws in force in the area of the project.

.2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.

.3 In the event that changes, or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor's expense.

.4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.

1.5 DRAWINGS

.1 The drawings and this specification have been assembled together as a responsibility of the consultant. The same is true for the other consultants, i.e. architect, structural engineer, civil engineer, fire protection engineer, electrical engineer, etc.

.2 The drawings and specifications are not assembled together for responsibility/division between subcontractors. The division of work between subcontractors remains the responsibility of the buildings' contractor (also known as the prime contractor or general contractor).

.3 All subcontractors are encouraged to perform work amicably utilizing all of the drawings and specifications published by all of the consultants.

.4 Plumbing and Mechanical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes, or additions to runs of piping, conduits, and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.5 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings, or obtain directions for exact location of such equipment and fittments.

.6 Plumbing and Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.

.7 Install piping and ductwork to clear structural members and any fireproofing. Locate plumbing work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.

.8 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels, and dimensions to ensure proper and correct installation. Verify existing/municipal services.

.9 Locate all plumbing, mechanical, and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.10 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.11 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.12 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.6 INTERFERENCE AND COORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant's request submit copies of interference drawings to consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, plumbing, mechanical, and electrical systems for the consultant's review prior to fabrication.

.2 Detailed layout drawings, clearly showing fasteners and hangers.

.6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof for all plumbing systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

.2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

1.8 ALTERNATES AND SUBSTITUTIONS

.1 Throughout Plumbing and Mechanical Division are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.

.2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" nor "equal" specified product unit is proposed and does not fit space allotted in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for "alternate" or "equal" equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

.5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

1.9 EXAMINATION

.1 Site Reviews

.1 Examine premises to understand conditions which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Drawings:

.1 Plumbing and Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

.2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.

.3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

.3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.10 SEQUENCING SCHEDULING AND COORDINATION

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of plumbing items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Plumbing Division caused by neglect to do so shall be made at no cost to Owner.

.3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish and install inserts and supports required by Plumbing Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Plumbing Division.

.5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.6 Adjust locations of pipes, ducts, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.

.1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc., as required to affect these offsets, transitions, and changes in direction.

.7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.11 REQUEST FOR INFORMATION (RFI) PROCEDURES

.1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit an RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.

.2 All RFIs will be submitted with the following information:

.1 RFI number
.2 Name of project
.3 Date of initiation
.4 Date response required by (minimum two (2) weeks)
.5 Subject
.6 Submitter's name
.7 Drawing/specification reference
.8 Photograph of the issue (if applicable)
.9 Description of the issue
.10 Contractor's proposed resolution

1.12 CONTRACT BREAKDOWN

.1 Provide breakdown of contract exclusive of HST to acceptance of consultants prior to first draw submission.

.2 Provide labour and material cost for each item.

.3 Breakdown shall indicate total contract amount.

.4 Contract breakdown shall be as follows as a minimum.

.1 Mobilization and shop drawings (max. $2,000.00)
.2 Inside buried plumbing and drainage
.3 Above grade rough-in plumbing and drainage
.4 Roof drainage system
.5 Plumbing fixtures
.6 Plumbing equipment

.7 Condensate piping

.8 Piping insulation

.9 Firestopping

.10 3rd Party Commissioning Agent

.11 Plumbing contractor closeout requirements (min. of 3% for the first $500,000.00, 1% from $500,000.00 to $5,000.000.00, and 0.5% beyond. Shall not be less than $5,000.00).

.5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.13 COMMISSIONING CONTRACT BREAKDOWN

.1 This contractor shall work with the plumbing and HVAC system commissioning contractor as specified elsewhere.

1.14 SHOP DRAWINGS AND PRODUCT DATA

.1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 14 days after award of Contract.

.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.

.3 Provide a complete list of shop drawings to be submitted prior to first submission.

.4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.5 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.

.6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.7 Submit all shop drawings for the project as a package. Partial submittals will not be accepted.

.8 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or their Engineer shall not supersede Contract Documents.

.9 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to

such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. e.g., access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 Shop drawings shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (1) copy of the “reviewed” shop drawings in a binder as noted above.

.6 Contractor to print copies of “reviewed” shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

1.15 EQUIPMENT NAMEPLATE DATA

.1 Between the manufactures design published literature, the shop drawing submission literature, and the nameplate data on the equipment, they can all read differently.

.2 Most of the confusion and differences are coming out of the electrical power installation.

.3 The contractors installing and connecting the equipment are responsible for the coordination of this data through the construction period.

.4 The contractors shall share and/or request this information through out the project and monitor/make adjustments, provide recommendations accordingly based on any discrepancies.

.5 The contractors are responsible for any cost associated with the changing data.

.6 The final installation must meet the “Nameplate Data” on the equipment on site.

1.16 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as in submittals’ requirements.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

.3 Submit one (1) copy of Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant. Submission can be done electronically in PDF format or as a hard copy.

.1 Electronic submission/PDF file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.

.2 Hard copy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as ‘Operation and Maintenance Manual’ with project name and location. Dividers are to be used for binder organization.

.4 Make changes as required and re-submit as directed by Consultant.

.5 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Operation instruction for each system and each component.

.4 Description of actions to be taken in event of equipment failure.

.5 Valves schedule and flow diagram.

.6 Colour coding chart.

.7 Spare parts equipment list.

.8 Manufacturers standard or extended warranty information.

.6 Maintenance data shall include:

.1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.7 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.

.5 Copy of all substantial performance final certificates.

.8 Miscellaneous data to include:

.1 Letter of contractor’s warranty and guarantee.

.2 Index sheet.

.3 Tabbed format for each section.

.4 Manufacturers approved shop drawings.

.5 Spare parts list and source.

.6 List of Manufacturers and suppliers address for each piece of equipment.

.9 Final Submittals:

.1 Upon acceptance of Operation and Maintenance Manual by the Consultant, provide the following:

.1 Provide two (2) copies of final Operation and Maintenance Manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one (1) USB stick is to be provided containing both the approved manual and as-built drawings.

1.17 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible plumbing drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing plumbing systems, control systems, and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings submittal for TAB and review:

.1 Prior to start of Testing, Adjusting, and Balancing (TAB), finalize production of as-built drawings.

.2 Identify **each drawing** in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW PLUMBING SYSTEMS AS INSTALLED" (Company Name) (Signature of Contractor) (date).

.3 TAB to be performed using as-built drawings.

.4 Submit copy to Consultant for review and approval. When returned, make corrections as directed.

.3 As-built drawings final submittal:

.1 Once approved, submit completed, reproducible paper as-built drawings as well as a scanned PDF file copy on USB stick with Operation and Maintenance Manuals.

1.18 WARRANTIES

.1 In addition to guarantee specified in General Conditions, guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

.2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

.3 If plumbing sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local plumbing sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.

Warranty period shall start from date of ready for takeover. Warranty start date based on shipment date, start up date, substantial completion date, etc. are not applicable.

.4 Warranty Duration:

.1 One (1) year warranty period applies unless otherwise noted.

.5 Warranty Coverage:

.1 Applies to parts and labour.

1.19 READY FOR TAKEOVER

.1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.

.1 As-built Drawings

.2 Maintenance Manuals

.3 System Start up

.4 TAB Reports

.5 Plumbing Systems Commissioning

.6 Instructions to Owners

1.20 REVISION TO CONTRACT

.1 Provide the following:

.1 Itemized list of material with associated costs.

.2 Labour rate and itemized list of labour for each item.

.3 Copy of manufacturers/supplier's invoice if requested.

1.21 DELIVERY, STORAGE, AND HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or environmental damages but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

.3 Remove all damaged materials from site.

1.22 ENERGY EFFICIENCY

.1 The systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings" and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.

.2 All equipment, products, and installations must conform to the Codes and Standards.

END OF SECTION

Part 1 General

1.1 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant's satisfaction prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter).

.1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)

.2 Backflow Test Certificate (for all testable devices)

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 TESTS

.1 Give 48 hours written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Bear costs including retesting and making good.

.5 Piping:

.1 General: maintain test pressure without loss for 4 h unless otherwise specified.

.2 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.

.3 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa (124.8 psi), whichever is greater.

.6 Equipment: test as specified in relevant sections.

1.2 SYSTEM START UP

.1 Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.

.2 Provide consultant with written notice verifying all equipment operation and installation is complete.

.3 Start up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 Arrange with all parties and provide 72 hours notice for start up procedure.

.6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 COMMISSIONING

.1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.

.3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process.* The commissioning plan may be modified to reflect the actual construction schedule and design.

.4 Provide a pre-functional test of all plumbing system and sub-system elements, including control devices, shall be checked for the following:

.1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.

.2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.

.3 Verify that tests, meter readings, and specific plumbing/mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.

.4 Controls calibration to be completed in accordance with the specification.

.5 The TAB shall be done in accordance with the specifications.

.5 Reports:

.1 The contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.

.2 All data must be recorded as soon as possible during the course of the inspection and testing.

.3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.

.6 Plumbing System Execution:

.1 Operate equipment and systems shall be tested in the presence of the owner's representative and the consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.

.2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.

.3 Testing shall be conducted under specified design operating conditions as recommended or approved by the consultant.

.4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.

.5 All special testing materials and equipment shall be provided by the appropriate contractor.

.6 Provide three copies of all test reports and records to the consultant.

.7 The verification testing procedures shall address all operating characteristics of all plumbing equipment and systems.

1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Plumbing contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.

.3 Where specified elsewhere in this Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.

.4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.5 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Domestic water

.2 Plumbing and drainage.

1.6 DEFICIENCIES

.1 During the course of construction, the consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.

.2 Instruction to correct work shall be done within the work period before the next review.

.3 The contractor shall not conceal any work until inspected.

.4 The contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.

.5 Upon completion of the project the consultant will do a final review. Upon receiving the final inspection report, the contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once consultant receives this in writing.

1.7 EQUIPMENT INSTALLATIONS

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.8 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install plumbing equipment at following heights unless indicated otherwise.

.1	Standard water closets	350 (14") to top of bowl
.2	Barrier-free water closets	400 (16") to top of bowl
.3	Barrier-free water closets	450 (18") to top of seat lid
.4	Wall hung lavatory	787 (31") to rim
.5	Barrier-free wall hung lavatory	840 (33") max to top of rim 737 (29") min underside of rim front 685 (27") clear at 400 (8") from basin front 350 (14") min clear under waste trap
.6	Urinals (Adult)	± 600 (24)
	Urinals (Senior Elementary)	**475 (19") to rim**
	Urinals (Junior Elementary)	**425 (17") to rim**
	Urinals (Barrier-free)	425 (17") to rim
	Urinals (Barrier-free)	1000 (40") to flush lever or sensor
.7	Hose bibbs	+/- 600 (24")
.8	Barrier-free drinking fountains	840 mm (33") to rim Not less than 686 (27") under unit
.9	**Backflow preventors**	**900 – 1200 (3'– 4') to centerline of unit**

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

1.9 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other Divisions.

1.10 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.11 ELECTRICAL

.1 Electrical work to conform to Electrical Division including the following:

.1 Supplier and installer responsibility and related plumbing responsibility is indicated in Equipment Schedule on plumbing/mechanical and/or electrical drawings.

.2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems. Follow Electrical Division for quality of materials and workmanship.

.3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.12 CONTROL WIRING

.1 Furnish and install all components, devices, and control wiring for all plumbing, fire protection, HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of owner and consultant and to manufacturer's requirements and recommendations.

.2 All electrical wiring and installations shall comply with local and national electrical codes.

.3 Supply and install wiring as required for all devices and systems. Install wiring in EMT conduit and otherwise comply with all requirements of the Electrical Division. Approved plenum wire may be used for sensor and network communication wiring where it complies with appropriate building codes and regulatory authorities.

.4 All wiring concealed in walls and chases, and all exposed wiring shall be run in conduit.

.5 Provide recessed conduit and backer boxes where controls are wall mounted. Surface mounted boxes and conduit are acceptable in service rooms.

.6 Free-run plenum rated cable shall be run in cable hangers where provided by Electrical Division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring "as the crow flies".

1.13 MOTORS

.1 Provide high efficiency motors for plumbing equipment.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.

.4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

1.14 PIPING AND EQUIPMENT SUPPORTS

.1 Fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

.2 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.

.3 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

1.15 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.3 Through fire rated walls and floors.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

.7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

1.16 FIRE STOPPING

.1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.

.2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.

.3 Do not use cementitious or rigid seals around penetrations for pipe(s) or other equipment at all wall, floor, or ceiling penetrations.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

.5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.

.6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide “fire wrap” blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.

.8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.

.11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.12 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.

.14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.

.15 Acceptable Alternate Manufacturers to approval of local authority:

- .1 Minnesota Mining and Manufacturing
- .2 Fryesleeve Industries Inc.
- .3 General Electric Pensil Firestop Systems
- .4 International Protective Coatings Corp.
- .5 Rectorseal Corporation (Metacaulk)
- .6 Proset Systems
- .7 3M
- .8 AD Systems
- .9 Hilti

.16 Ensure firestop manufacturer representative performs onsite inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.17 ESCUTCHEONS

.1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

1.18 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Apply two coats of paint to exposed piping service in service room(s). Base colour as specified in Pipe Identification Section.

.4 Prime and touch up marred finished paintwork to match original.

.5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.19 ACCESS DOORS

.1 Provide access doors to concealed plumbing equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.3 Fire rated areas: provide ULC listed access doors.

.4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.5 Acceptable Manufacturers:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.20 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes NPS 50 mm (2") and under: isolating unions.

.3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

1.21 DRAIN VALVES

.1 Locate at low points and at section isolating valves unless otherwise specified.

.2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with vacuum air breaker and chain with cap.

.3 Drain valves on potable water systems shall be complete with vacuum breaker.

1.22 REPAIRS, CUTTING, AND RESTORATION

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

1.23 CLEANING

.1 Clean interior and exterior of all systems including strainers.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

1.24 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.25 VIDEO RECORDING OF NEW UNDERGROUND SERVICES

.1 Prior to final acceptance of the new underground plumbing system and prior to pouring the floor this contractor shall retain a qualified contractor to video tape the new, and revised sanitary and storm drainage piping and branch piping. Transfer all videotape information to USB.

.2 This contractor shall flush the new storm and sanitary system to remove all debris prior to final video taping of systems.

.3 Provide 1 copy of USB.

.4 Identify video routing on As-built drawings.

1.26 EXCAVATING AND BACKFILLING

.1 Provide all excavating and backfilling inside and outside the building for plumbing pipes, drains and equipment. All backfilling shall be new clean granular 'A' fill brought in specifically for the purpose of backfilling to the underside of floor slab. All backfilling shall be compacted at intervals not more than 150 mm (6") layer to the satisfaction of the Consultant.

.2 Provide excavating and backfilling outside the building with granular A brought in specifically for backfilling to a minimum of 450 mm (18") over the pipe. Backfilling outside building over and above the 450 mm (18") backfill as previously specified herein shall be by the Plumbing Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the plumbing contractor shall provide new clean granular 'A' fill to grade level.

.3 Bottoms of trenches shall be excavated so that the pipe will be supported on a 150 mm (6") compacted bed of clean granular 'A' fill. Provide all necessary pumping to maintain excavation free of water.

.4 Should water be encountered during excavation, the plumbing contractor shall provide all labour and material, including all equipment required for dewatering the excavation. After the water has been removed, this Contractor shall install a 300 mm (12") base of compacted 50 mm (2") clear stone covered with filter cloth before installing backfill as detailed and/or as specified.

.5 Be responsible for all weather protection required to install piping and/or equipment to the satisfaction of the Consultant.

.6 Be responsible for providing all clear stone or granular 'A' material suitable for application to replace existing soil not suitable for backfilling above the 450 mm (18") bedding material.

1.27 DOMESTIC HW SYSTEM BALANCING

.1 Meet all requirements as specified for balancing of hydronic systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device.

.3 At each ciruit setter balancing valve.

.4 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.28 BALANCING OTHER PLUMBING SYSTEM

.1 Plumbing systems:

.1 Pressure booster systems: test for capacity and pressures under all conditions and at all times.

.2 Recirculating Systems pump flows, pressures

.3 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates.

1.29 COOPERATION WITH OTHER TRADES

.1 Give full cooperation to other trades and furnish in writing to other trades, with copies to the engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

.2 Where plumbing work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. Prepare composite working drawings and sections at a suitable scale, not less than ¼ inches = 1-foot – 0-inches, clearly showing how the plumbing work is to be installed in relation to the work of other trades. If work is installed before coordinating with other trades, or if it causes any interference with work of other trades, make the necessary changes in the work to correct the conditions and bear all costs.

.3 Furnish to other trades necessary templates, patterns, setting drawings, and shop details for the proper installation of work and for coordinating adjacent work.

1.30 WATERPROOFING SEAL MATERIALS

.1 Modular, expanding mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Standard of quality assurance manufacturers are:

.1 Thunderline Corp. (Power Plant Supply Co.) “Link Seal” Model S-316

.2 The Metraflex Co. “MetraSeal” type ES

.3 Or approved equivalent.

1.31 SLEEVE, CUT, AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses, and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

1.32 SUSTAINABLE CONSTRUCTION

.1 Construction Waste Management:

.1 Recycle all waste materials to avoid land fill sites where possible.

.2 All metal contents shall be recycled.

.3 All cardboard and paper shall be recycled.

.4 All plastic packaging shall be recycled.

.5 All wood shall be directed to the appropriate recycled wood section at the landfill site.

.2 This contractor is responsible for their own waste management system and cost associated with the disposal. This can be their own on site system, daily removal, back to shop, or a communal system shared with other contractors on site.

.3 In all cases the cost to remove materials on site are the cost of this contractor.

1.33 FREEZE PROTECTION

.1 Do not run lines in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection.

1.34 SCAFFOLDING, RIGGING, AND HOISTING

.1 Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required. Conform to OSHA requirements and standards.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

.3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit manufacturer's product data for following items:

.1 Thermometers.

.2 Pressure gauges.

.3 Stop cocks.

.4 Siphons.

.5 Wells.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

.2 Ranges: suitable for application.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, 225 mm (9") scale length: to CAN/CGSB 14.4.

.1 Acceptable Manufacturers:

.1 Trerice

.2 Winters

.3 Wiess

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.4 PRESSURE GAUGES

.1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Acceptable Manufacturers:

.1 Winters

.2 Trerice

.3 Wiess

.2 Provide:

.1 Siphon for steam service.

.2 Snubber for pulsating operation.

.3 Diaphragm assembly for corrosive service.

.4 Gasketted pressure relief back with solid front.

.5 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on all piping. Provide heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Water heaters/DHW boilers inlet and outlet.

.2 All ports of thermostatic mixing valve.

.3 In other locations indicated.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Inlet and outlet of coils.

.5 Inlet and outlet of backflow preventors.

.6 Upstream & downstream of water meters.

.7 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society for Testing and Materials

.1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

.3 MSS SP 58 (Manufacturers Standardization Society of the Valve and Fitting Industry – Pipe Hangers and Supports, Materials, Design and Manufacture).

1.2 DELEGATED ENGINEERING DESIGN AND PRODUCT SUBMITTAL

.1 Provide a delegated engineering design for all hydronic and domestic water risers to good engineering practice.

.1 Design Limitation: No more than 1,800 lbs shall be point loaded per core slab plank per floor.

.2 The design shall include analysis documentation signed and sealed by a licensed Professional Engineer with a minimum of five (5) years of experience in the design of piping risers and associated support systems.

.3 Submittal Requirements:

.1 Submit detailed calculations addressing thermal expansion, and where applicable to project location, seismic restraint requirements for the piping systems.

.2 Submit schematic drawing of the installed Riser system indicating components used and locations.

.3 Submit maximum anchor reaction loads for review and approval by the Structural Engineer of Record.

.4 Provide detailed drawings for each anchor, including dimensions and attachment method to the building structure.

.5 Provide detailed drawings and specifications for field assembly and structural attachment of pipe alignment guides.

.6 Provide product submittals for each required guide, anchor and expansion device.

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled; axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with general requirements.

.2 Submit sign off letter from Professional Engineer who completed the expansion compensation design.

.3 Data to include:

.1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

.1 All materials furnished under this section shall be from a single supplier, designed and engineered as a complete system:

.1 Mason Industries

.2 Kinetics Noise Control Inc.

.3 Flex Pression Ltd.

2.2 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated in expansion compensation design drawings.

.2 Alignment guides:

.1 Provide as indicated in expansion compensation design drawings.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

2.3 ALIGNMENT GUIDES

.1 Wall Mounted:

.1 Spider type, designed to maintain axial alignment of piping.

.2 Guides shall not carry dead weight loads.

.3 Guides shall allow for movement of insulation with pipe.

.2 Floor Mounted:

.1 Anchored to floor or ceiling and designed to maintain axial alignment of piping.

.2 Guides shall be provided with plastic inserts.

.3 Guides shall not carry dead weight loads.

.4 Guides shall allow for movement of insulation with pipe.

2.4 SLIP TYPE EXPANSION JOINTS

.1 Application: For axial pipe movement, as indicated.

.2 Repacking: Under full line pressure.

.3 Body and packing housings: Class 150, 1Mpa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe and with raised face slip-on flanges to match pipe. One-piece body construction.

.4 Slip or traverse sleeves: Carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.

.5 Anchor base: Construction steel, welded to body.

.6 Guides (internal and external): Embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: Stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, P7FE (teflon) or graphite impregnated non-asbestos fiber.

.9 Thermal plastic packing: P7FE (teflon) or graphite impregnated non-asbestos fiber slug supplied loose.

.10 Lubricating fittings: Pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: To manufacturer's recommendations.

.13 Lubricant gun: Complete with hose assembly.

.14 Drip connection: 20 MPa (2900 psi) forged steel to ASTM A105. Include half coupling with drain plug.

.15 Lubricant fittings, plunger, gun not required for low friction self lubricating packing.

2.5 EXPANSION LOOPS

.1 Steel braided hoses, U-loop assembly.

.2 Corrugated metal inner hoses, braided outer sheaths, braid retaining collar and 90 degree elbows.

.3 321 or 316 stainless steel corrugated hose

.4 304 or 316 stainless steel braid and braid collar

.5 Operating conditions:

.1 Working pressure: 1034 kPa (150 psi).

.2 Working temperature: 250°C (482°F).

.3 To match system requirements.

2.6 FLEXIBLE CONNECTIONS

.1 Application: To suit motion.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: Stainless steel corrugated.

.4 Braided wire mesh stainless steel outer jacket.

.5 Diameter and type of end connection: As indicated.

.6 Operating conditions:

.1 Working pressure: 1034 kPa (150 psi).

.2 Working temperature: 250°C (482°F).

.3 To match system requirements.

Part 3 Execution

3.1 INSTALLATION

.1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

.4 All isolators shall be adjusted to the preset dimensions provided as part of the engineered expansion system design prior to system filling.

.5 Once the system is filled and loaded and operating at its normal temperature all restrained spring isolators shall be inspected and where/if they remain preloaded, the nuts shall be backed off the minimum amount to ensure contract with preloaded screws no longer exists.

.6 No rigid connections shall be made between the system and structure where it will degrade either the seismic or expansion performance of the engineered system.

3.2 SITE REVIEW

.1 The Professional Engineer who stamps the submitted expansion compensation shop drawings shall be responsible to conduct periodic site reviews of the installed systems.

.2 The Professional Engineer shall provide written confirmation that the systems are installed to manufacturer recommendations and their design prior to project closeout.

3.3 APPLICATION

.1 Provide on all vibration isolated equipment.

.2 Provide where requested by equipment manufacturers installation manuals.

.3 Install in accordance with manufacturer’s recommendations.

3.4 THERMAL EXPANSION

.1 Provide in long runs of hot water mains exceeding 100 ft. in length.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: to ANSI & ULC requirements

.2 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 10 mm (3/8") UL listed

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are <u>not</u> considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: ASME B31.1.

.2 Steel brackets: ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for all piping.

.4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.

.3 Bolts: to ASTM A 307.

.4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m² (13.12 lbs/ft²) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.

.2 Insulated hot piping:

.1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.5 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

2.6 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.

2.7 MANUFACTURER

.1 Acceptable Manufacturers:

.1 Grinnell

.2 Anvil

.3 Myatt

.4 Taylor

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.3 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.3 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	

3.3 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Do “NOT” support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.

.2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

.2 To be of the same manufacturer for all isolation.

.3 Acceptable Manufacturers:

.1 Korfund

.2 Vibro-Acoustics

.3 Vibron

2.2 ELASTOMERIC PADS

.1 Type EP4 - rubber-steel-rubber; 10 mm (3/8") minimum thick rubber bonded to 1.5 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60.2 psi).

.2 Acceptable Manufacturers:

.1 Korfund

.2 IAC Acoustics

.3 Vibro-Acoustics

.4 Vibron

2.3 SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.

.3 Cadmium plate for all installations.

.4 Colour code springs.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:

.1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.

.2 Provide Consultant with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.

.2 Vibration measurements shall be taken for equipment-listed below:

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 Canadian Standards Association (CSA).

.1 Natural Gas and Propane Installation Code CSA B149.1.

.4 National Fire Protection Association

.1 NFPA 13, Installation of Sprinkler Systems.

.2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

.1 Submit product literature in accordance with General Requirements.

.2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Equipment in Mechanical Rooms: Use size #9.

.2 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.3 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.

.2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.

.3 Use double-headed arrows where flow is reversible.

.4 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.5 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: To following table:

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

.7 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR MARKING	LEGEND
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HW recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Domestic tempered supply	Green	DOM. TEMPERED
Trap Primer	Green	TRAP PRIMER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT

2.4 VALVES, CONTROLLERS

.1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

2.5 LANGUAGE

.1 Identification to be in English.

Part 3 Execution

3.1 TIMING

.1 Provide identification only after all painting specified has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND AS-BUILT DRAWINGS

.1 Conform to General Requirements Section for shop drawings and as-built drawings requirements.

1.2 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The Plumbing Contractor shall co-ordinate with the Consultant who will inspect the plumbing installation.

.2 The Plumbing Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

- Manufacturers name, address and telephone number
- Distributors name, address and telephone number
- Make, model number and serial number
- Pumps - RPM, impeller sizes, rated flow
- Electrical - volts, amps, fuse size, overload size
- Any other special characteristics.

1.3 PLUMBING AND DRAINAGE SYSTEM TESTING

.1 The plumbing and drainage system shall be tested in accordance with the Plumbing Code under the Ontario Water Resources Act and the specification.

.2 The Mechanical Contractor shall notify the Building Inspector when systems are available for testing. The Mechanical Contractor shall document all tests performed and shall arrange for the Building Inspector to sign for tests completed. The forms shall be forwarded to the Consultant.

1.4 THE CONTRACTOR'S TESTING OF PIPING SYSTEMS

.1 Test all piping systems in accordance with all applicable plumbing codes and General Requirements section.

.2 All tests for the systems shall be performed in the presence of the Consultant or Commissioning Consultant. Complete the testing forms and forward to the Consultant.

1.5 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF WATER SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by the plumbing contractor and shall report to the Commissioning Consultant.

1.6 CLOSEOUT SCHEDULE

.1 The Plumbing Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.

.2 All testing forms and reports associated with the plumbing systems shall be directed to the Consultant with copies to the Owner and Consultant.

.3 The forms and reports to be issued shall include:

- Shop drawings, issued and accepted
- Equipment verification forms
- Testing forms
- Reports resulting from tests
- Testing schedule
- Equipment Start-up Forms

1.7 OPERATION AND MAINTENANCE MANUAL

.1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

1.8 OPERATOR TRAINING

.1 Conform to General Requirements section for requirements for Instruction to Operating Staff.

.2 The training shall be conducted in a classroom and at the equipment or system.

.3 Training will begin when the operating and maintenance manuals have been delivered to The Owner and approved by the Consultant.

.4 Each training session shall be structured to cover:

The operating and maintenance manual

- Operating procedures
- Maintenance procedures
- Trouble-shooting procedures
- Spare parts required
- Submit a course outline to the Consultant before training commences. Provide course documentation for up to eight people.

.5 The training sessions shall be scheduled and co-ordinated by the Plumbing Contractor.

.6 Training shall be provided for the following systems:

System	Minimum Training Times
Pumps	2 hours
Water Heaters	2 hours
Emergency Showers & Eye Wash	2 hours
Water Sewer Treatment Systems	2 hours

1.9 COMMISSIONING CONSULTANT

.1 A Commissioning Consultant (CC) reports to the Owner.

.2 The CC responsibilities shall include:

- Preparing the commissioning plan
- Coordinating with the contractor to schedule tests
- Preparing a test form manual
- Witnessing selected tests
- Receiving all test forms
- Conducting performance test
- Coordinating the contractors training
- Chair commissioning meetings

.3 The Plumbing Contractor shall co-operate with the CC.

.4 The Plumbing Contractor shall provide assistance to the CC and have personnel available during the performance testing procedure. Each mechanical system shall be tested in the operational mode.

.5 Performance testing shall begin when all systems have been completed, tested by the Mechanical Contractor and the Consultant has completed their final review.

1.10 PLUMBING SYSTEM DEMONSTRATION AND TURNOVER

.1 Refer to General Requirements section, Mechanical Project Completion.

.2 The system demonstration and turnover to The Owner shall occur when:

- The installation is complete
- The acceptance test conducted by the Mechanical Consultant has been completed successfully
- The Commissioning Consultant system performance testing has been completed successfully
- Training has been completed
- Operating and Maintenance Manuals have been accepted
- Shop-drawings have been updated
- As-built drawings have been completed

.3 The systems demonstration shall be conducted by the Mechanical Contractor and the manufacturers. The demonstration shall cover a demonstration of equipment installation and operation.

1.11 WARRANTIES

.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by The Owner.

.2 The Mechanical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to the general conditions specification section for the requirements during the warranty period.

1.12 CLOSEOUT PROCESS ALLOCATION

.1 The mechanical contractor closeout process shall be as follows:

.1 3% for the first $500,000 of contract value.

.2 1% of the contract value for value between $500,000 to $5,000,000.

.3 0.5% of contract value for the value in excess of $5,000,000.

.4 Minimum Allocation for Close Out Documents is $5,000.

.2 The Mechanical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

.3 The monies shall not be paid out until the performance testing, O & M manuals, systems demonstration, and training including all required paperwork have been completed to the satisfaction of the consultant. Refer to General Requirements section for contract breakdown.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C547, Type I and IV, Standard Specifications for Mineral Fibre Pipe Insulation.

.2 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded Hot-Plate Apparatus.

.4 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.5 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.6 ASTM C1695, Standard Specification for Fabrication of Flexible, Removable, and Reusable Blanket Insulation for Hot Service.

.7 ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC), North American Commercial and Industrial Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

.3 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

Part 2 Products

2.1 MATERIAL LIMITATIONS

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335, ASTM C177 or ASTM C518.

.3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547 Type I and IV.

.2 Jacket: to ASTM C1136, Type I, II, III, IV, X.

.3 Maximum "k" factor: to ASTM C547.

.4 Type A-2: Mineral fibre faced with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.5 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Manufacturers:

.1 Johns Manville

.2 Knauf

.3 Manson

.4 Owens Corning

2.4 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

2.5 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 Minimum thickness: 20 mm (0.020")

.2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.3 Colours: white.

.4 Minimum service temperatures: -29°C (-20°F).

.5 Maximum service temperature: 65°C (150°F).

.6 Moisture vapour transmission: 0.05 perm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks are not to be used below ambient temperature (cold) operating systems.

.3 Pressure sensitive vinyl tape of matching colour.

2.9 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC, North American Commercial and Industrial Insulation Standards.

.2 Apply materials in accordance with manufacturers' instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.5 Below ambient/chilled water installation:

.1 All pipes, valves, strainers, flanges, unions, and other pipe system components and spec must be properly insulated with correctly completed vapor retarder applied.

.2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.

.3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a 0.02 or lower perm rating.

.4 Vapor stops must be installed at 18' intervals at all pipe insulation termination points including fittings, flanges, and other changes in direction or other types of piping specialties.

.5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricate from the same material as the pipe insulation. Full thickness must be maintained over all fitting surfaces. Blanket insulation with a factory applied vapor retarder facing is unacceptable.

.6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder of the pipe insulation.

.7 Additional fitting covers, PVC, or metal must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.

.8 Additional field applied to jackets must not use staples, screws, tacks, or rivets for attachment to avoid puncturing vapor retarder underneath.

.9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Flexible removable blanket insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material, that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.

.3 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.4 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: As per adjacent insulation.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.

.2 Install insulator and jackets to applicable TIAC codes.

.3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table:

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.2 All storm piping including all vertical and horizontal piping shall be insulated.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Domestic Water Piping	A-1	25 (1")	25 (1")	40 (1½")	40 (1½")	40 (1½")
Storm Piping	A-1/A-5	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")
Roof Drain sumps	A-2/A-5	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Horizontal Cast Iron Sanitary Piping	A-1/A-5	N/A	N/A	25 (1")	25 (1")	25 (1")
Trap Primer Piping	A-1	15 (½")	15 (½")	25 (1")		

.5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC
Exposed		

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/AWWA B301, Liquid Chlorine.

.3 ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

.4 ANSI/AWWA C205, Cement Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and larger - Shop Applied.

.5 ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Service, 4 inch through 144 inch.

.6 ANSI/AWWA C500, Metal-seated Gate Valves for Water Supply Service.

.7 ANSI/AWWA C600, Installation of Ductile Iron Water Mains, and their Appurtenances.

.8 ANSI/AWWA C800, Underground Service Line Valves and Fittings.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general division.

1.3 AS-BUILT DRAWINGS

.1 Provide Data to produce as-built drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Submittals Section.

Part 2 Products

2.1 PIPES, JOINTS AND FITTINGS

.1 Ductile iron pipe: to ANSI/AWWA C151/A21.51, class 52 cement mortar lined to ANSI/AWWA C104/A21.4.

.1 Acceptable material: HYPROTEC

.2 P.V.C. pipe: to AWWA C900, CSA B137.2, ASTM, class 150 P.V.C. (DR18).

.1 Acceptable material: Blue Brute or Equal.

.3 Joints and fittings for ductile iron pipe:

.1 Joints:

.1 Rubber gasket for mechanical pipe joints: to ANSI/AWWA C111/A21.11.

.2 Rubber gasket for flange pipe joints 1.6 mm thick: to ANSI/AWWA C111/A21.11.

.3 Bolts, nuts, hex head with washers: to ASTM A307, heavy series.

.4 Ensure electrical conductivity across joints.

.2 Fittings:

.1 Mechanical joint cast iron and ductile iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.

.2 Flanged cast iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.

2.2 FITTINGS AND SPECIALTIES

.1 All fittings and specials shall be installed where shown or where ordered by the Engineer. Fittings subject to lateral thrust or "blow-out" shall be properly supported by cast-in-place thrust blocks of 25 Mpa concrete placed against undisturbed earth in accordance with the contract drawings. Where necessary, when working in unstable ground conditions or when installing vertical bends, the contractor shall use anchor blocks with anchor rods, or tie rods connected to the closest solid joint, to assure proper support against "blow-out".

2.3 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to Aggregates: General and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 Sieve sizes to CAN/CGSB-8.1.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Cast-in-Place Concrete Section.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Excavating, Trenching and Backfilling.

2.5 PIPE DISINFECTION

.1 Liquid chlorine to ANSI/AWWA B301 to disinfect water mains.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching work in accordance with Excavating Trenching and Backfilling Section.

.2 Trench depth to provide cover over pipe of not less than1.85 m from finished grade.

3.3 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe to depth as indicated.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 95% of corrected maximum dry density and 95% maximum density to ASTM D698.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Excavating Trenching and Backfilling Section.

3.4 PIPE INSTALLATION

.1 **Connect to domestic water and fire main piping installed by site services contractor.** Terminate building water service inside building and 450 mm above finish floor. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection; otherwise cap or seal end of pipe.

.2 Lay pipes to ANSI/AWWA C600 and ANSI/AWWA Manual of Practice and manufacturer's standard instructions and specifications. Do not use blocks.

.3 Join pipes in accordance with ANSI/AWWA C600 ANSI/AWWA C602 ANSI/AWWA C206 AWWA Manual of Practice and manufacturer's recommendations.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe, which is not in true alignment or grade or pipe, which shows differential settlement after installation greater than 10 mm.

.6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with equipment and methods approved by Consultant.

.10 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Align pipes carefully before jointing.

.12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.14 Complete each joint before laying next length of pipe.

.15 Minimize deflection after joint has been made.

.16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Engineer.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.20 Do not lay pipe on frozen bedding.

.21 Do hydrostatic and leakage test and have results approved by Consultant before surrounding and covering joints and fittings with granular material.

.22 Backfill remainder of trench.

3.5 THRUST BLOCKS

.1 Install thrust blocks to OPS standards for roads and municipal services.

.2 Concrete shall be placed to within 50 mm of the face of the bell.

.3 Bond breaker shall be used between the fittings and concrete.

3.6 HYDROSTATIC AND LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Consultant at least 24 h in advance of all proposed tests. Perform tests in presence of Consultant.

.3 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.4 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Consultant.

.5 Leave hydrants, valves, joints and fittings exposed.

.6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.7 Open valves.

.8 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.9 Thoroughly examine exposed parts and correct for leakage as necessary.

.10 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.11 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.12 Do not exceed allowable leakage of 0.03 L/mm diameter per 300 m of pipe, including lateral connections, per hour.

.13 Locate and repair defects if leakage is greater than amount specified.

.14 Repeat test until leakage is within specified allowance for full length of watermain.

3.7 PIPE SURROUND

.1 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

3.8 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density. In other areas, compact to at least 90% corrected maximum dry density.

3.9 FLUSHING AND DISINFECTING

.1 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.

.2 Flushing flows shall be as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

.3 Provide connections and pumps for flushing as required.

.4 Open and close valves, hydrants and service connections to ensure thorough flushing.

.5 When flushing has been completed to satisfaction of Consultant, introduce a strong solution of chlorine as approved by authority having jurisdiction into watermain and ensure that it is distributed throughout entire system.

.6 Rate of chlorine application to be proportional to rate of water entering pipe.

.7 Chlorine application to be close to point of filling water main and to occur at same time.

.8 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.9 Flush line to remove chlorine solution after 24 h.

.10 Measure chlorine residuals at extreme end of pipe-line being tested.

.11 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.

.12 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.13 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.10 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface including all roads, curbs, sidewalks, landscaped areas etc. to original condition and to standards of local authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).

.7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2 SHOP DRAWINGS

.1 Submit shop drawing data in accordance with general requirements.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 Tee drill NPS 25 mm (1") and larger.

2.3 JOINTS

.1 Solder: 95/5.

.2 Teflon tape: for threaded joints.

.3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F1545, complete with thermoplastic liner.

.4 Tee drill fittings shall be brazed with silver solder, 45% Ag - 15% Cu or copper phosphorous, 95% Cu, 5% P and non-corrosive flux.

2.4 VALVES

.1 All valves shall be of commercial grade and of same manufacturer, Lead-Free.

.2 Acceptable Manufacturers:

.1 Milwaukee

.2 Crane

.3 Kitz

.4 Apollo

2.5 BALL VALVES

.1 All valves shall be of commercial grade and of same manufacturer.

.2 NPS 80 mm (3") and under, soldered:

.1 To ANSI B16.18, Class 150.

.2 Bronze body, full port stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

2.6 GATE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, screw-in bonnet, solid wedge disc.

.2 NPS 50 mm (2") and under, screwed:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, screw-in bonnet, solid wedge disc.

.3 NPS 65 mm (2-1/2") and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS SP-70, Class 125, 860 kPa (125 psi), flat flange faces, cast-iron body, OS&Y bronze trim.

.4 NPS 65 mm (2-1/2") and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS SP-70, Class 125, 860 kPa (125 psi), flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.7 SWING CHECK VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 50 mm (2") and under, screwed:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.

.3 NPS 65 mm (2 1/2") and over, flanged:

.1 To MSS SP-71, Class 125, 860 kPa (125 psi), cast iron body, flat flange faces, [regrind] [renewable] seat, bronze disc, bolted cap.

2.8 BALANCING VALVES

.1 Provide brass balancing valves suitable for potable water.

.2 Brass body, EDPM O-Ring, Polytetrafluoroethylene slip washer and stainless steel spring.

.3 Connect with dielectric connections.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble all piping using fittings manufactured to ANSI standards.

.4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.5 Install CWS piping below and away from HWS and HWC and all other hot piping so as to maintain temperature of cold water as low as possible.

.6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

.7 Bent tubing is not acceptable.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to requirements of general requirements.

.2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

3.4 FLUSHING AND DISINFECTING

.1 Maintain testable RP backflow preventor between municipal water and new plumbing system.

.2 Ensure a minimum of 90% of plumbing fixtures are installed.

.3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, and operate fixtures to ensure thorough flushing.

.6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.

.7 Rate of chlorine application to be proportional to rate of water entering pipe.

.8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.

.9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

.10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.

.11 Measure chlorine residuals at extreme end of pipe-line being tested.

.12 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or reoccur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.

.13 Take water samples at remote fixtures and service connections.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA – B64.10/B64.10.1 – Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

1.2 SUBMITTALS

.1 Complete the required cross connection survey form and submit to authority having jurisdiction. Provide a copy to the consultant.

.2 Incorporate data into maintenance manual.

Part 2 Products

2.1 GENERAL

.1 Provide backflow prevention devices in all new and existing fixtures and equipment as indicated and as required by the authority having jurisdiction.

.2 Acceptable Manufacturers:
Watts
Wilkins

Part 3 Execution

3.1 INSTALLATION

.1 Install devices in accordance with acceptable engineering practices, the requirements of the Ontario Building Code and the requirements of the authority having jurisdiction.

3.2 TESTING

.1 Provide testing to requirements of authority having jurisdiction.

.2 Provide copy of test report for each device in the maintenance manual.

.3 Provide tag on each device.

.4 Provide a list of devices complete with tag number on a framed chart. Locate chart in Water Entrance Room.

.5 Provide additional testing on all devices at one year warranty period. Provide documentation to owner and consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 PDI-WH201, Water Hammer Arresters.

.5 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 INTERIOR HOSE BIBB

.1 20 mm (3/4") diameter brass construction, 200 psi, 180°F pressure and temperature limits, complete with hose connection, and wheel handle straight/angle pattern to suit.

.2 Provide vacuum breaker complete with hose connection.

.3 Acceptable Manufacturers:

.1 Exposed on wall; Watts BD series

.2 Surface mounted (piping in wall); Watts SC-3 series

.3 Delta

.4 Waltec

.5 Wilkins

.6 Emco

2.2 BACK FLOW PREVENTORS

.1 The backflow preventor shall prevent backflow by either backpressure or backsiphonage from a cross-connection between potable water lines and substances that are objectionable.

.2 To CAN/CSA-B64.

.3 Application: as indicated.

.4 Reduced pressure principle type from 65 mm (2½") to 250 mm (10") (RP):

The reduced pressure principle backflow preventer shall be ASSE 1013 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The first and second checks shall be accessible for maintenance without removing the relief valve or the entire device from the line.
If installed indoors, the installation shall be supplied with an air gap adapter, strainer, and integral monitor switch.

2.3 VACUUM BREAKERS

.1 To CAN/CSA-B64 Series.

.2 Atmospheric vacuum breaker (A-VB):

.1 Acceptable Manufacturers:

.1 Watts 288A

.2 Conbraco 38-103 Series

.3 Wilkins 35

.3 Hose connection vacuum breaker (HCVB):

.1 Acceptable Manufacturers:

.1 Watts Series 8

.2 Conbraco 38-304-AS

.3 Wilkins BFP-8

.4 Laboratory faucet intermediate vacuum breaker (LFVB):

.1 Acceptable Manufacturers:

.1 Watts N-LF9

.2 Conbraco 38-502-01

2.4 PRESSURE REGULATORS

.1 Capacity: as indicated.

.1 Inlet pressure: 1034 kPa (150 psi).

.2 Outlet pressure: 41 kPa (5.9 psi).

.2 Up to NPS 40 mm (1 1/2") bronze bodies, screwed: to ASTM B62.

.1 Acceptable Manufacturers:

.1 Watts Series 25AUB (1/2" - 2")

.3 NPS 50 mm (2") and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class [B].

.1 Acceptable Manufacturers:

.1 Watts PV-10

.2 Conbraco 36 Series

.4 Semi-steel spring chambers with bronze trim.

.1 Acceptable Manufacturers:

.1 Watts PV-10

.2 Conbraco 36 Series

2.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

.1 Acceptable Manufacturers:

.1 Watts BD series

.2 Emco

.3 Chicago

.4 Zurn

2.6 STRAINERS

.1 860 kPa (125 psi), Y type with 20 mm (3/4") mesh, bronze or stainless steel removable screen.

.2 NPS 50 mm (2") and under, bronze body, screwed ends, with brass cap.

.1 Acceptable Manufacturers:

.1 Watts Series 777SI

.2 Crane/Powers

.3 Colton 125 YTB

.4 Wilkins S Series

.3 NPS 65 mm (2½") and over, cast iron body, flanged ends, with bolted cap.

.1 Acceptable Manufacturers:

.1 Watts 77F-D (77F-D-FDA for water service)

.2 Crane/Powers

.3 Colton 125 YTB

.4 Wilkins FS Series

2.7 SOLENOID VALVES

.1 Two (2) way normally closed all bronze construction.

.2 Voltage shall be suitable for controlling function.

.3 Acceptable Manufacturers:

.1 Asco

2.8 OWNER SUPPLIED EQUIPMENT

.1 The mechanical contractor shall supply and install all water, gas, condensate and sanitary piping to the owner supplied equipment. Connection to equipment shall be by this contractor.

.2 Provide flexible riser stops to all sinks and ball valves to all other equipment.

.3 Provide backflow preventors on equipment required by the local plumbing inspector.

.4 Provide flexible gas piping to all gas equipment.

.5 All equipment in store equipment schedule will be supplied and set in place by Mechanical Contractor unless otherwise noted.

.6 Coordinate all rough-ins and connection with the supplier on site.

.7 Owner supplied equipment includes existing relocated equipment.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 NON FREEZE WALL HYDRANTS

.1 Install 600 mm (24") above finished grade unless otherwise indicated.

3.3 BACK FLOW PREVENTORS

.1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and or service sink.

.3 Provide test results in manual and leave tag with test results on device.

3.4 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.5 STRAINERS

.1 Install with sufficient room to remove basket.

.2 Strainer size to match pipe size.

3.6 WATER METERS

.1 Install water meter provided by local water authority.

.2 Install water meter as indicated.

.3 Install remote readout to acceptance of local water authority and as indicated.

3.7 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Non-freeze wall, ground hydrants:

.1 Verify complete drainage.

.2 Verify operation of vacuum breaker.

.2 Water hammer arrestors:

.1 Verify accessibility.

.3 Backflow preventors, vacuum breakers:

.1 Verify installation of correct type to suit application.

.2 Adjust as necessary to ensure proper operation.

.3 Verify visibility of discharge.

.4 Pressure regulators:

.1 Adjust settings to suit installed locations, required flow rates.

.5 Hose bibbs, sediment faucets:

.1 Verify operation.

.6 Water meters:

.1 Verify operation.

.7 Pipeline strainers:

.1 Verify accessibility of basket.

.2 Clean out during commissioning until system clean.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

3.8 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM C117, Test Method for Material Finer Than 0.075 mm (3 mil) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.5 ASTM D2680, Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.6 ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.7 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.8 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.9 CSA B182.11, Standard Practice for the Installation of Thermoplastic Drain and Sewer, Storm Pipe and Pipe Fittings.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Submittals Section.

1.3 MATERIAL CERTIFICATION

.1 Submit manufacturers test data and certification at least 2 weeks prior to commencing work.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify the building manager a minimum of 24 hrs in advance of any interruption in service.

Part 2 Products

2.1 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 or CAN/CSA-B182.2.

.1 Standard Dimensional Ratio SDR 28 35 41.

.2 Locked in gasket and integral bell system.

.3 Nominal lengths: 6 m (20').

2.2 CEMENT MORTAR

.1 Portland cement: to CAN/CSA-A300 Series, normal type 10.

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

2.3 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to Excavating, Trenching, and Backfilling Section: and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117]. Sieve sizes to CAN/CGSB-8.1.

	Stone/Gravel	Gravel/Sand
200 mm (8")	-	-
75 mm (3")	-	-
50 mm (2")	-	-
40 mm (1 1/2")	-	-
25 mm (1")	100	-
20 mm (3/4")	-	-
15 mm (1/2")	65-90	100
10 mm (3/8")	-	-
5 mm (3/16")	35-55	50-100
2.00 mm (80 mil)	-	30-90
0.425 mm (16 mil)	10-25	10-50
0.180 mm (7 mil)	-	-
0.075 mm (3 mil)	0-8	0-10

.2 Concrete mixes and materials for cradles, encasement, and supports: to Cast-in-Place Concrete Section.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Excavating, Trenching and Backfilling Section.

.3 Unshrinkable fill: to Excavating, Trenching and Backfilling Section.

Part 3 Execution

3.1 PREPARATION

.1 Clean and dry pipes and fittings before installation.

3.2 TRENCHING

.1 Do trenching work in accordance with Excavating, Trenching and Backfilling Section.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth require approval of Consultant prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layer(s) not exceeding 150 mm (6") compacted thickness to depth of 300 mm (12").

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations.

.2 Handle pipe using methods approved. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipe during construction.

.7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.5 m (5') from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available.

.12 Use prefabricated saddles or field connections approved by Consultant, for connecting pipes to existing sewer pipes. Joints to be structurally sound and watertight.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm (6") compacted thickness as indicated. Do not dump material within 1.0 m (40") of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% corrected maximum dry density and maximum density to ASTM D698.

.7 When field test results are acceptable to Consultant, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm (6") compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698. In other areas, compact to at least 90% maximum density to ASTM D698.

3.7 FIELD TESTING GRAVITY DRAINS

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Consultant, draw tapered wooden plug with diameter of 50 mm (2") less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Carry out tests on each section of sewer between successive manholes including service connections.

.6 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.7 Exfiltration test:

.1 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 h to ensure absorption in pipe wall is complete before test measurements are commenced.

.2 Immediately prior to test period add water to pipeline until there is a head of 1.0 m (40") over interior crown of pipe measured at highest point of test section or water in manhole is 1.0 m (40") above static ground water level, whichever is greater.

.3 Duration of exfiltration test: 2 h.

.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.8 Repair and retest sewer line as required, until test results are within limits specified.

.9 Repair visible leaks regardless of test results.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor drains and trench drains: to CAN/CSA-B79.

.2 Refer to schedule for types and acceptable manufacturer.

2.2 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.1 Acceptable Manufacturers:

.1 Zurn ZSS-1469

.2 Mifab C1400-RD

.3 Watts CO-480-RD-3

.4 Jay R. Smith 4710

.3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:
Plugs: bolted bronze with neoprene gasket.

.1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400 – HD or Zurn ZXN-1612

.2 Mifab C1100-XR-6

.3 Watts CO-200-RX-1-6

.4 Jay R. Smith SQ-4-1753-XNBCO-SP-U

.2 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400-T – HD

.2 Mifab C1100-TS-6

.3 Watts CO-200-TS-1-6

.4 Jay R. Smith 4200-U

.3 Cover for ceramic tile floors: 15 mm (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400 – T-HD or Zurn ZXN-1612

.2 Mifab C1100-S-6

.3 Watts CO-200-S-1-6

.4 Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

.4 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400-HD-CM or ZN-1612-CM

.2 Mifab C1100C-S-1-6

.3 Ancon CO-200-RC-1-6

.4 Smith

.5 Contour C3000RMNB

2.3 SOLENOID VALVES (HEADER TRAP SEAL PRIMER)

.1 Two (2) way normal closed all bronze construction.

.2 With integral adjustable cycle time clock control. Timer control to have two dial functions, time between cycles and time held in “open position”.

.3 Suitable for 120V.

.4 Acceptable Manufacturers:

.1 Asco

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

3.3 TRAP SEAL PRIMER STATIONS

.1 Provide primer stations where indicated.

.2 Install for all floor drains and elsewhere, as indicated.

.3 Install copper piping to floor drains above grade. Install polypropylene piping to floor drains on grade.

3.4 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: Commission only after start-up deficiencies rectified.

.3 Access doors: Verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

- .1 Floor, hub and trench drains:
  - .1 Verify proper operation of trap primer, flushing features.
  - .2 Verify security and removability of strainers.
- .2 Cleanouts:
  - .1 Verify covers are gastight, secure and easily removable.
  - .2 Verify that cleanout rods can probe as far as next cleanout.
- .3 Backwater valves:
  - .1 Verify accessibility of cover, valve.
- .4 Trap seal primers:
  - .1 Verify operation.
  - .2 Adjust flow rate to suit site conditions.
- .5 Acid dilution devices:
  - .1 Verify operation.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

3.5 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM B32, Specification for Solder Metal.

.3 ASTM B306, Specification for Copper Drainage Tube (DWV).

.4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.6 CAN/CSA-B125.3, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, and vent, maximum 65 mm (2½") Type DWV copper to: ASTM B306.

- .1 Fittings.
  - .1 Cast brass: to CAN/CSA B125.3.
  - .2 Wrought copper: to CAN/CSA B125.3.
- .2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above and below ground sanitary, and vent, minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.

- .1 Mechanical joints (vents)
  - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
  - .2 Stainless steel clamps (2 band).
- .2 Mechanical joints (sanitary)
  - .1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.
  - .2 Stainless steel clamps (4 band min).

2.3 VENT FLASHINGS

.1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

Part 3 Execution

3.1 APPLICATION

.1 Install copper or cast iron drainage on first 10'-0" (3.0m) of all fixtures discharging waste above 110°F.

3.2 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50') of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

.4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

.5 Vent entire waste system to atmosphere.

.1 Discharge 500 mm (20") above roof. Join lines together in fewest practicable number before projecting above roof.

.2 Set back vent lines so they will not pierce roof near an edge or valley.

.3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.

.4 Provide copper vent piping through roof as per detail.

.6 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

.7 Flash pipes passing through roof with 453 g (16 oz) sheet copper flashing fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound.

.1 Flashing base shall be at least 600 mm (24") square.

.2 Flashing may be a 24 kg/m^2 (5 lb/ft^2) lead flashing fitted around pipes and turned down into pipe 15 mm (½") with turned edge hammered against pipe wall.

.8 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Do not caulk threaded work.

.2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried sanitary, and vent piping to:

- .1 80 mm (3") and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.
- .2 100 mm (4") and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.
- .3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.2 Above grade sanitary and vent piping:

- .1 80 mm (3") and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
- .2 100 mm (4") and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
- .3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.3 Use plastic XFR – DWV in pipe chase for urinal piping to 1.5 M (5' –0") above finished floor.

.4 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

2.3 EXPANSION

.1 Provide solvent welded expansion joints as required by manufacturer's recommendations.

2.4 VENT FLASHINGS

.1 Thaler Stack Jack spun aluminum complete with insulation, cap, and rubber gasket.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction. Install in accordance with manufacturer's instructions.

.2 Installation of underground pipe

.1 Provide all excavation, bedding, backfill, and compaction.

.2 Install materials in accordance with Manufacturer's instructions.

.3 Use jacks to make-up gasketed joints.

.4 Stabilize unstable trench bottoms.

.5 Bed pipe true to line and grade with continuous support from firm base.

.1 Bedding depth - 100 mm to 150 mm (4" to 6").

.2 Material and compaction to meet ASTM standard noted above.

.6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

.7 Trench width at top of pipe -

.1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.

.2 Maximum - Outside diameter of pipe plus 600 mm (24").

.8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.

.9 Do not use back hoe or power equipment to assemble pipe.

.10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50') of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

.4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

.5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Fill waste and vent system a minimum of 1.8 m (6') above finished floor with water and show no leaks for 2 hours.

.2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

.6 Install solvent welded expansion joints as per manufacturer's recommendation. Care is to be taken to accommodate ambient temperatures at time of install.

.7 Vent entire waste system to atmosphere.

.1 Discharge 350 mm (14") above roof. Join lines together in fewest practicable number before projecting above roof.

.2 Set back vent lines so they will not pierce roof near an edge or valley.

.3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.

.8 Flash pipes passing through roof with Thaler insulated Stack Jack flashing.

.1 Flashing base shall be at least 600 mm (24") square.

.9 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM C14M, Specification for Non-reinforced Concrete Sewer, Storm Drain and Culvert Pipe.

.3 ASTM C76M, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

.4 ASTM C117, Test Method for Material Finer Than 0.075 mm (3 mil) Sieve in Mineral Aggregates by Washing.

.5 ASTM C136, Method for Sieve Analysis of fine and Coarse Aggregates.

.6 ASTM C443M, Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.7 ASTM D2680, Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.8 ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.9 CAN/CSA-A3001, Cementitious Materials for Use in Concrete.

.10 ASTM C700, Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

.11 CAN/CSA-A257, Standards for Concrete Pipe and Manhole Sections.

.12 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.13 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.14 CSA B182.11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Pipe Fittings.

.15 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.16 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Submittals Section.

1.3 MATERIAL CERTIFICATION

.1 Submit manufacturers test data and certification at least 2 weeks prior to commencing work.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.5 STANDARDS

.1 To local Municipal Standards.

.2 To Ontario Provincial Standards (OPS) for Roads and Municipal Services.

Part 2 Products

2.1 PLASTIC PIPE

.1 Large diameter, ribbed PVC sewer pipe and fittings: to CAN/CSA B182.4 ASTM F794.

.1 Standard dimension ratio SDR 35

.2 Gasket and integral bell system

.3 Nominal length 6 m (20').

2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to Excavating, Trenching, and Backfilling Section and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

	Stone/Gravel	Gravel/Sand
200 mm (8")	-	-
75 mm (3")	-	-
50 mm (2")	-	-
40 mm (1 1/2")	-	-
25 mm (1")	[100]	-
20 mm (3/4")	-	-
15 mm (1/2")	[65-90]	[100]
10 mm (3/8")	-	-
5 mm (3/16")	[35-55]	[50-100]
2.00 mm (80 mil)	-	[30-90]
0.425 mm (16 mil)	[10-25]	[10-50]
0.180 mm (7 mil)	-	-
0.075 mm (3 mil)	[0-8]	[0-10]

.2 Concrete mixes and materials for bedding, cradles, encasement, and supports: to Cast-in-Place Concrete Section.

2.3 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3 to Excavating Trenching and Backfilling Section.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation and remove defective materials from site to approval of Consultant.

3.2 TRENCHING

.1 Do trenching work in accordance with Excavating, Trenching and Backfilling Section.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING AND PIPE SURROUND

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm (6") compacted thickness to depth of as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

.7 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.0 m of pipe.

.8 Compact each layer from native material to 300 mm (12") above pipe to at least 95% corrected maximum dry density.

3.4 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.

.2 Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipes during construction.

.7 Install plastic pipe and fittings in accordance with CSA B182.11.

.8 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.9 Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available.

.10 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.

.11 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm (6") compacted thickness as indicated. Do not dump material within 1.0 m (40") of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% corrected maximum dry density.

.7 When field test results are acceptable to Consultant, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm (6") compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density maximum density to ASTM D698. In other areas, compact backfill to at least 90% maximum density to ASTM D698.

3.7 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Consultant, draw tapered wooden plug with diameter of 50 mm (2") less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried storm piping to:

.1 80 mm (3") and smaller: ABS drain pipe to CAN/CSA-B181.1.

.2 100 mm (4") and larger: SDR-35 PVC drain pipe to CAN/CSA-B181.2.

.2 Above grade storm piping:

.1 80 mm (3") and smaller: IPEX: PVC-XFR fire rated drain storm pipe to CAN/CSA-B181.1.

.2 100 mm (4") and larger: IPEX: PVC-XFR storm pipe to CAN/CSA-B181.2.

.3 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Installation of underground pipe

.1 Provide all excavation, bedding, backfill, and compaction.

.2 Install materials in accordance with Manufacturer's instructions.

.3 Use jacks to make-up gasketed joints.

.4 Stabilize unstable trench bottoms.

.5 Bed pipe true to line and grade with continuous support from firm base.

.1 Bedding depth - 100 mm to 150 mm (4" to 6").

.2 Material and compaction to meet ASTM standard noted above.

.6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

.7 Trench width at top of pipe -

.1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.

.2 Maximum - Outside diameter of pipe plus 600 mm (24").

.8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.

.9 Do not use back hoe or power equipment to assemble pipe.

.10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50 ft) of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

.4 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.

.2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 ROOF DRAINS

.1 As indicated on schedules.

2.2 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.1 Acceptable Manufacturers:

.1 Zurn ZSS-1469

.2 Mifab C1400-RD

.3 WATTS CO-480-RD-3

.4 Jay R. Smith SQ-A-1753-XNBCO-SP-U

.3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:
Plugs: bolted bronze with neoprene gasket.

.1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400 – HD or Zurn ZXN-1612

.2 Mifab C1100-XR-6

.3 WATTS CO-200-RX-1-6

.4 Jay R. Smith SQ-4-1753-XNBCO-SP-U

.2 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400-T – HD

.2 Mifab C1100-TS-6

.3 WATTS CO-200-S-1-6

.4 Jay R. Smith 4200-U

.3 Cover for ceramic tile floors: 15 (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400 – T-HD or Zurn ZXN-1612

.2 Mifab C1100-S-6

.3 WATTS CO-200-RC-1-6

.4 Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

.4 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400-HD-CM or ZN-1612-CM

.2 Mifab C1100C-S-1-6

.3 Ancon CO-200-RC-1-6

.4 Smith

.5 Contour C3000RMNB

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

.3 Install roof drains in lowest point of roof. Co-ordinate location with architectural, structural, and mechanical drawings.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

3.3 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Roof drains:

.1 Verify installation at low points in roof.

.2 Verify security and removability of dome.

.3 Adjust weirs to suit actual roof slope and meet requirements of design.

.4 Verify provision for movement of roof and integrity of roof drain piping system.

.2 Cleanouts:

.1 Verify covers are gastight, secure and easily removable.

.2 Verify that cleanout rods can probe as far as next cleanout.

.3 Backwater valves:

.1 Verify accessibility of cover, valve.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI Z21.10.1/CSA 4.1, Gas Water Heaters Volume I, Storage Water Heaters with Inputs Ratings of 75,000 Btuh, or less.

.3 ANSI Z21.10.3/CSA 4.3, Gas Water Heaters Volume III; Storage Water Heaters with Input Ratings above 75,000 Btuh, circulating and Instantaneous.

.4 CSA-B149.1, Natural Gas and Propane Installation Code.

.5 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.6 CAN/CSA-B139, Installation Code for Oil Burning Equipment.

.7 CAN/CSA-B140.0, Oil Burning Equipment: General Requirements.

.8 CSA B140.12, Oil Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.

.9 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.5 ASME Certification (for all heaters over 600 mm (24") in diameter).

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Manufacturer’s name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 GAS FIRED HIGH EFFICIENCY WATER HEATER

.1 Acceptable Manufacturers:

.1 A. O. Smith

.2 Ruud

.3 Bradford White

2.2 GAS FIRED WATER HEATER (POWER VENT)

.1 To ANSI Z21.10.3/CSA 4.3 with a recovery rate based on 56°C (100°F) rise and input. Efficiency of 96%. Refer to schedule for selection.

.2 Tank: glass, lined steel, 692 mm (27¼") dia x 1739 mm (69½") high fibreglass insulation, enameled steel jacket.

.3 Gas burner: complete with high limit control, gas valve, gas pressure regulator, 100% safety shut-off, firepower gas burner with air distribution ring, 120V /1/60.

.4 Power vent kit complete with concentric vent termination.

.5 Tank to be ASME certified if over 600 mm (24") in diameter.

.6 Acceptable Manufacturers:

.1 A. O. Smith HDHE

.2 Ruud

.3 J. Wood

.4 Bradford White

2.3 WATER HEATER TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 25 mm (1") with hose end.

.2 Thermometer: 100 mm (4") dial type with red pointer and thermowell filled with conductive paste.

.3 Thermowell filled with conductive paste for control valve temperature sensor.

.4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.5 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

Part 3 Execution

3.1 WATER HEATER

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal (vertical) mounted tanks.

.3 Provide insulation between tank and supports.

.4 Provide neutralizing cartridge on each vent drain.

.5 Install oil burning domestic water heaters in accordance with CAN/CSA B139.

.6 Install natural gas or propane gas fired domestic water heaters in accordance with CSA-B149.1-00.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.6 Demonstrate equipment operation as directed by consultant.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 Gas fired high efficiency water heater: three (3) year warranty certificate.

.2 Gas fired water heater (power vent): three (3) year warranty certificate.

.3 Gas fired water heater (atmospheric): three (3) year warranty certificate.

.4 Domestic hot water heater and storage tank: extended warranty: ten (10) years. Provide certificate.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

.1 Manufacturer's name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 DOMESTIC HOT WATER EXPANSION TANK

.1 Pre-charged 6.4 gal (3.2 gal accept volume) hydropneumatic steel expansion tank complete with internal butyl diaphragm.

.2 Tank construction shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature of 250°F.

.3 Tank shall be one of two styles:

.1 Complete with anti legionella liner (silver antimicrobial) and designed with water agitator to deter any legionella growth.

.2 Flow through style to ensure continuous water movement.

.1 This Contractor shall pipe flow through expansion tanks as per manufacturer's recommendations. Provide isolation valve on both sides of horizontal tank. Provide bypass valve around tank.

.4 Tank volume: 24 l (4.5 gallons) with 0.73 acceptance factor.

.5 Acceptable Manufacturers:

.1 Amtrol ST-12C

.2 Calefactio FTTE-12

2.2 DOMESTIC HOT WATER CIRCULATING PUMPS

.1 Capacity: 0.6 l/s (9.5 gpm) against total differential head of 10 kPa (1.45 psi or 3.35 ft. wc.) as indicated.

.2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105°C (220°F) continuous service.

.3 Motor: 124 W (1/6 hp), drip-proof, with thermal overload protection.

.4 Supports: provide as recommended by manufacturer.

.5 Acceptable Manufacturers:

.1 Bell & Gossett

.2 Armstrong

.3 Taco

2.3 THERMOSTATIC WATER CONTROLLER (3 Port)

.1 1-¼" inlets 1-½" outlets thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellows mounted out of water. Volume control shut off valve, bimetal dial thermometer (3" face, range 20° – 240°F), brass pipe, fittings and unions. Standard valve and piping finish is rough bronze.

.2 Acceptable Manufacturers:

.1 Symmons 7-1000A-ASB-W

.2 Powers

2.4 AUTOMATIC URINAL FLUSHING SYSTEM

.1 Passive Infrared Motion Sensor

.1 First of all, it can be flush mounted on the ceiling or behind a ceiling grate and still give optimum performance.

.2 Sensor shall activate only when the urinals are used. Designed to offer coverage of 360°. Sensor shall “only” pick up someone directly in front of urinals.

.3 Sensor also has an activation light to show it has picked up motion. This light can either remain visible or be covered by the plastic slide located on the sensor. This light is useful when setting up the field of activation, however it is normally covered after installation so that it does not attract attention. This sensor has a 16 volt DC @ 50mA rating.

.2 Solenoid Valve and Assembly

.1 The solenoid valve shall be installed in the main supply line.

.2 The solenoid valve shall have a 6 watt rating and operates on 24 volts DC. This solenoid valve is a “normally closed” valve so that should the power be interrupted, the valve will remain closed. It is also to be a “slow actuating” valve, meaning that it is designed to open and close slowly.

.3 Programmable Control Unit

.1 The control unit shall plug into a 110 volt outlet. The output is 24 volts DC/60Hz/1.2 Amps and shall be CSA approved.

.2 Stage 1 is the “inactivity” timer. This stage is programmable from 1 hour to 99 hours. The function of this stage is to flush the urinals within a certain period of time, even if the system is not activated by the motion sensor, when so desired.

.3 Stage 2 is a programmable delay time initiated from the activation of the motion sensor. This delay can be programmed from 1 minute to 99 minutes. The purpose of this delay is to prevent the urinals from being flushed after each and every person.

.4 Stage 3 is also programmable from 1 to 99 minutes and determines how long the solenoid valve is open to flush the urinals (determines flush volume).

.5 Test button shall allow the on site person to test the system to ensure it flushes, in a reduced delay time.

.6 The control unit shall also monitor the number of flushes.

.4 Mounting of all devices and all wiring shall be by this Contractor to the standards of Division.

.5 Flow rate: each flush flow rate shall not exceed 1.9 liters (0.5 gallons).

.6 Acceptable Manufacturers:

.1 Water Matrix UTC Sentinel (1-800-668-4420)

2.5 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other Divisions.

Part 3 Execution

3.1 RECIRCULATING PUMP

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

3.2 DOMESTIC HOT WATER EXPANSION TANK

.1 Adjust expansion tank pressure to suit system pressure.

.2 Provide an expansion tank on the cold water feed to each water heater complete with lockshield type shutoff valve at inlet to tank.

.3 Provide an expansion tank at the water entrance.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.6 Adjust flow from water-cooled bearings.

.7 Adjust impeller shaft stuffing boxes, packing glands.

.8 Demonstrate equipment operation as directed by consultant.

.9 Demonstrate water softener regeneration controls.

3.4 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Conform to Sections of Division 1 and to General Mechanical Requirements Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Perform work in accordance with the recommendations of and the requirements of:

- .1 Local and district bylaws and regulations.
- .2 N.F.P.A.14 “Installation of Standpipe and Hose Systems".
- .3 The Ontario Building Code.
- .4 U.L.C. or Factory Mutual approval for hose, valve and extinguisher requirements.
- .5 N.F.P.A.10 “Standard for Portable Fire Extinguishers”.
- .6 The Ontario Fire Code.

1.3 SUBMITTALS

.1 Submit shop drawings and maintenance data in accordance with general requirements.

1.4 COORDINATION

.1 Confirm fire extinguisher cabinet locations and quantities from both architectural and mechanical drawings and report any discrepancies to consultant prior to bid close.

.2 Coordinate location of cabinet with other trades and provide protection against damage during construction.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS (CLASS ABC)

.1 Stored pressure rechargeable type with hose and shut off nozzle, ULC labelled for A, B and C class protection as indicated. Size of extinguishers shall be as follows:

.1	Servery Areas	Type ‘K’	10 lb	20 BC rating
.2	Mechanical Rooms		10 lb	ABC rating
.3	Storage Rooms		10 lb	ABC rating
.4	Corridor/Gym/Finished Areas		5 lb	ABC rating complete with cabinet

.2 Acceptable Manufacturers:

- .1 Wilson & Cousins
- .2 National

2.2 CABINETS

.1 Recessed mounted type of a size sufficient to contain all necessary components. Tub to be constructed of 1.5 mm (16 gauge) steel and finished with Wilco "Pro-Tech" Premier white painted finish. Adjustable frame comprising of 180° opening door and trim to be separate assembly adaptable to any type of finished wall. Trim to have 6 mm (1/4") return on outer edges with full length semi-concealed piano hinge, and Corbin style latching device.

.2 Doors and trim to be 1.5 mm (16 gauge) white painted finish. Door glass to be 6 mm (1/4") Duo Lite Safety Glass.

.3 Cabinet to maintain fire resistive rating of construction in which they occur.

.4 Do not provide cabinets for mechanical room and service area fire extinguishers unless indicated.

.5 Acceptable Manufacturers:

.1 Wilson & Cousins Model IE - 105R (5 and 10 lb. Class)

.2 National

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10.

.2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

2.4 FIRE BLANKET

.1 100% non-combustible fire retardant glass fibre, non-toxic, non-conductor, cleanable complete with straps.

.2 Size: 1 m x 1 m (40" x 40").

.3 Cabinet to be surface mounted, 400 mm x 300 mm (16" x 12").

.4 Mount on wall in kitchen area where indicated or directed on site by consultant.

.5 Acceptable Manufacturers:

.1 National FB 4040 blanket, FB 6078 MC cabinet

.2 Wilson & Cousins

Part 3 Execution

3.1 INSTALLATION

.1 Provide portable fire extinguisher cabinets and mount in wall during construction. Cabinet to be surface or recessed mounted as indicated on the drawings. Install cabinets so that the door will not obstruct normal traffic when open.

.2 Hang extinguishers in cabinets with wall mounting bracket.

.3 Prior to installing the extinguisher cabinets, confirm the mounting height and exact location with the Consultant. Mount extinguisher so top of unit is not more than 1.5 m (5').

.4 Install wall mounted fire extinguishers complete with wall mounting bracket where indicated and/or directed on site by consultant.

.5 Caulk perimeter of fire extinguisher cabinets after acceptance.

3.2 TESTS

.1 Fire protection equipment shall be tested to the requirements of NFPA10, NFPA13, NFPA14 and comply with the requirements of the authorities having jurisdiction.

3.3 FIRE BLANKET

.1 Hang blanket on wall in cabinet as indicated, to manufacturers' recommendations.

.2 Fire blanket next to each NFPA 96 hood mounted on wall.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA B45S1, Supplement #1 to CAN/CSA B-45 Series Plumbing Fixtures.

.3 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.

.4 CAN/CSA-B125.3, Plumbing Fittings.

.5 CAN/CSA-B651, Accessible Design for the Built Environment.

1.2 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Indicate, for all fixtures and trim:

- .1 Dimensions, construction details, roughing-in dimensions.
- .2 Factory-set water consumption per flush at recommended pressure.
- .3 For water closets, urinals: minimum pressure required for flushing.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data including monitoring requirements for incorporation into manual specified in general requirements.

.2 Include:

- .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
- .2 Details of operation, servicing, maintenance.
- .3 List of recommended spare parts.

1.4 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

- .1 Connect with unions.

.3 Equipment not installed.

- .1 Capped with valves for future connection by others.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: Architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 FIXTURE CARRIERS

.1 Provide factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

.2 Acceptable Manufacturers:

.1 Zurn

.2 Smith

.3 Ancon

2.3 PLUMBING FIXTURES

.1 Refer to plumbing fixture schedule on the drawings for fixture type, manufacturer, trim, drainage supply, and accessories.

2.4 FIXTURE PIPING

.1 Hot and cold water supplies to each fixture/faucet:

.1 Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.

.2 Acceptable Manufacturers:

.1 Delta 47T900 Series

.2 McGuire

.2 Waste:

.1 Open grid strainer, or pop up as indicated, offset open grid strainer on Barrier-Free fixtures, cast brass fittings with tubular piping, chrome plated, rubber gasket compression fitting, and overflow flange.

.2 Acceptable Manufacturers:

.1 Delta 33T200 Series

.2 McGuire

.3 'P' Traps:

.1 Cast brass P trap with cleanout on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

.3 Acceptable Manufacturers:

.1 Delta 33T300 Series

.2 McGuire

Part 3 Execution

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified. Confirm mounting height(s) with consultant prior to rough-in.

.2 Wall-hung fixtures: measured from finished floor.

.3 Physically Barrier-Free: to comply with most stringent of either NBCC or CAN/CSA B651.

.2 Drinking fountains:

.1 In accordance with CAN/CSA B45S1.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments.

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Adjust water cooler, drinking fountain flow stream to ensure no spillage.

.6 Automatic flush valves for water closets and urinals: set controls to prevent unnecessary flush cycles during silent hours.

.3 Checks.

.1 Water closets, urinals: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventors: operation under all conditions.

.4 Wash fountains: operation of flow-actuating devices.

.5 Refrigerated water coolers: operation, temperature settings.

.4 Thermostatic controls.

.1 Verify temperature settings, operation of control, limit and safety controls.

.5 Floor and wall mounted fixtures: caulk to floor or wall using silicone caulking to make water tight, colour to match fixture.

.6 Counter mounted fixtures: lay fixtures into bead of caulking to ensure excess moisture does not reach the cut edge of the countertop. Clean excess caulking off outside the sink.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

END OF SECTION

Part 1 General

1.1 INSTRUCTIONS TO BIDDERS

.1 The HVAC Supplemental Tender Form must be submitted to the architect and consultant (admin@deiassociates.ca) within 2 hours after tender closing. HVAC contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.

.2 Should the HVAC Supplemental Form not be submitted then the contractor shall use Base Bid manufacturers as listed.

.3 CONTRACTOR

I/We certify that I/We have the authority to bind the company.

COMPANY NAME	AUTHORIZED SIGNATURE
ADDRESS	PRINTED SIGNATURE
CITY	TITLE
TELEPHONE NUMBER	DATE
FAX	

SUB-CONTRACTORS

The Contractor shall state below the name of the Sub-contractors he intends to use, which shall not be changed without the consent of the Consultant.

Insulation _____

Sheet Metal _____

TAB _____

BAS Controls _____

.4 The Stipulated Bid Sum shall be for the base bid manufacturer or supplier equipment only, unless otherwise indicated. Where a choice of this equipment is given, this Contractor shall indicate the supplier or manufacturer he intends to use. Where no choice is indicated, the base bid supplier or equipment shall be used.

.5 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The HVAC Contractor shall not indicate equipment, materials or suppliers which are not listed. If this is done, the base bid supplier shall be used.

.6 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.7 Submit the following list of Base Bid and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	**Equipment**	**Base Bid**	**Acceptable Alternate Manufacturer Or Supplier**	**Indicate Manufacturer Or Supplier**
23 05 11	Access Doors	Le Hage	Zurn Acudor Nailor Industries Inc.	
23 05 19	Thermometers	Trerice	Winters Wiess	
23 05 19	Pressure Gauges	Trerice	Winters Wiess	
23 05 34	Bases, Hangers, & Supports (Indoor)	Grinnell	Anvil Myatt Taylor	
23 05 49	Elastomeric Mounts	Vibro-Acoustics	Korfund IAC Acoustics Vibron	
23 05 49	Hangers	Vibron	IAC Acoustics Korfund Vibro-Acoustics	

CONTRACTOR'S NAME:_____ DATE:_____

23 10 13	Duct Insulation	Johns Manville	Knauf Manson	
23 10 19	HVAC Piping Insulation	Knauf	Manson Owens Corning	
23 11 23	Lubricated Plug Valves	Newman Hattersley	Crane Jenkins Milwaukee Toya	
23 11 23	Regulators	Singer	Schlumberger	
23 23 13	Filter Drier	Mueller	Parker Sporlan Virginia	
23 23 13	Expansion Valves	Henry	Mueller Parker Sporlan	
23 23 13	Flexible Connectors	Anamet	Packless Superior Vibration Mountings	
23 23 13	Pipe Support Assembly	Unistrut	Or equal	
23 31 13	Metal Ducts	Ductmate Canada	Nexus, Ecanno WDCI	
23 32 13	Acoustic Sound Plenums	BVA Systems	Vibron VAW Systems IAC Acoustics	
23 33 13	Access Doors in Ducts	Nailor	E.H. Price Titus	
23 33 13	Prefabricated Roof Curb	Greenheck	Penn	

23 33 14	Multi-Bladed Dampers & Locking Quadrants	Duro Dyne	E.H. Price Nailor T.A. Morrison Tamco Ruskin Ventex/Alumavent United Enertech Ductmate Pottorff	
22 33 18	Disc Type Dampers	Duro Dyne	Henderson Industrial Pottorff	
22 33 18	Back Draft & Relief Dampers	T.A. Morrison	Tamco Series 7000 Ruskin Nailor E.H. Price Henderson Industrial Ventex/Alumavent Pottorff	
23 33 46	Flexible Ducts	Flexmaster	Ductmate	
23 33 53	Rectangular/Square Duct Liners	Knauf Atmosphere Duct Liner	Manson Johns Manville Owen Corning	
23 33 53	Adhesive, Fasteners, Joint Tape, & Sealer	Duro Dyne	Ductmate	
23 37 23	Louvres/Brick Vents	Greenheck	Construction Specialties Airolite Co. Krueger Ventex Ruskin Ventmaster Nailor Carnes GLAB Penn Barry Pottorff E.H. Price	

CONTRACTOR'S NAME:_____ DATE:_____

23 37 23	Gooseneck Hoods	Ductmate Canada	Exanno Nexus	
23 37 23	Aluminum Wall Caps (Clothes Dryer)/Wall Boxes	Reversomatic	Broan Ventex AirVent Shop fabricated (submit sample for approval)	
23 38 13	Fire Blanket	National		
23 05 11	Fire Stopping	Minnesota Mining & Manufacturing	Fryesleeve Industries Inc. General Electric Pensil Firestop Systems International Protective Coatings Corp. Rectorseal Corporation (Metacaulk) Proset Systems 3M AS Systems Hilti	
23 05 31	Expansion Fittings and Loops	Metraflex	Mark David Canada Senior Flexonics	
23 05 49	Vibration Control Measures	Korfund	Vibro-Acoustics Vibron IAC Acoustics	
23 33 16	Fire Dampers	Ruskin	Nailor E.H. Price Ventox/Alumavent United Enertech Safeair-Dowco T.A. Morrison Greenheck Pottorff Tamco	

23 33 17	Smoke Control Dampers	E.H. Price	NCA Ltd. Nailor Industries Ruskin Alumavent United Enertech Safeair-Dawco (stainless steel) Pottorff	
23 33 18	Motorized Dampers	Honeywell	Johnson T.A. Morrison E.H. Price Tamco Ruskin Nailor Henderson Industrial Ventex/Alumavent Pottorff	
23 34 23	Packaged Exhausters	Greenheck	Penn-Barry Cook Jenn/Jenco (S&P) Carnes Acme Zonex Nutone (Range hood) Broan (Range hood) Twin-City Reversomatic Fantech Aerovent	
23 34 23	Dryer Booster Fan	Reversomatic		
23 36 16	VAV/VVT Boxes	E.H. Price	Nailor Titus Krueger Carnes Metalaire Barber Colman	

23 37 13	Grilles and Diffusers	E.H. Price	Nailor Krueger Titus Carnes Seiho Metalaire Tuttle and Bailey	
23 37 13	Spot Diffuser	Krueger	Anemostat Price	
23 81 26	Condensing Unit	Carrier	Lennox Trane	
23 81 26	Indoor DX Cooling Coil	Mitsubishi	LG Daikin Carrier Lennox	
23 72 13	Heat Wheel Air to Air Energy Recovery Ventilators	Aldes	Greenheck Ruskin Cook	
23 75 12	Semi-Custom Outdoor Heating & Cooling Air Handling Units	Daikin Applied Rebel/Skyline	Valent VX Series Engineered Air Johnson Solution Endura	

1.2 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Superintendent	$_____/hr
Journeymen	$_____/hr
Labourers	$_____/hr
Sheet Metal	$_____/hr
Insulation	$_____/hr
Other	$_____/hr

1.3 HVAC TENDER PRICE (EXCLUDING HST)

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: $_____

_____

(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Products

3.1 NOT USED

.1 Not used.

END OF SECTION

CONTRACTOR'S NAME:_____ DATE:_____

Part 1 General

1.1 GENERAL PROVISIONS

.1 This section covers items common to all sections of Heating, Ventilation, and Air Conditioning (HVAC) Division.

.2 Conform to Division 1 General Conditions.

.3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

.4 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

.5 The term “Mechanical Contractor” shall remain active and shall mean a “single contractor” performing plumbing, drainage, heating, cooling, ventilation, and control services.

.6 When quoting as a subcontractor this building contractor shall explicitly state the services they are providing i.e. Mechanical (all services), Plumbing (water and drainage systems) or HVAC (including hydronic and air systems).

.7 Contractors shall be explicit to identify whether Fire Protection is included or omitted from the mechanical scope.

1.2 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for HVAC work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 TENDERS AND BONDING

.1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.

.2 Submit Supplemental Tender Form as noted.

.3 Submit tender based on specified described equipment or Alternates listed.

.4 State in Tender, names of all Subcontractors proposed for work under this Division.

.5 No bonding required for this Contractor.

1.4 REGULATIONS, PERMITS, AND FEES

.1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes, and by-laws in force in the area of the project.

.2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.

.3 In the event that changes, or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor's expense.

.4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.

1.5 DRAWINGS

.1 The drawings and this specification have been assembled together as a responsibility of the consultant. The same is true for the other consultants, i.e. architect, structural engineer, civil engineer, fire protection engineer, electrical engineer, etc.

.2 The drawings and specifications are not assembled together for responsibility/division between subcontractors. The division of work between subcontractors remains the responsibility of the buildings' contractor (also known as the prime contractor or general contractor).

.3 All subcontractors are encouraged to perform work amicably utilizing all of the drawings and specifications published by all of the consultants.

.4 Plumbing and HVAC Drawings do not show structural and related details. Take information involving accurate measurements of building from building drawings, or at building. Make, without additional charge, any necessary changes, or additions to runs of piping, conduits, and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.5 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings, or obtain directions for exact location of such equipment and fitments.

.6 Plumbing and HVAC drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.

.7 Install piping and ductwork to clear structural members and any fireproofing. Locate HVAC work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.

.8 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels, and dimensions to ensure proper and correct installation. Verify existing/municipal services.

.9 Locate all HVAC and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.10 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.11 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.12 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.6 INTERFERENCE AND COORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant’s request submit copies of interference drawings to consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, plumbing, HVAC, and electrical systems for the consultant’s review prior to fabrication.

.2 Detailed layout drawings, clearly showing fasteners and hangers.

.6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with applicable provisions of local plumbing code, gas ordinances, and adoptions thereof for all HVAC systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

.2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

1.8 ALTERNATES AND SUBSTITUTIONS

.1 Throughout HVAC Division are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.

.2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" nor "equal" specified product unit is proposed and does not fit space alloted in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for "alternate" or "equal" equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

.5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

1.9 EXAMINATION

.1 Site Reviews

.1 Examine premises to understand conditions which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Drawings

.1 Plumbing and HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

.2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, HVAC, and Fire Protection Drawings.

.3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

.3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.10 SEQUENCING SCHEDULING AND COORDINATION

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of HVAC items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in HVAC Division caused by neglect to do so shall be made at no cost to Owner.

.3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish and install inserts and supports required by HVAC Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by HVAC Division.

.5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.6 Adjust locations of pipes, ducts, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.

.1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc., as required to effect these offsets, transitions, and changes in direction.

.7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.11 REQUEST FOR INFORMATION (RFI) PROCEDURES

.1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit an RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.

.2 All RFIs will be submitted with the following information:

.1 RFI number

.2 Name of project

.3 Date of initiation

.4 Date response required by (minimum two (2) weeks)

.5 Subject

.6 Submitter’s name

.7 Drawing/specification reference

.8 Photograph of the issue (if applicable)

.9 Description of the issue

.10 Contractor’s proposed resolution

1.12 CONTRACT BREAKDOWN

.1 Provide breakdown of Contract exclusive of HST to acceptance of consultants prior to first draw submission.

.2 Provide labour and material cost for each item.

.3 Breakdown shall indicate total contract amount.

.4 Contract breakdown shall be as follows as a minimum.

.1 Mobilization and shop drawings (max. $2,000.00)

.2 Piping insulation

.3 Ductwork

.4 Duct insulation

.5 Grilles and diffusers

.6 Fire stopping

.7 AC splits

.8 Condensing Unit

.9 Fans and equipment

.10 HVAC system commissioning

.11 Building automation systems

.12 Testing, adjusting, and balancing

.13 Refrigeration piping

.14 3rd Party Commissioning Agent

.15 HVAC contractor closeout requirements (min. of 3% for the first $500,000.00, 1% from $500,000.00 to $5,000.000.00, and 0.5% beyond. Shall not be less than $5,000.00.)

.5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.13 COMMISSIONING CONTRACT BREAKDOWN

.1 This contractor shall work with the HVAC system commissioning contractor as specified elsewhere. The following commissioning breakdown shall be indicated on the contract breakdown draw.

1.14 SHOP DRAWINGS AND PRODUCT DATA

.1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 14 days after award of Contract.

.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.

.3 Provide a complete list of shop drawings to be submitted prior to first submission.

.4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.5 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.

.6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.7 Submit all shop drawings for the project as a package. Partial submittals will not be accepted.

.8 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or their Engineer shall not supersede Contract Documents.

.9 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances. e.g., access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify as to current model production.
- .5 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 Shop drawings shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultant’s project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (1) copy of the “reviewed” shop drawings in a binder as noted above.

.6 Contractor to print copies of “reviewed” shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

1.15 EQUIPMENT NAMEPLATE DATA

.1 Between the manufactures design published literature, the shop drawing submission literature, and the nameplate data on the equipment, they can all read differently.

.2 Most of the confusion and differences are coming out of the electrical power installation.

.3 The contractors installing and connecting the equipment are responsible for the coordination of this data through the construction period.

.4 The contractors shall share and/or request this information through out the project and monitor/make adjustments, provide recommendations accordingly based on any discrepancies.

.5 The contractors are responsible for any cost associated with the changing data.

.6 The final installation must meet the “Nameplate Data” on the equipment on site.

1.16 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as in submittals’ requirements.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

.3 Submit one (1) copy of Operation and Maintenance Manual to Consultant for review and approval. Submission of individual data will not be accepted unless directed by Consultant. Submission can be done electronically in PDF format or as a hard copy.

.1 Electronic submission/PDF file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.

.2 Hard copy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as ‘Operation and Maintenance Manual’ with project name and location. Dividers are to be used for binder organization.

.4 Make changes as required and re-submit as directed by Consultant.

.5 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.8 Spare parts equipment list.

.9 Manufacturers standard or extended warranty information.

.6 Maintenance data shall include:

.1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.7 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting, and balancing reports as specified in Testing, Adjusting, and Balancing Section.

.5 Copy of all substantial performance final certificates.

.8 Miscellaneous data to include:

.1 Letter of contractor’s warranty and guarantee.

.2 Index sheet.

.3 Tabbed format for each section.

.4 Manufacturers approved shop drawings.

.5 Spare parts list and source.

.6 List of Manufacturers and suppliers address for each piece of equipment.

.9 Final Submittals:

.1 Upon acceptance of Operation and Maintenance Manual by the Consultant, provide the following:

.1 Provide two (2) copies of final Operation and Maintenance Manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one (1) USB stick is to be provided containing both the approved manual and as-built drawings.

1.17 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible HVAC drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing HVAC systems, control systems, and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings submittal for TAB and review:

.1 Prior to start of Testing, Adjusting, and Balancing (TAB), finalize production of as-built drawings.

.2 Identify **each drawing** in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW HVAC SYSTEMS AS INSTALLED" (Company Name) (Signature of Contractor) (date).

.3 TAB to be performed using as-built drawings.

.4 Submit copy to Consultant for review and approval. When returned, make corrections as directed.

.3 As-built drawings final submittal:

.1 Once approved, submit completed, reproducible paper as-built drawings as well as a scanned PDF file copy on USB stick with Operation and Maintenance Manuals.

1.18 WARRANTIES

.1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

.2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation and Maintenance Manual.

.3 If HVAC sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local HVAC sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation and Maintenance Manual.

.4 Contractor shall rectify any installation deficiencies in the boiler or pressurized other systems identified by a TSSA Inspector for a period of three (3) years from ready for takeover.

.5 Warranty period shall start from date of ready for takeover. Warranty period shall start from date of ready for takeover. Warranty start date based on shipment date, start up date, substantial completion date, etc. are not applicable.

.5 Warranty Duration:

.1 One (1) year warranty period applies unless otherwise noted.

.6 Warranty Coverage:

.1 Applies to parts and labour.

1.19 READY FOR TAKEOVER

.1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.

.1 As-built Drawings
.2 Maintenance Manuals
.3 System Start up
.4 TAB Reports
.5 HVAC System Commissioning
.6 Instructions to Owners

1.20 REVISION TO CONTRACT

.1 Provide the following:

.1 Itemized list of material with associated costs.
.2 Labour rate and itemized list of labour for each item.
.3 Copy of manufacturers/supplier's invoice if requested.

1.21 DELIVERY, STORAGE, AND HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or environmental damaging conditions but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

.3 Remove any damaged materials from the site.

1.22 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

1.23 ENERGY EFFICIENCY

.1 The HVAC systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings" and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.

.2 All equipment, products, and installations must conform to the Codes and Standards.

END OF SECTION

Part 1 General

1.1 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant's satisfaction prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter).

.1 Mandatory TSSA Gas Pressure Test (CSA B149.1)

.2 Contractor letter verifying all refrigeration leak detection systems and their interlocks to downstream devices have been installed and tested.

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 TESTS

.1 Give 48 hours' written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Bear costs including retesting and making good.

.5 Piping:

.1 General: Maintain test pressure without loss for 4 h unless otherwise specified.

.2 Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.

.3 Test natural gas systems to CSA-B149.1-00, TSSA requirements and requirements of authorities having jurisdiction.

.6 Equipment: Test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.2 SYSTEM START UP

.1 Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.

.2 Provide Consultant with written notice verifying all equipment operation and installation is complete.

.3 Start up shall be in presence of the following: Owner or Representative, Contractor, Building Automation Systems (BAS) Contractor, and Manufacturer's Representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by Consultant.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 Arrange with all parties and provide 72 hours' notice for start up procedure.

.6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 COMMISSIONING

.1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to Consultant and Owner/Owner's Representative.

.3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process.* The commissioning plan may be modified to reflect the actual construction schedule and design.

.4 Provide a pre-functional test of all HVAC system and sub-system elements, including control devices, shall be checked for the following:

.1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.

.2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.

.3 Verify that tests, meter readings, and specific HVAC/electrical performance characteristics agree with those required by equipment or system manufacturer.

.4 Controls calibration to be completed in accordance with the specification.

.5 The TAB shall be done in accordance with the specifications.

.5 A functional performance testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests and test the systems through all possible modes of operation.

.6 Reports:

.1 The Contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.

.2 All data must be recorded as soon as possible during the course of the inspection and testing.

.3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.

.4 All test instruments shall be documented for valid calibration.

.5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Engineer and the Owner's Representative prior to the start of the testing.

.6 Include all commissioning documentation in the maintenance manuals.

.7 HVAC System Execution:

.1 Operate equipment and systems shall be tested in the presence of the Owner's Representative and the Consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.

.2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.

.3 Testing shall be conducted under specified design operating conditions as recommended or approved by the Consultant.

.4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.

.5 All special testing materials and equipment shall be provided by the appropriate contractor.

.6 Provide three copies of all test reports and records to the Consultant.

.8 The verification testing procedures shall address all operating characteristics of all HVAC equipment and systems, including:

Equipment Checklist
Exhaust Fans
Air Handling Unit(s)
Heat Recovery Unit(s)
Controllers/Valves/Dampers
Relays/Sensors/Transducers

System Checklist
Air Handling Units
Heat Recovery Unit(s)

1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 HVAC Contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.

.3 Where specified elsewhere in HVAC Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.

.4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.5 TRIAL USAGE

.1 Consultant or Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 HVAC

.2 Exhaust air

.3 Hydronic water systems

.4 Boilers and pumps

.5 Control systems

1.6 DEFICIENCIES

.1 During the course of construction, the Consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.

.2 Instruction to correct work shall be done within the work period before the next review.

.3 The Contractor shall not conceal any work until inspected.

.4 The Contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.

.5 Upon completion of the project, the Consultant will do a final review. Upon receiving the final inspection report, the Contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once Consultant receives this in writing.

1.7 EQUIPMENT INSTALLATIONS

.1 Unions or flanges: Provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: Provide as recommended by manufacturer or as indicated.

.3 Equipment drains: Pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.8 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.9 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.10 ELECTRICAL

.1 Electrical work to conform to Electrical Division including the following:

.1 Supplier and installer responsibility and related HVAC responsibility is indicated in Equipment Schedule on HVAC and/or electrical drawings,

.2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in HVAC Division. Follow Electrical Division for quality of materials and workmanship.

.3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.11 CONTROL WIRING

.1 Furnish and install all components, devices, and control wiring for all HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of Owner and Consultant and to manufacturer's requirements and recommendations.

.2 All electrical wiring, HVAC wiring and installations shall comply with local and national electrical and HVAC codes.

.3 Supply and install wiring as required for all devices and systems. Install wiring in EMT conduit and otherwise comply with all requirements of the Electrical Division. Approved plenum wire may be used for sensor and network communication wiring where it complies with appropriate building codes and regulatory authorities.

.4 All wiring concealed in walls and chases, and all exposed wiring shall be run in conduit.

.5 Provide recessed conduit and backer boxes where controls are wall mounted. Surface mounted boxes and conduit are acceptable in service rooms.

.6 Free-run plenum rated cable shall be run in cable hangers where provided by electrical division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring "as the crow flies".

1.12 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install equipment at following heights unless indicated otherwise.

.1	Thermostats (Operable, Barrier Free)	1200 mm (47.2")
.2	Thermostats (Non Barrier Free)	1500 mm (59")

.4 Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

1.13 MOTORS

.1 Provide high efficiency motors for HVAC equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.

.4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

1.14 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW 10 hp: Standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW 10 hp and over: Sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.6 Motor slide rail adjustment plates to allow for centre line adjustment.

.7 Provide sheave changes as required for final air balancing.

1.15 GUARDS

.1 Provide guards for unprotected devices.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm (18 gauge) thick sheet metal tops and bottoms.

.3 40 mm (1 1/2") diameter holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm (16 gauge) thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 20 mm (3/4") mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

.7 Duct Openings

.1 Provide reinforced expanded mesh grating, style 3 (3 lbs/sq.ft.) cover on accessible unprotected duct openings over 300 mm (12") wide and as indicated. This includes all ductwork terminating in air handling units and plenums.

.2 Securely fasten in place.

.3 Removable for servicing.

1.16 PIPING AND EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: Specified elsewhere in HVAC Division.

.2 Piping and equipment supports not supplied by equipment manufacturer: Fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

.3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.

.4 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

1.17 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.3 Through fire rated walls and floors.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

.7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

1.18 FIRE STOPPING

.1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.

.2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.

.3 Do not use cementitious or rigid seals around penetrations for pipe or ductwork where penetrating through walls, floors, ceilings, etc.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

.5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.

.6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide “fire wrap” blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.

.8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.

.11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.12 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.

.14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.

.15 Acceptable Alternate Manufacturers to approval of local authority:

- .1 Minnesota Mining and Manufacturing
- .2 Fryesleeve Industries Inc.
- .3 General Electric Pensil Firestop Systems
- .4 International Protective Coatings Corp.
- .5 Rectorseal Corporation (Metacaulk)

.6 Proset Systems

.7 3M

.8 AD Systems

.9 Hilti

.16 Ensure firestop manufacturer representative performs onsite inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.19 ESCUTCHEONS

.1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

1.20 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Apply two coats of paint to exposed piping service in service room, base colour as specified in HVAC Identification Section.

.4 Prime and touch up marred finished paintwork to match original.

.5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.21 SPARE PARTS

.1 Furnish spare parts in accordance with general requirements and as follows:

.1 One set of belts for each type or each size of machinery.

.2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

.3 Mechanical contractor shall provide two (2) spare sets of filters for all air moving systems. Filters shall be CAMFIL MERV 13 (no alternates)

.1 One set shall be installed by contractor immediately prior to occupancy and replace the initial construction filters.

.2 Second set shall be handed over to owner. Ensure signature of receipt from owner's operational and maintenance staff is obtained and provide to consultant.

1.22 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Maintenance Materials Special Tools and Spare Parts.

1.23 ACCESS DOORS

.1 Provide access doors to concealed HVAC equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: Use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: Use prime coated steel.

.3 Fire rated areas: Provide ULC listed access doors.

.4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.5 Acceptable Manufacturers:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.24 DRAIN VALVES

.1 Locate at low points and at section isolating valves unless otherwise specified.

.2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.

.3 Drain valves on potable water systems shall be complete with vacuum breaker.

1.25 REPAIRS, CUTTING, AND RESTORATION

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

1.26 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.27 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.28 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.29 EXCAVATING AND BACKFILLING

.1 Provide all excavating and backfilling inside and outside the building for any buried services. All backfilling shall be new clean granular ‘A’ fill brought in specifically for the purpose of backfilling to the underside of floor slab. All backfilling shall be compacted at intervals not more than 150 mm (6") layer to the satisfaction of the Consultant.

.2 Provide excavating and backfilling outside the building with granular A brought in specifically for backfilling to a minimum of 450 mm (18") over the pipe or ductwork. Backfilling outside building over and above the 450 mm (18") backfill as previously specified herein shall be by the HVAC Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the HVAC Contractor shall provide new clean granular ‘A’ fill to grade level.

.3 Bottoms of trenches shall be excavated so that the pipe will be supported on a 150 mm (6") compacted bed of clean granular ‘A’ fill. Provide all necessary pumping to maintain excavation free of water.

.4 Should water be encountered during excavation, the HVAC Contractor shall provide all labour and material, including all equipment required for dewatering the excavation. After the water has been removed, this Contractor shall install a 300 mm (12") base of compacted 50 mm (2") clear stone covered with filter cloth before installing backfill as detailed and/or as specified.

.5 Be responsible for all weather protection required to install piping and/or equipment to the satisfaction of the Consultant.

.6 Be responsible for providing all clear stone or granular 'A' material suitable for application to replace existing soil not suitable for backfilling above the 450 mm (18") bedding material.

1.1 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

1.2 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 HVAC systems in this building, including but not limited to smoke control dampers, smoke control fans, high speed low velocity ceiling fans, makeup air units, and heat tracing for fire protection systems may be subject to Integrated Life Safety Systems testing.

.2 The HVAC Contractor shall co-ordinate with the Integrated Life Safety Systems Testing Agent as follows:

.1 Confirm which HVAC systems are to be included as part of the testing process.

.2 Verify in writing to the Integrated Life Safety Systems Testing Agent that HVAC commissioning of the affected systems/devices is complete prior to the scheduled testing date(s).

.3 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all associated systems.

.4 This contractor shall work with the Integrated Life Safety Systems Testing Agent to reset all systems back to normal operating mode after the testing is complete.

.3 Include all costs associated with Integrated Life Safety System Testing in the tender value.

.4 Refer to Division 1/Division 26 Integrated Life Safety Systems Testing specifications for additional information/requirements.

1.3 REFRIGERANT CONTAINING EQUIPMENT

.1 A2L refrigerants are classified as mildly flammable. CSA B52-2023 has specific safety clauses related to the use of refrigerants with this classification within buildings.

.2 This Contractor shall be responsible to ensure that the installation requirements of CSA B52-2023 are met.

.3 Throughout this specification various pieces of equipment have been specified with refrigerant leak detection systems. Field wiring of the alarm status of this system to various downstream system components is required under Annex P of the standard and is the responsibility of this Contractor. These devices include the following:

.1 Open all zone dampers connected to the affected system.

.2 Disable electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves on the affected refrigeration systems.

.4 De energize any potential sources of ignition with the ductwork system of the affected system.

.5 Energize fans within the ductwork system.

.6 Activate any designated refrigeration leak ventilation systems.

1.4 FREEZE PROTECTION

.1 Do not run lines in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection.

1.5 SCAFFOLDING, RIGGING, AND HOISTING

.1 Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required. Conform to OSHA requirements and standards.

1.6 COOPERATION WITH OTHER TRADES

.1 Give full cooperation to other trades and furnish in writing to other trades, with copies to the engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

.2 Where plumbing work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. Prepare composite working drawings and sections at a suitable scale, not less than ¼ inches = 1-foot – 0-inches, clearly showing how the HVAC work is to be installed in relation to the work of other trades. If work is installed before coordinating with other trades, or if it causes any interference with work of other trades, make the necessary changes in the work to correct the conditions and bear all costs.

.3 Furnish to other trades necessary templates, patterns, setting drawings, and shop details for the proper installation of work and for coordinating adjacent work.

1.7 WATERPROOFING SEAL MATERIALS

.1 Modular, compressed seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Standard of quality assurance manufacturers are:

.1 Thunderline Corp. (Power Plant Supply Co.) “Link Seal” Model S-316

.2 The Metraflex Co. “MetraSeal” type ES

.3 Or approved equivalent.

1.8 SLEEVE, CUT, AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses, and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

1.9 SUSTAINABLE CONSTRUCTION

.1 Construction Waste Management:

.1 Recycle all waste materials to avoid land fill sites where possible.

.2 All metal contents shall be recycled.

.3 All cardboard and paper shall be recycled.

.4 All plastic packaging shall be recycled.

.5 All wood shall be directed to the appropriate recycled wood section at the landfill site.

.2 This Contractor is responsible for their own waste management system and cost associated with the disposal. This can be their own on site system, daily removal, back to shop, or a communal system shared with other contractors on site.

.3 In all cases the cost to remove materials on site are the cost of this Contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

.3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit manufacturer's product data for following items:

- .1 Thermometers.
- .2 Pressure gauges.
- .3 Stop cocks.
- .4 Siphons.
- .5 Wells.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

.2 Ranges: suitable for application.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, 225 mm (9") scale length: to CAN/CGSB 14.4.

- .1 Acceptable Manufacturers:
  - .1 Trerice
  - .2 Winters 91T
  - .3 Wiess

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.4 PRESSURE GAUGES

.1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Acceptable Manufacturers:

.1 Trerice

.2 Winters

.3 Wiess

.2 Provide:

.1 Siphon for steam service.

.2 Snubber for pulsating operation.

.3 Diaphragm assembly for corrosive service.

.4 Gasketted pressure relief back with solid front.

.5 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on all piping. Provide heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 In other locations indicated.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society for Testing and Materials

.1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

.3 MSS SP 58 (Manufacturers Standardization Society of the Valve and Fitting Industry – Pipe Hangers and Supports, Materials, Design and Manufacture).

1.2 DELEGATED ENGINEERING DESIGN AND PRODUCT SUBMITTAL

.1 Provide a delegated engineering design for all hydronic and domestic water risers to good engineering practice.

.1 Design Limitation: No more than 1,800 lbs shall be point loaded per core slab plank per floor.

.2 The design shall include analysis documentation signed and sealed by a licensed Professional Engineer with a minimum of five (5) years of experience in the design of piping risers and associated support systems.

.3 Submittal Requirements:

.1 Submit detailed calculations addressing thermal expansion, and where applicable to project location, seismic restraint requirements for the piping systems.

.2 Submit schematic drawing of the installed Riser system indicating components used and locations.

.3 Submit maximum anchor reaction loads for review and approval by the Structural Engineer of Record.

.4 Provide detailed drawings for each anchor, including dimensions and attachment method to the building structure.

.5 Provide detailed drawings and specifications for field assembly and structural attachment of pipe alignment guides.

.6 Provide product submittals for each required guide, anchor and expansion device.

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled; axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with general requirements.

.2 Submit sign off letter from Professional Engineer who completed the expansion compensation design.

.3 Data to include:

.1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

.1 All materials furnished under this section shall be from a single supplier, designed and engineered as a complete system:

.1 Mason Industries

.2 Kinetics Noise Control Inc.

.3 Flex Pression Ltd.

2.2 SLIP TYPE EXPANSION JOINTS

.1 Application: For axial pipe movement, as indicated.

.2 Repacking: Under full line pressure.

.3 Body and packing housings: Class 150, 1Mpa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe and with raised face slip-on flanges to match pipe. One-piece body construction.

.4 Slip or traverse sleeves: Carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.

.5 Anchor base: Construction steel, welded to body.

.6 Guides (internal and external): Embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: Stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, P7FE (teflon) or graphite impregnated non-asbestos fiber.

.9 Thermal plastic packing: P7FE (teflon) or graphite impregnated non-asbestos fiber slug supplied loose.

.10 Lubricating fittings: Pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: To manufacturer's recommendations.

.13 Lubricant gun: Complete with hose assembly.

.14 Drip connection: 20 MPa (2900 psi) forged steel to ASTM A105. Include half coupling with drain plug.

.15 Lubricant fittings, plunger, gun not required for low friction self lubricating packing.

2.3 EXPANSION LOOPS

.1 Steel braided hoses, U-loop assembly.

.2 Corrugated metal inner hoses, braided outer sheaths, braid retaining collar and 90 degree elbows.

.3 321 or 316 stainless steel corrugated hose

.4 304 or 316 stainless steel braid and braid collar

.5 Operating conditions:

.1 Working pressure: 1034 kPa (150 psi).

.2 Working temperature: 250°C (482°F).

.3 To match system requirements.

Part 3 Execution

3.1 INSTALLATION

.1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

3.2 SITE REVIEW

.1 The Professional Engineer who stamps the submitted expansion compensation shop drawings shall be responsible to conduct periodic site reviews of the installed systems.

.2 The Professional Engineer shall provide written confirmation that the systems are installed to manufacturer recommendations and their design prior to project closeout.

3.3 APPLICATION

.1 Provide on all vibration isolated equipment.

.2 Provide where requested by equipment manufacturers installation manuals.

.3 Install in accordance with manufacturer’s recommendations.

3.4 THERMAL EXPANSION

.1 Provide in long runs of heating mains exceeding 100 ft. in length.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: to ANSI & ULC requirements

.2 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 10 mm (3/8") UL listed

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are <u>not</u> considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: ASME B31.1.

.2 Steel brackets: ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for all piping.

.4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.3 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

2.4 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.5 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.

2.6 MANUFACTURER

.1 Acceptable Manufacturers:

.1 Grinnell

.2 Anvil

.3 Myatt

.4 Taylor

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').

.4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.5 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

.6 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

3.3 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Do “NOT” support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.

.2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

.5 CSA B272-93 – Prefabricated Self-Sealing Roof Vent Flashings

.6 CRCA (Canadian Roofing Contractor’s Association)

.7 SPRI (Single Ply Roofing Institute)

.8 CUFCA (Canadian Urethane Foam Contractor’s Association) and CGSB-51-GP-46MP, Manual for “Installers of Spray Polyurethane Foam Thermal Insulation”

.9 CSA G40.21-M1987, M350W, and M300W (Structural Quality Steels)

.10 CSA W47.1-1983 (Certificate of Companies for Fusion Welding of Structural Steel)

.11 CSA W59-M1989 (Welded Steel Construction – Metal Arc Welding)

.12 CSA G164-M1981 (Hot Dip Galvanizing of Irregularly Shaped Articles)

1.2 RELATED SECTIONS

.1 Section 03300 – Cast-in-place Concrete

.2 Section 05210 – Steel Joists

.3 Section 05300 – Metal Deck

.4 Section 06100 – Rough Carpentry

.5 Section 07200 – Thermal Protection

.6 Section 07500 – Membrane Roofing

.7 Section 07900 – Joint Sealers

1.3 DESIGN REQUIREMENTS

.1 Construct support systems to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Design supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Manufacturer’s installation instruction.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.6 QUALITY ASSURANCE

.1 Roof accessories manufactures to have minimum five (5) years documented experience in the design and fabrication of roofing specialties and accessories.

1.7 SPECIAL WARRANTY

.1 Warrant products installed under this section of work to be free of leaks, condensation, and defects in materials and/or manufacture for a period of twenty (20) years when installed in accordance with the manufacturer’s written instructions.

Part 2 Products

2.1 PIPE/SUPPORT

.1 Pipe/Support:

.1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51 mm) diameter.

.2 Stack Jack Flashing:

.1 Height to suit application.

.2 Fully urethane insulated.

.3 Aluminum construction.

.4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.

.3 Provide appropriate stainless steel mounting hardware to suit supported pipe/equipment.

.4 Provide appropriate system support as specified in this section to suit application.

.1 Single Plain Pipe: Type 304 stainless steel pipe roller assembly to suite actual 0.D pipe.

.2 Double Plain Pipe: Type 304 stainless steel pipe roller assemblies sized to suit actual 0.D pipe.

.3 Single Insulated Pipe: Type 304 stainless steel pipe cradle assembly sized to suit actual 0.D of insulated pipe.

.4 Double insulated Pipe: Type 304 stainless steel pipe cradle assemblies sized to suit actual 0.D of insulated pipe.

.5 Acceptable Manufacturers:

.1 Thaler MERS 600 series.

.2 Acceptable equals if submitted and approved during tender period.

2.2 NON-PENETRATING ROOF EQUIPMENT SUPPORT (SMALL UNITS)

.1 Provide zero penetration support on roof where indicated.

.2 Supports shall be ballasted to resist wind loads.

.3 Ballast system shall be fully engineered by manufacturer to withstand:

.1 Unit weight

.2 Wind loads based on prevailing wind conditions on roof of building.

.4 Engineered shop drawings, stamped by a Professional Engineer shall be provided indicating loading and calculations that demonstrate that the stand is suitable for the proposed application.

.5 Base shall be made of non-combustible material.

.6 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.

.7 Provide shop drawings as specified. Install to manufacturers recommendations.

.8 Acceptable Manufacturers:

.1 Portable pipe hanger
.2 Bigfoot systems
.3 Miro rooftop support
.4 Trikon Systems
.5 Walravin BIS Yet
.6 Ecofoot

2.3 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.4 ROOF CURB MOUNTED EQUIPMENT

.1 Install as per manufacturer's instructions on roof curbs provided by manufacturer as indicated.

.2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

2.5 ALUMINUM ROOF SUPPORTS

.1 450 mm high aluminum pipe support.

.2 Adjustable leg assembly, base plate, roller assembly.

.3 Acceptable Manufacturers:

.1 Thaler Mers-600A Series.

2.6 PIPING THROUGH ROOF

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

Part 3 Execution

3.1 INSTALLATION

.1 Roof support install in accordance with:

.1 Manufacturer's instructions and recommendations.
.2 Provide protection against deterioration due to contact of dissimilar metals.

.2 Flashing Installation:

.1 Install roof support flashing in accordance with manufacturer's printed instructions.

.3 Vibration Control Devices:

.1 Install as indicated and at all roof mounted equipment that is not internally isolated.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 PIPE SUPPORT SPACING

.1 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

.2 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

.3 Gas and fuel oil piping: every 1.8 m (6').

3.3 EXAMINATION

.1 Report to the contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Verify site dimensions. Commencement of work will imply acceptance of prepared work.

3.4 ADJUSTING

.1 Verify that all manufactured units have been installed in accordance with specifications and details and will function as intended. Adjust any items where necessary to ensure proper operation.

3.5 CLEANING

.1 Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaning techniques which could impair performance of the roofing system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASHRAE Handbook (2013) – Noise and Vibration Control chapter.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

.3 Provide detailed engineered shop drawings, outlining the manufacturer's recommended product for each piece of mechanical equipment. Submission shall be specific to the reviewed and returned shop drawings for equipment on the project.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

.2 To be of the same manufacturer for all isolation.

.3 Acceptable materials:

.1 Kinetics Noise Control

.2 Korfund

.3 Mason Industries

2.2 BASE TYPES

.1 Provide Base Type as indicated in Table under section 2.4 of this specification.

.2 Type A: No base, isolators attached directly to equipment. Refer to section 2.3 of this specification for isolator details.

.3 Type D: Roof Curbs

.1 Spring Isolation Roof Curb:

.1 Curb type isolator with integral spring isolators, designed to provide a complete roof curb installation. All rooftop air handling units shall be supported by vibration isolation curbs. The vibration isolation curbs shall be complete assemblies designed to resiliently support equipment at the specified elevation and shall constitute a fully enclosed air- and weather-tight system. The isolation curb shall consist of an upper support rail with supply and return duct supports on which the equipment and duct openings rest and a lower support curb which is attached to the roof structure, separated by free-standing, un-housed, laterally stable steel springs.

.2 Minimum 3" static deflection from spring isolators.

2.3 ISOLATOR TYPES

.1 Provide Isolator Type as indicated in Table under section 2.4 of this specification.

.2 Type 1 (Neoprene and Fiberglass Isolation Pads)

.1 Type A:

.1 Isolation pads shall be single ribbed or crossed, double ribbed elastomer-in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All pads shall be true elastomer-in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI (176 kg/cm2) tensile strength, oil resistant compounds with no color additives. Pads shall be 45 to 65 durometer and designed to permit 60 or 120 PSI (4.2 or 8.4 kg/cm2) loading at maximum rated deflections. When two isolation pads are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate.

2.4 ROOF CURB ACOUSTIC LINING

.1 Design Basis: Kinetics RT-7

.2 Factory laminated acoustic panel. Panels to be sectional and modular, designed for easy and accurate field assembly.

.3 Panels to be minimum 7 – ¼" thick and comprised of alternating fiberglass absorption media and acoustically dampened sheet rock. Integrate additional layers as required to meet required STC rating.

.4 Provide on all HVAC equipment over 4,000 cfm capacity.

.5 Required STC Rating: 60.

2.5 MINIMUM DEFLECTION REQUIREMENTS BASED ON EQUIPMENT TYPE

.1 The following table is to be used to reference required base and isolator types, following the tagging convention outlined in Parts 2.2 and 2.3 above. Reference notes are detailed after the table.

				Equipment Location												
				Slab on Grade			Up to 20 ft (6 m) Floor Span			20 to 30 ft (6-9 m) Floor Span			30 to 40 ft (9-12 m) Floor Span			
Equipment Type	Equipment Category	Horsepower and Other	RPM	Base Type	Isolator Type	Min. Defl., in. (mm)	Base Type	Isolator Type	Min. Defl., in. (mm)	Base Type	Isolator Type	Min. Defl., in. (mm)	Base Type	Isolator Type	Min. Defl., in. (mm)	Reference Notes
Condensing Units	All	All	All	A	1	0.25	A	4	0.75	A	4	1.50	A/D	4	1.50	
Packaged AH, AC, H, and V Units	All	≤10	All	A	3	0.75	A	3	0.75	A	3	0.75	A	3	0.75	7
		≤15	Up to 300	A	3	0.75	A	3	3.50	A	3	3.50	C	3	3.50	2,4,7,8
			301 to 500	A	3	0.75	A	3	2.50	A	3	2.50	A	3	2.50	4,7
		≤4 in. SP	501 and up	A	3	0.75	A	3	1.50	A	3	1.50	A	3	1.50	4,7
		>15,	Up to 300	B	3	0.75	C	3	3.50	C	3	3.50	C	3	3.50	2,4,8,9
		>4 in. SP	301 to 500	B	3	0.75	C	3	1.50	C	3	2.50	C	3	2.50	2,4,9
			501 and up	B	3	0.75	C	3	1.50	C	3	1.50	C	3	2.50	2,4,9
Packaged Rooftop Equipment	All	All	All	A/D	1	0.25	D	3	0.75							5,8

Base Types:

A. No base, isolators attached directly to equipment (Note 28)
B. Structural steel rails or base (Notes 29 and 30)
C. Concrete inertia base (Note 31)

Isolator Type:

1. Pad, rubber, or glass fiber
2. Rubber floor isolator or hanger
3. Spring floor isolator or hanger
4. Restrained spring isolator
5. Thrust restraint
6. Air spring

.2 Notes accompanying table:

.1 Cooling Towers: These are normally isolated with restrained spring isolators (type 4) directly under the tower or lower dunnage. High deflection isolators proposed for use directly under the motor-fan assembly must be used with extreme caution ensure stability and safety under all weather conditions. See Note 5.

.2 For large equipment capable of generating substantial vibratory forces and structure borne noise, increase isolator deflection, if necessary, so isolator stiffness is less than one-tenth the stiffness of the supporting structure, as defined by the deflection due to load at the equipment support.

.3 Pumps: Concrete inertia bases (type C) are preferred for all flexible-coupled pumps and are desirable for most close-coupled pumps, although steel bases (type B) can be used. Close-coupled pumps should not be installed directly on individual isolators (type A) because the impeller usually overhangs the motor support base, causing the rear mounting to be in tension. The primary requirements for type C bases are strength and shape to accommodate base elbow supports. Mass is not usually a factor, except for pumps over 55 kW, where extra mass helps limit excess movement due to starting torque and forces. Concrete bases (type C) should be designed for a thickness of one-tenth the longest dimension with minimum thickness as follows: (1) for up to 20 kW, 150 mm; (2) for 30 to 55 kW, 200 mm; and (3) for 75 kW and up, 300 mm. Pumps over 55 kW and multistage pumps may exhibit excessive motion at start-up (“heaving”); supplemental re-straining devices can be installed if necessary. Pumps over 90 kW may generate high starting forces; a vibration specialist should be consulted.

.4 Certain designs cannot be installed directly on individual isolators (type A), and the equipment manufacturer should be consulted on the need for supplemental support (base type).

.5 Wind load conditions must be considered. Provide restrained spring isolators (type 4), supplemental bracing, snubbers, or limit stops.

.6 Compressors: Base-mounted compressors through 5 HP and horizontal tank-type air compressors through 10 HP can be installed directly on spring isolators (type 3) with structural bases (type B) if required, and compressors 15 to 100 HP on spring isolators (type 3) with inertia bases (type C) with a mass 1 to 2 times the compressor mass.

.7 Fans and Air-Handling Equipment:

.1 For fans operating under 300 rpm, select isolator deflection so the isolator natural frequency is 40% or less than the fan speed.

.2 Flexible duct connectors must be installed at the intake and discharge of all fans and air-handling equipment to reduce vibration transmission

.3 Inertia bases (type C) are required for all class 2 and 3 fans and air-handling equipment.

.8 To avoid isolator resonance problems, select isolator deflection so that resonance frequency is 40% or less of the lowest normal operating speed of equipment. Equipment such as variable-frequency drives, and high-speed equipment, such as screw chillers and vane axial fans, contain very-high-frequency vibration. To reduce high-frequency vibration transmission, add a 25 mm thick pad (type 1) to the base plate of spring isolators (type 3).

.9 To limit undesirable movement, thrust restraints (type 5) are required for all ceiling-suspended and floor-mounted units operating at 1500 Pa or more total static pressure.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Provide Roof Curb acoustic lining on all HVAC equipment above 4,000 cfm / 10 tonnes capacity.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:

.1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

.7 Rooftop Units and Central Air Handling Units

.1 Packaged rooftop units shall be provided with standard curb mounted spring rails.

.2 Central air handling units (10,000 cfm or greater) shall be provided with spring isolation roof curbs.

.8 Spring isolators shall not be used in series to ensure no harmonics issues. This contractor shall review internally isolated equipment against method of spring isolation and ensure no overlap.

3.2 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.

.2 Provide Consultant with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.

.2 Vibration measurements shall be taken for equipment-listed below:

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 Canadian Standards Association (CSA).

.1 Natural Gas and Propane Installation Code CSA B149.1.

.4 National Fire Protection Association

.1 NFPA 13, Installation of Sprinkler Systems.

.2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

.1 Submit product literature in accordance with General Requirements.

.2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned, and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size #5.

.2 Equipment in Mechanical Rooms: Use size #9.

.3 Roof top equipment: use size #9.

.4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES/FIRE SMOKE DAMPER

.1 Colours:

.1 Black letters, yellow background.

.2 Construction:

.1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.

.3 Locations:

.1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

2.4 PIPING SYSTEMS GOVERNED BY CODE

.1 Identification:

.1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.

.2 Sprinklers: To NFPA 13.

.3 Standpipe and hose systems: To NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.3 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.

.2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.

.3 Use double-headed arrows where flow is reversible.

.4 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.5 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: To following table:

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

.7 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR MARKING	LEGEND
Condensate	Green	CONDENSATE
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Gas regulator vents		to Codes
Conduit for low voltage Control wiring	White	CONTROL WIRING___VOLTS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

.3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

2.9 LANGUAGE

.1 Identification to be in English.

Part 3 Execution

3.1 TIMING

.1 Provide identification only after all painting specified has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.

.2 This contractor must co-ordinate their work with that of the TAB contractor.

1.2 QUALIFICATIONS OF TAB AGENCIES

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.

.2 Provide documentation confirming qualifications, successful experience.

.3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:

.1 Air Audit Inc.
110 Turnbull Court, Unit 11
Cambridge, ON N1T 1K6
(519) 740-0871

.2 Air Velocities Control Ltd.
206 Lawlor Avenue
Toronto, ON M4E 3M1
(905) 279-4433

.3 Flowset Balancing Ltd.
431 Willis Drive .
Oakville, ON L6L 4V6
(416) 410-9793

.4 Air Adjustments & Balancing Inc.
P.O. Box 176,
Schomberg, ON L0G 1T0
(416) 254-3004

.5 Clark Balancing Ltd.
8094 Esquesing Line
Milton, ON L9T 2X9
(905) 693-1518

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

.4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.9 START OF TAB

.1 Notify Consultant in writing 3 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather-stripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.

.4 All provisions for TAB installed and operational.

.5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 All outlets installed, volume control dampers open.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10%, minus 5%.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format to be in accordance with NEBB, AABC, or SMACNA.

.2 The following additional information shall be provided for all air systems:

.1 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE occupied ventilation requirements.

.2 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE unoccupied ventilation requirements.

.3 Static pressure reading for each HVAC/AHU unit with VAV/VVT boxes open to 80% of design airflow and bypass damper closed to 0%. Provide reading at normal MAD/economizer damper position, dampers fully closed and dampers fully open.

.3 TAB report to show all results in SI or imperial units as indicated on plans and to include:

.1 Project as-built drawings.

.2 System schematics.

1.16 VERIFICATION

.1 All reported results subject to verification by Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Consultant.

.4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.

.2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:

.1 Air handling systems and equipment

.2 Duct testing to SMACNA standards.

.3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.

.4 Quality assurance: Perform TAB under direction of qualified supervisor.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

.2 At each controller, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

1.20 DUCT LEAKAGE TESTING

.1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

1.21 OTHER TAB REQUIREMENTS

.1 General requirements applicable to all work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.3 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions **[during [winter] [summer] design conditions]** [at all times].

.2 TAB procedures:

Positive	Negative
Corridors	Washrooms

.4 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish air pressure differentials, with all systems in all possible combinations of normal operating modes.

.5 Smoke management systems:

.1 Test for proper operation of all smoke and fire dampers installed as component parts of air systems specified.

.6 Provide duct testing as specified.

.7 Provide AHU testing as specified.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The Mechanical Contractor shall provide the labour and material to conduct the closeout process as outlined in this specification section.

.2 The mechanical contractor shall perform the closeout requirements specified in conjunction with the independent commissioning consultant (CC) retained by the owner.

Part 2 Products

2.1 GENERAL

.1 The mechanical contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The Mechanical Contractor shall advise the Mechanical Consultant of instrumentation to be used and the dates the instruments were calibrated.

Part 3 Execution

3.1 THE CONTRACT CLOSE OUT PROCESS

.1 The mechanical contractor close out process shall consist of:

- Shop Drawings and As-built Drawings
- Installation inspection and equipment verification
- Plumbing and drainage system testing
- Testing of piping systems
- Independent contractor balancing of water systems
- Testing of air systems
- Independent contractor balancing of air systems
- Testing of equipment and systems
- BAS Commissioning
- Verification of refrigeration leak detection systems
- Commissioning Consultant performance testing
- Commissioning meetings
- Operating and maintenance manuals
- Training
- Systems Demonstration and turnover
- Testing forms
- Warranties
- Contractor to provide list of equipment maintenance including schedule of maintenance parts, quantities, and model fixtures, etc.

3.2 SHOP DRAWINGS AND AS-BUILT DRAWINGS

.1 Conform to General Requirements Section for shop drawings and as-built drawings requirements.

3.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The Mechanical Contractor shall co-ordinate with the Consultant who will inspect the mechanical installation.

.2 The Mechanical Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

- Manufacturers name, address and telephone number
- Distributors name, address and telephone number
- Make, model number and serial number
- Pumps - RPM, impeller sizes, rated flow
- Fans - belt type and size, shive type and size
- Electrical - volts, amps, fuse size, overload size
- Any other special characteristics.

3.4 THE CONTRACTOR'S TESTING OF PIPING SYSTEMS

.1 Test all piping systems in accordance with all applicable plumbing codes and General Requirements section.

.2 All tests for the systems shall be performed in the presence of the Consultant or Commissioning Consultant. Complete the testing forms and forward to the Consultant.

3.5 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF WATER SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

3.6 THE CONTRACTORS TESTING OF AIR SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 All tests shall be performed in the presence of the Mechanical Consultant or the Commissioning Consultant. Complete the testing forms and forward to the Consultant.

3.7 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF AIR SYSTEMS

.1 Conform with specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

3.8 TESTING OF EQUIPMENT AND SYSTEMS

.1 General:

.1 The Mechanical Contractor shall hire the services of the manufacturers technicians to test the equipment and associated systems. The technician shall record the results of the tests on the testing forms. The tests shall be witnessed by the Consultant or Owners representative. When the tests have been completed satisfactorily the technician and witnessing authority shall sign the forms. A copy of the forms shall be forwarded to the Consultant. The original shall be inserted into the operating and maintenance manual.

.2 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed.

.3 Tests which have not been witnessed shall not be accepted and shall be repeated.

.4 The equipment and systems to be tested shall include:

- Heat Pumps
- Condensing Units
- Boilers and Pumps
- Air Handling Units
- Cooling Tower
- Life Safety and Fire Protection Systems
- Water Treatment Systems
- Building Automation Systems (BAS)

.2 BAS Testing:

.1 The BAS Contractor shall test the system as described in General Requirements and/or Controls Sections.

.2 Co-ordinate with the Consultant and submit completed test forms monthly.

.3 Demonstrate to the Owner and Consultant the operation of the BAS when all tests have been completed.

.3 Verification of Refrigeration Leak Detection System Operation:

.1 The commissioning process shall include the verification of the refrigeration leak detection system.

.2 All interlocks between leak detection systems installed and system components, as well as interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52. Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate all refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

3.9 CLOSEOUT SCHEDULE

.1 The Mechanical Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.

.2 All testing forms and reports associated with the mechanical systems shall be directed to the Consultant with copies to the Owner and Consultant.

.3 The forms and reports to be issued shall include:

- Shop drawings, issued and accepted
- Equipment verification forms
- Testing forms
- Reports resulting from tests
- Testing schedule
- Equipment Start-up Forms

3.10 OPERATION AND MAINTENANCE MANUAL

.1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

3.11 OPERATOR TRAINING

.1 Conform to General Requirements section for requirements for Instruction to Operating Staff.

.2 The training shall be conducted in a classroom and at the equipment or system.

.3 Training will begin when the operating and maintenance manuals have been delivered to The Owner and approved by the Consultant.

.4 Each training session shall be structured to cover:

The operating and maintenance manual

- Operating procedures
- Maintenance procedures
- Trouble-shooting procedures
- Spare parts required
- Submit a course outline to the Mechanical Consultant before training commences. Provide course documentation for up to eight people.

.5 The training sessions shall be scheduled and co-ordinated by the Mechanical Contractor.

.6 Training shall be provided for the following systems:

System	Minimum Training Times
Condensing Units	2 hours
Air Handling Units	2 hours
Life Safety & Fire Protection Systems	2 hours
Water Treatment Systems	2 hours
The Mechanical System	8 hours

.7 The minimum training for the BAS shall be 16 hours. The training shall include:

- A walk through of the installation for the Building Owner to review the installation and equipment
- Operation of the central computer
- Operation of portable terminals
- Control sequences
- Report set-up and generation
- Managing the system
- Maintenance requirements

Refer to Controls specification section for further information.

.8 The training requirement for the mechanical system shall include a walk-through of the building by the Mechanical Contractor. During the walk through the Mechanical Contractor shall:

- Identify equipment
- Identify starters associated with equipment
- Identify valves and balancing dampers
- Identify access doors
- Review general maintenance of equipment
- Review drain points in pipework systems
- Identify maintenance items

.9 When each training session has been completed The Owner shall sign the associated form to verify completion.

3.12 COMMISSIONING CONSULTANT

.1 A Commissioning Consultant (CC) reports to the Owner.

.2 The CC responsibilities shall include:

- preparing the commissioning plan
- co-ordinating with the contractor to schedule tests
- preparing a test form manual
- witnessing selected tests
- receiving all test forms
- conducting performance test
- co-ordinating the contractors training
- chair commissioning meetings

.3 The Mechanical Contractor shall co-operate with the CC.

.4 The Mechanical Contractor shall provide assistance to the CC and have personnel available during the performance testing procedure. Each mechanical system shall be tested in the operational mode.

.5 Performance testing shall begin when all systems have been completed, tested by the Mechanical Contractor and the Consultant has completed their final review.

3.13 MECHANICAL SYSTEM DEMONSTRATION AND TURNOVER

.1 Refer to General Requirements section, Mechanical Project Completion.

.2 The system demonstration and turnover to The Owner shall occur when:

- The installation is complete
- The acceptance test conducted by the Mechanical Consultant has been completed successfully
- The Commissioning Consultant system performance testing has been completed successfully
- Training has been completed
- Operating and Maintenance Manuals have been accepted
- Shop-drawings have been updated
- As-built drawings have been completed

.3 The systems demonstration shall be conducted by the Mechanical Contractor and the manufacturers. The demonstration shall cover a demonstration of equipment installation and operation.

3.14 TESTING FORMS

.1 The Mechanical Contractor and manufacturers shall provide forms for testing. The forms must be approved by the Consultant and The Owner before they are used.

3.15 WARRANTIES

.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by The Owner.

.2 The Mechanical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to the general conditions specification section for the requirements during the warranty period.

3.16 CLOSEOUT PROCESS ALLOCATION

.1 The mechanical contractor closeout process shall be as follows:

.1 3% for the first $500,000 of contract value.

.2 1% of the contract value for value between $500,000 to $5,000,000.

.3 0.5% of contract value for the value in excess of $5,000,000.

.4 Minimum Allocation for Close Out Documents is $5,000.

.2 The Mechanical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

.3 The monies shall not be paid out until the performance testing, O & M manuals, systems demonstration, and training including all required paperwork have been completed to the satisfaction of the consultant. Refer to General Requirements section for contract breakdown.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The work shall be coordinated between the mechanical contractor and commissioning agent.

1.2 QUALIFICATIONS OF COMMISSIONING AGENTS

.1 Only the following Commissioning Agents may quote:

.1 Isotherm Engineering Ltd.
Phone: 905-822-2430

.2 CFMS Consulting
Phone: 905-787-9449

.3 John M. Poland Consulting Services
Phone: 905-954-5455

.4 Pact Engineering Inc.
Phone: 905-773-2442

1.3 GENERAL REQUIREMENTS

.1 Definition:

.1 This section describes HVAC System Commissioning. HVAC System Commissioning is to be a joint team effort to:

.1 Ensure that all HVAC equipment, controls and systems function together properly and meet design intent.

.2 Ensure that system performance parameters are documented for fine-tuning of control sequences and operational procedures.

.2 The commissioning process shall encompass and co-ordinate the following areas:

.1 System documentation.

.2 Equipment start-up and Performance Testing (Pre-Functional Testing).

.3 Testing and balancing.

.4 Control system calibration.

.5 System start-up and Performance Testing (Function Testing).

.6 Training.

.7 Deficiency Documentation and Resolution.

.2 Commissioning Team:

.1 The Commissioning Team shall consist of:

.1 Owner/Owner's Representative

.2 Commissioning Authority

.3 Consultant, as required

.4 Architect, as required

.5 Prime Contractor

.6 Specialty or Sub-Contractors, as required by Prime Contractor

.7 Equipment Suppliers, as required by Prime Contractor

.2 The trades represented on the Commissioning Team may include sheet metal, piping and fitting, controls, and balancing, as required.

.3 The lead hand for each trade who will perform or supervise the commissioning work is to be designated as a Representative to the Commissioning Team.

1.4 RESPONSIBILITIES

.1 Commissioning Authority:

.1 Verify Pre-Functional and Functional performance of HVAC systems for compliance with design intent as specified in the appropriate Specification sections.

.2 Provide the documentation with standard Pre-Functional and Functional performance reports on completion of the testing.

.3 Verify submissions for HVAC system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.

.4 Co-ordinate and direct training of personnel for operation and maintenance of HVAC systems and equipment.

.5 Co-ordinate and direct each step of the commissioning process, and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.6 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to Prime Contractor and Owner/Owner's Representative.

.7 The Commissioning Authority is not responsible for:

.1 Contracting methods.

.2 Contracting safety.

.3 Product liability/warranties.

.4 Maintenance/long-term building operation.

.5 System functions which have changed since Commissioning.

.6 Problems which arise out of recommended resolutions which are not implemented.

.7 Testing the operation of each and every component (e.g. shutoff valve, breaker, etc.).

.8 Normal wear and tear on equipment and systems.

.2 Prime Contractor:

.1 The Prime Contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation and control of HVAC equipment and systems.

.2 The Prime Contractor shall be responsible for appointing the commissioning team members from the Sub and Specialty trades.

.3 The Prime Contractor will assure participation and co-operation of Sub-Contractors and Specialty Contractors (mechanical, electrical, TAB, building management, etc.) under the Prime Contractor's jurisdiction as required for the commissioning process.

.4 The Prime Contractor shall be responsible for the actual system Pre-Functional (Section 2.5) and Functional Performance Testing (Section 2.8). Any changes to the supplied test procedures must be approved by the Commissioning Agent.

.5 The Prime Contractor shall be responsible for correcting deficiencies.

.3 Sub- and Specialty Contractors:

.1 The Sub- and/or Specialty Contractors will be responsible for providing labour, material, equipment, etc., required within the scope of the respective sub-trade or specialty trade to facilitate the commissioning process.

.2 The Sub- and/or Specialty Contractor will perform Pre-Functional and Functional Performance Tests as required by the commissioning process.

.4 Consultant:

.1 The Consultant shall provide the Design Intent Documentation for commissioning.

.2 The Consultant shall observe (Pre-Functional and Functional Performance Testing), where specified, and sign-off reports when required.

.3 The Consultant shall provide technical capabilities for resolution of deficiencies, where required.

Part 2 Commissioning Process

2.1 GENERAL REQUIREMENTS

.1 The Commissioning Process is detailed in ***ASHRAE Guideline 1-1996 HVAC Commissioning Process.*** The commissioning plan will be modified to reflect the actual construction schedule.

2.2 COMMISSIONING SCOPE MEETING

.1 After the contract award and before HVAC system construction begins, a commissioning scope meeting of all members of the Commissioning Team shall be held at a time and place designated by the Owner/Owner's Representative. The purpose of the meeting will be to familiarize all parties with the requirements of the commissioning process, and to ensure that the responsibilities of each party are clearly understood. The Prime Contractor shall ensure that the appropriate Specialty and Sub-Contractors are in attendance.

2.3 OPERATIONS AND MAINTENANCE MANUALS FOR HVAC EQUIPMENT AND SYSTEMS

.1 Furnish Final, reviewed Operation and Maintenance Manuals to the Commissioning Authority and Owner/Owner's Representative fourteen (14) days prior to scheduled Functional Performance Tests.

2.4 START-UP, PRE-FUNCTIONAL PERFORMANCE TEST

.1 The Prime Contractor shall be responsible for the Pre-Functional Performance Tests. These tests ensure that all equipment and systems are installed in accordance with the Specifications, Drawings and manufacturers' requirements.

.2 The Prime Contractor shall be responsible for co-ordinating schedule for Pre-Functional tests of various equipment and systems.

.3 In the Pre-Functional Test, all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:

.1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.

.2 Verify that the hydronic piping system has been cleaned and flushed.

.3 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.

.4 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.

.5 Test format shall be supplied by the Commissioning Authority.

.6 Pre-Functional Performance Tests shall be completed prior to starting Functional Performance Tests.

.7 Pre-Functional Performance Tests need to be performed once only, if there are no deficiencies, as determined by the Commissioning Authority. Re-testing of corrected items shall be the responsibility of the Prime Contractor.

.8 Completion of the Pre-Functional Performance Tests shall be the responsibility of the Prime Contractor who shall sign and date each Test.

.9 Notify the Commissioning Authority, in writing, at least fourteen (14) days prior to the date of Pre-Functional Performance Testing. Schedule the Pre-Functional performance tests over a period of consecutive business days.

2.5 TESTING, ADJUSTING AND BALANCING (TAB)

.1 The TAB shall be done in accordance with the Construction Schedule.

.2 The TAB agency shall submit two (2) copies of the TAB reports to the Commissioning Authority.

2.6 CONTROLS CALIBRATION

.1 To be completed in accordance with the specification.

2.7 FUNCTIONAL PERFORMANCE TESTS

.1 The Prime Contractor shall be responsible for the Functional Performance Tests. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests, and test the systems through all possible modes of operation.

.2 The Functional Performance Testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions.

.3 The Prime Contractor shall be responsible for co-ordinating the Functional Performance Tests for the HVAC mechanical systems and sub-systems.

.4 In the Functional Performance Tests, all HVAC mechanical systems, including control systems, shall be checked for the following:

.1 Verify that each system and sub-system is operating, and complies with Contract Specifications and the Design Intent Document through the entire range of operating conditions.

.2 Test format shall be supplied by the Commissioning Agent.

.3 Notify the Commissioning Agent and Consultant, in writing, at least fourteen (14) days prior to date of Functional Performance Tests. Schedule each of the two seasonal Functional Performance Test periods over a period of consecutive business days.

.4 Re-testing of corrected items shall be the responsibility of the Prime Contractor.

.5 The following personnel are to be present during Functional Performance Testing:

.1 The Prime Contractor and mechanical and controls specialty or sub-contractors as relevant to specific test.

.2 The Commissioning Agent

.3 Owner/Owner's Representative (operation personnel), Consultant and Architect may be present for some or all of Functional Performance Testing.

.4 Deficiencies in system, sub-system, or element performance will be brought to the attention of the Commissioning Team. Deficiencies will be resolved on a case-by-case basis.

2.8 CONTROLS COMMISSIONING

.1 Controls commissioning shall be done in accordance with the specification.

2.9 VERIFICATION OF REFRIGERATION LEAK DETECTION SYSTEM OPERATION

.1 The commissioning process shall include the verification of the refrigeration leak detection system.

.2 All interlocks between leak detection systems installed and system components, as well as interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52. Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De energize any other potential sources of ignition within the affected system.

2.10 TRAINING

.1 HVAC training shall be done in accordance with the Commissioning Plan Schedule.

2.11 REPORTS

.1 Documentation, General:

.1 The Commissioning Authority shall be responsible for recording and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.

.2 All data must be recorded as soon as possible during the course of the inspection and testing.

.3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.

.4 All test instruments shall be documented for valid calibration.

.5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Consultant and the Commissioning Agent prior to the Start of Functional Performance Testing.

.2 The Commissioning Authority shall prepare and submit the following reports:

.1 Interim Report. Submit after completion of first functional seasonal commissioning period. Report shall document tests performed, any modifications to tests, comparison to TAB and other agency tests, and verification of compliance with design intent for ambient conditions under which initial commissioning was performed.

.2 Final Report. Submit after completion of last functional seasonal commissioning period. Report shall verify performance of HVAC equipment and systems during each seasonal commissioning process. Document any field modifications to the testing process and why these modifications were made.

Part 3 Execution

3.1 GENERAL REQUIREMENTS

.1 HVAC commissioning Pre-Functional and Functional Performance Tests shall begin after HVAC equipment and systems, along with related equipment, systems, structures and areas are complete.

.2 The testing and balancing Contractor shall perform the TAB after the Pre-Functional Tests have been completed and documented. The TAB agency shall submit two (2) TAB reports to the Commissioning Authority.

3.2 MECHANICAL SYSTEM COMMISSIONING

.1 General Requirements:

.1 Operating equipment and systems shall be tested in the presence of the Commissioning Authority (and the Consultant – at the Consultant's option) to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.

.2 The Prime Contractor shall notify the Commissioning Authority, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.

.3 Testing shall be conducted under specified design operating conditions as recommended or approved by the Commissioning Authority and Consultant, and outlined in the Pre-Functional and Functional Performance Tests.

.4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.

.5 All special testing materials and equipment shall be provided by the appropriate Contractor, as determined by the Prime Contractor.

.6 Provide three copies of all test reports and records to the Commissioning Authority.

.2 Test Procedure and Test Documentation:

.1 The Commissioning Authority will provide the Prime Contractor with Pre-Functional and Functional test procedures and test documentation reports. The Prime Contractor may propose alternate documentation and may alter the test procedures and test documentation to suit as-built conditions. However, the Prime Contractor will be expected to co-operate to the level of detail and general approach of the provided test procedures and test documentation.

.2 The Commissioning Authority shall verify test and air balance (TAB) readings for at least 20 percent (20%) of the supply (maximum and minimum primary air), return, and exhaust diffusers, registers and grilles. If more than one-fifth of these readings differ from the documented TAB readings by more than 15 percent, then the TAB shall be repeated in entirety. The TAB agency shall pay the extra costs.

.3 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:

Equipment Checklist	System Checklist
Rooftop Heating/Cooling Unit(s)	Rooftop Heating/Cooling Unit(s)
Fan Coil Units	Pumps
Exhaust Fans	
Pumps	
Controllers/Valves/Dampers	
Relays/Sensors/Transducers	

.3 Pre-Functional Performance Test Checklist:

.1 The Prime Contractor shall be responsible for completing and submitting Pre-Functional Performance Testing.

.2 Pre-Functional Performance Test Checklist:
Perform and submit one (1) Pre-Functional Performance Test for each of the following:
- rooftop heating/cooling units
- pump(s)

.4 Testing, Adjusting, and Balancing (TAB):

.1 Comply with the Specification.

.5 Functional Performance Test Checklist:

.1 The Prime Contractor shall be responsible for completing and submitting Functional Performance Testing.

.2 Functional Performance Test Checklist:
Perform and submit one (1) Functional Performance Test for each of the following:
- rooftop heating/cooling unit(s)
- pump(s)

.6 Training:

.1 General:
Each of the following manufacturers/suppliers shall deliver training to the Owners appointed staff and management who will provide operating services:

.1 Domestic hot water boiler

.2 Heat Recovery Unit

.3 Rooftop Units

.4 Controls

.5 Fire/life safety controls

.2 Each of the manufacturers required to deliver training as part of this Specification shall comply with training schedules, formats and structures designed and provided by the commissioning contractor. The commissioning contractor is the final authority on the substance, content and quality of the instruction to be delivered.

.3 Submittals:

.1 Manufacturer/Suppliers shall submit lesson plans to the commissioning contractor three (3) weeks prior to the scheduled training session.

.2 Each manufacturer/supplier shall revise the lesson plan according to the direction and assistance of the commissioning contractor.

.3 If requested the commissioning contractor the revised lesson plan shall be re-submitted one (1) week prior to the scheduled training sessions.

.4 Quality Assurance:

.1 The Owner reserves the right to videotape each training session.

.2 Each manufacturer/supplier required to deliver training shall use the following tools to facilitate learning:

.1 Visual aids: use of overhead projectors, flipcharts, videos and/or slides.

.2 Printed material: each participant shall receive a copy of the material to be reviewed at the commencement of each session.

.7 Deficiency Resolution for HVAC Mechanical System Commissioning:

.1 If acceptable performance cannot be achieved, then the necessary corrective measures should be carried out. The Consultant and/or the Prime contractor should issue appropriate directions in this regard.

.2 The allocation of cost of deficiency resolution shall be determined by the Commissioning Team, on a case-by-case basis.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM).

.1 ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Mean of the Guarded Hot-Plate Apparatus.

.2 ASTM C518 Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.3 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.4 ASTM C1729 Standard Specification for Aluminum Jacketing for Insulation.

.5 ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

.6 ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes And Tanks.

.7 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.8 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations.

.1 Thermal Insulation Association of Canada (TIAC)

.2 North American Commercial and Industrial Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

.3 Submit completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specification section.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

.5 “FSK” – Foil Scrim Kraft – vapor retarder laminate of aluminium foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.

.2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

1.7 QUALITY ASSURANCE

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

Part 2 Products

2.1 LIMITATION ON MATERIALS

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C177 or ASTM C518.

.3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket meeting the requirement of ASTM C1136 Type II and IV (FSK):

.1 Jacket: to ASTM C1136 Type II and IV (FSK)

.2 Maximum "k" value: .033 W/M•°C (.23 BTU•IN/HR•FT^2•°F)

.4 Type C-2: Mineral fibre blanket to ASTM C553 Type I, II, and III, ASTM C1136 Type II and IV, and ASTM C1290 Type III:

.1 Jacket: to ASTM C1136, Type II and IV.

.2 Maximum "k" value: 0.042 W/M•°C (.29 BTU•IN/HR•FT^2•°F)

.5 Type C-6: Pipe and tank insulation: Fibreglass segmented board bonded to laminated vapor retarder:

.1 Mineral fibre: to ASTM C1393 type II or type IIIA, Category 2.

.2 Jacket: ASJ or FSK type

.3 Maximum "k" factor: 0.26 BTU • IN/HR • FT2 • °F (0.037 W/M • °C) or less

.6 Manufacturers:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Manufacturers:

.1 Johns Manville **(with proof of Asthma and allergy friendly certification)**

.2 Knauf

.3 Manson

2.4 JACKETS

.1 Canvas:

.1 220 g/m^2 (6 oz/sq.yd.) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

2.5 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 g/m² (6oz/yd^2) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.

.6 Contact adhesive: quick-setting Childers CP-82 or equal.

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm (16 gauge) stainless steel.

.9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation

.10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with North American Commercial and Industrial Insulation Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers in accordance with general requirements.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.

.6 Provide rigid insulation for exposed ductwork.

.7 **Use two layers with staggered joints when required nominal thickness exceeds 75 mm (3").**

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses conform to following table:

Application	Type	Thickness
Rectangular supply air ducts	C-1	25 mm (1")
Round supply air ducts	C-2	25 mm (1")
Supply, return, and fan exhaust ducts exposed (visible) in space being served	None	
Energy/heat recovery ventilator Exhaust ducts	C-1	25 mm (1")
Exhaust plenums dampers and louvres	C-1	25 mm (1")
Interior acoustically lined ducts	None	
Last 1.5m of exhaust duct	C-1	25 mm (1")

.2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.3 Finishes: Conform to following table:

Application	Rectangular	Round
Indoor, concealed	None	None
Indoor, exposed	Canvas	Canvas

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels, and Round Ducts.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C547, Type I and IV Standard Specification for Mineral Fiber Pipe Insulation.

.2 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded-Hot-Plate Apparatus.

.3 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus to recognize the correct thermal insulation performance testing for blanket.

.4 ASTM C1393, Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks

.5 ASTM C1695, Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service.

.6 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.7 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.8 ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.

.9 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.10 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC)

.2 North American Commercial and Industrial Insulation Standards

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.

.3 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

.5 "FSK" – Foil Scrim Kraft – vapor retarder laminate of aluminum foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner liner.

.6 "PSK" – Poly Scrim Kraft – vapor retarder laminate of polypropylene outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.

.7 "PVC" – Poly Vinyl Chloride – polymer used to manufacture a non-metallic final protective finish jacket over insulation systems.

1.7 QUALITY ASSURANCE

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

.2 Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold and formaldehyde free.

.3 Recycled content: Mineral fiber products will contain a minimum of 50% recycled glass content certified and UL validated and are to be constructed using bio-based thermosetting binder.

Part 2 Products

2.1 MATERIAL LIMITATIONS

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335, ASTMC177 or ASTM C518.

.3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547 Type I and IV.

.2 Jacket: to ASTM C1136, Type I, II, III, IV, X.

.3 Maximum "k" factor: to ASTM C547.

.4 Type A-3: Tubular flexible elastomeric closed cell foam:

.1 Insulation to ASTM C534 Type I.

.2 Maximum "k" factor: to ASTM C534.

.3 To be certified by manufacturer to be free of potential stress corrosion cracking corrodents.

.5 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Manufacturers:

.1 Knauf

.2 Manson

.3 Owens Corning

2.4 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5mm (16 gauge) diameter stainless steel.

.5 Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (0.020") thick.

2.5 CEMENT

.1 Thermal insulating and finishing cement:

.1 Air drying on mineral wool, to ASTM C 449M.

.2 Hydraulic setting on mineral wool, to ASTM C165

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

.2 Reinforcing fabric: Open weave fibreglass fabric, with maximum weave of 10 x 10 squares per inch.

2.9 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 Minimum thickness: 20mil (0.020")

.2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.3 Colours: white.

.4 Minimum service temperatures: -29°C (-20°F).

.5 Maximum service temperature: 65°C (150°F).

.6 Moisture vapour transmission: 0.05 perm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks (not to be used on below-ambient temperature systems)

.3 Pressure sensitive vinyl tape of matching colour.

.2 Aluminum:

.1 To ASTM C1729.

.2 Thickness: 0.50 mm (0.020") sheet.

.3 Finish: Smooth.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.

.5 Fittings: 0.50 mm (0.020") thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (0.020") thick at 300 mm (12") spacing.

2.10 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with North American Commercial and Industrial Insulation Standards.

.2 Provide continuous insulation for complete systems including all valves, air separators, fittings, and other equipment.

.3 Apply materials in accordance with manufacturers' instructions and this specification.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.6 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm (3").

.7 Below ambient/chilled water installation:

.1 All pipes, fittings, valves, strainers, flanges, unions, and other pipe system components and specialties must be properly insulated with correctly completed vapor retarded applied.

.2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.

.3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a .02 or lower perm rating.

.4 Vapor stops must be installed at 18' intervals, at all pipe insulation termination points, including fittings, flanges, and other changes in direction or other types of piping specialities.

.5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricated from the same material as the pipe insulation. Full thickness must be factory-applied, vapor-retarder facing is unacceptable.

.6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder or pipe insulation.

.7 Additional fitting covers, PVC or metal, must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.

.8 Additional field applied jackets must not use staples, screws, tacks or rivets for attachment, to avoid puncturing vapor retarder underneath.

.9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

3.3 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Flexible removable insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.

.3 Insulation:

.1 Insulation, fastenings, and finishes: same as system.

.2 Jacket: As per adjacent insulation.

3.4 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, air separators, and fittings unless otherwise specified.

.2 Install insulator and jackets to applicable TIAC codes.

.3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Condensate	A-1	40 (1½")	40 (1½")	50 (2")	50 (2")	50 (2")
Refrigerant piping	A-3	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")

.5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC
Exterior refrigerant piping	Aluminum	Aluminum

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).

.6 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.7 ASTM A53/A53M, and A106, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded ERW and Seamless.

.8 ASTM B32, Specification for Solder Metal.

.9 ASTM B75M, Specification for Seamless Copper Tube [Metric].

.10 CSA B149.1, Natural Gas and Propane Installation Code.

.11 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings product data in accordance with general requirements.

.2 Indicate on manufacturers catalogue literature.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GAS SERVICE

.1 Arrange with the local utility to have the gas service provided from the street to the gas meter where indicated.

.2 Fees and charges requested by the local utility to provide the gas service and meter.

.3 Submit all plans as requested by the local utility.

.4 Utility supplied gas meter shall be complete with pulse signal for connection to BAS system (co-ordinate pulse representation in m^3 of gas used on meter specifications.

.5 Provide approved pulse gas meter in all locations where indicated on the drawings.

2.2 PIPE

.1 Steel pipe: to ASTM A106, Schedule 40, seamless as follows:

.1 NPS 15 mm to 50 mm (1/2" to 2"), screwed.

.2 NPS 65 mm (2 1/2") and over, plain end.

.2 Buried pipe: CGA approved polypropylene complete with tracer wire and marker.

.3 Copper tube: to ASTM B75M.

2.3 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Soldered: to ASTM B32, tin antimony 95/5.

.5 Screwed brass fittings: Teflon Tape.

2.4 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ANSI B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M/A106.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ANSI B16.18.

.3 Brass fittings: To ASTM B16.

2.5 BALL VALVES

.1 NPS 50 mm (2") and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.

.3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders.

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel solid ball and teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

2.6 LUBRICATED PLUG VALVES

.1 All sizes

.1 Provincial Code approved, lubricated plug type.

.2 Body: cast iron to ASTM A 126 Class B semi-steel.

.1 Rating: Class 125 psig.

.3 Plug: tapered, with regular pattern port – 90 from full open to fully closed.

.4 Ends: 50 mm (2") and smaller with hexagon shoulders, ends screwed to ANSI B1.20.1. Flanged to ANSI B16.1.

.5 Lubrication system, nickel-plated.

.6 Lubricant: to suit type, temperature and pressure of contained fluid.

.7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film.

.8 Lubricant screw for lubrication.

.9 O-rings between body and plug.

.10 Operator: removable manual lever handle.

.11 Acceptable Manufacturers:

.1 Newman Hattersley

.2 Crane

.3 Jenkins

.4 Milwaukee

.5 Toya

2.7 GAS REGULATOR

.1 Reduce pressure from 34.5 kPa (5 psi) to 1.74 kPa (7" WC) capacity as indicated.

.1 Acceptable Manufacturers:

.1 Singer

.2 Schlumberger

.2 Vent interior relief valve to outdoors with gooseneck and stainless steel insect screen. Vent piping shall be sized as per manufacturers' requirements and recommendations.

.3 Isolate with lubricated plug valve and union connection.

2.8 EMERGENCY GAS SOLENOID VALVE

.1 Two (2) way normally closed all bronze construction.

.2 Suitable for 120V and natural gas.

.3 Acceptable Manufacturers:

.1 Asco.

2.9 TREATED WOOD ROOF SUPPORTS

.1 Wolmanized wood with blocking and styrofoam SM insulation, constructed as detailed on drawings.

2.10 MANUFACTURED ROOF SUPPORTS

.1 Single piece injection moulded polypropylene support.

.2 Type 3-20 psi extruded polystyrene UV protected base glued to the support.

.3 Minimum base dimension of 300 x 225 (12" x 9") and be 140 mm (5.5") high.

.4 Pull test of 1.4 KN (315 lbs) using two #14-10 screws on pipe strap.

.5 Acceptable Manufacturers:

.1 Quick Block

.2 Erico

2.11 ALUMINUM ROOF SUPPORTS

.1 450 mm high aluminum pipe support.

.2 Adjustable leg assembly, base plate, roller assembly.

.3 Acceptable Manufacturers:

.1 Thaler Mers-600A Series.

2.12 PIPING THROUGH ROOF

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

Part 3 Execution

3.1 PIPING

.1 Install in accordance with applicable Provincial/Territorial Codes.

.2 Install in accordance with CAN/CSA B149.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.5 Slope piping down in direction of flow to low points.

.6 Install drip points:

.1 At low points in piping system.

.2 At each connection to equipment.

.7 Use eccentric reducers at pipe size change installed to provide positive drainage.

.8 Provide clearance for access and for maintenance.

.9 Ream pipes, clean scale and dirt, inside and out.

.10 Install piping to minimize pipe dismantling for equipment removal.

.11 Install regulator vents to code. Terminate in open air with Gooseneck fitting complete with stainless steel screen.

.12 Paint gas piping with two (2) coats yellow paint. Banding of gas will not be accepted.

3.2 PIPING ON ROOF

.1 Support piping as follows or as per seismic requirements (1.8 M (6' - 0") O.C.) whichever is more stringent:

.1 ≤ 40 mm (1½") 2.4 M (8' – 0") O.C.

.2 ≥ 50 mm (2") 3.0 M (10' - 0") O.C.

.2 Provide support at each elbow and fitting.

.3 Provide support at each regular and/or isolating valve.

.4 Provide support within 600 mm (24") of each piece of equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Consultant.

.2 Install valves at branch take-offs to isolate each piece of equipment, and as indicated.

.3 Provide lubricated plug type when gas line is exterior of building or 65 mm (2½") and larger.

.4 Provide ball valve when gas line is interior of building and 50 mm (2") or smaller.

3.4 FIELD QUALITY CONTROL

.1 Test system in accordance with CAN/CSA B149. Requirements of authorities having jurisdiction.

.2 Provide copy of TSSA tag to the consultant.

3.5 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.

3.6 GAS SERVICE

.1 Arrange with local gas distributor to install gas service and gas meter. Pay all fees and charges to provide the gas service and gas meter.

.2 Install all the gas meters where indicated.

3.7 GAS FIRED EQUIPMENT START-UP

.1 Start-up of all new and existing gas fired equipment shall be by this contractor to the requirements of the equipment manufacturer.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.22, Wrought Copper Alloy and Copper Alloy Solder - Joint Pressure Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.3 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.

.4 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

.5 ANSI/ASME B31.5, Refrigeration Piping and Heating Transfer Components.

.6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 413.5 mPa (60,000 psi) Tensile Strength.

.7 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.8 CSA B52, Mechanical Refrigeration Code.

.9 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, Type ACR-B.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa (300 psi) and temperature 121°C (250°F).

.2 Brazed:

.1 Fittings: wrought copper to ANSI/ASME B16.22.

.2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ANSI/ASME B16.24, Class 150 and Class 300.

.2 Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ANSI/ASME 16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm (1/4") clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm (7/8") and under: Class 500, 3.5 MPa (500 psi), globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm (7/8"): Class 375, 2.5 MPa (375 psi), globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 FILTER-DRIER

.1 On lines 20 mm (3/4") outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.

.2 On lines smaller than 20 mm (3/4") outside diameter, filter-drier shall be sealed type using flared copper fittings.

.3 Size shall be full line size.

.4 Acceptable Manufacturers:

.1 Mueller

.2 Parker

.3 Sporlan

.4 Virginia

2.6 SIGHT GLASS

.1 Combination moisture and liquid indicator with protection cap.

.2 Sight glass shall be full line size.

.3 Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.

.4 Acceptable Manufacturers:

.1 Mueller

.2 Henry

.3 Parker

.4 Superior

2.7 SUCTION LINE TRAP

.1 Manufactured standard one-piece traps.

2.8 EXPANSION VALVES

.1 For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.

.2 Size valves to provide full rated capacity of cooling coil served. Co-ordinate selection with evaporator coil and condensing unit.

.3 Acceptable Manufacturers:

.1 Henry

.2 Mueller

.3 Parker

.4 Sporlan

2.9 FLEXIBLE CONNECTORS

.1 Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.

.2 Approved manufacturers:

.1 Anaconda “Vibration Eliminators” by Anamet

.2 Vibration Absorber Model VAF by Packless Industries

.3 Vibration Absorbers by Superior Valve Co

.4 Style “BF” Spring-flex freon connectors by Vibration Mountings.

2.10 ROOF FLASHING

.1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.11 PREFABRICATED PIPE ENTRY DOGHOUSE

.1 Dog House and cover shall be fabricated from 2mm thick aluminum with UV protected powder coated finish is also acceptable.

.2 Cover shall be gasketed to ensure air and water tightness.

.3 Mount in curb shall be full insulated and supplied with Doghouse.

.4 Curb shall be 610 mm (24") high with 89 mm (3.5") wide flange pre-punched for securement to roof deck.

.5 Curb shall be insulated with 50 mm (2") thick glass fibre insulation.

.6 Pipe entry openings shall be provided by the pipe entry chase manufacturer and be specifically made for the application. Minimum acceptable standard:

.1 Sigrist Exit Seal

.2 Vault Exit Seal

.7 Cover shall be removable and be fastened to the curb/body with vandal resistant fasteners. Hardware shall be zinc plated or stainless steel.

.8 Size: To suite required penetrations.

.9 Acceptable Manufacturers:

.1 Sigrist Alta Pipe Chase Housing

.2 Vault Roof Penetration Housing

.3 Other Acceptable Manufacturers if approved by Consultant prior to tender close.

2.12 PIPING SUPPORT ASSEMBLY

.1 All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011/A1011M, A653/A653M.

.2 All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A36/A36M or A635/A635M.

.3 Electro galvanized cush clamps with shoulder bolt and molded thermoplastic cushion, size to suit pipe.

.4 Acceptable Manufacturers:

.1 Unistrut

.2 Or equal

Part 3 Execution

3.1 GENERAL

.1 Install in accordance with CSA B52, EPS 1/RA/2 and ANSI/ASME B31.5.

.2 Connect to equipment with isolating valves and unions.

.3 Provide space for servicing, disassemble, and removal of equipment and components all as recommended by manufacturer.

.4 Protect all openings in piping against entry of foreign material.

.5 Provide all necessary equipment including thermal expansion valve, sight glass, solenoid valve, filter dryer, etc., for a complete installed system. Pipe system as per manufacturer's recommendation and requirements.

.6 Provide number of refrigerant circuits and appropriate corresponding piping as per manufacturer's recommendations and requirements.

3.2 APPLICATION [WRITER TO SELECT]

.1 Soft copper piping is allowed to be used as follows:

.1 For all systems under 3 tons in nominal size, except for exterior piping.

.2 For all vertical risers passing through more than two (2) floors not served by the system. Refer to Piping Through Floors section.

.3 For piping within a residential/long term care/apartment suite served by a variable refrigerant flow system.

.2 Hard Copper shall be used as follows:

.1 For all other systems/applications.

.2 For all exterior piping.

3.3 PIPING THROUGH FLOORS

.1 Refrigerant piping systems containing refrigerants that pass through floors not served by the system shall be installed as per the requirements of CSA B23-2023:

.1 Refrigerant piping shall be installed through a rigid and tight, continuous fire-resisting pipe (stainless steel, cast iron or similar) without openings into any floors not served by the system.

.2 The pipe shall be vented to the floor served by the system.

.3 Soft copper may be used when the shaft extends beyond two (2) storeys in length.

3.4 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.5 PIPING INSTALLATION

.1 General:

.1 Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Soft drawn copper: install in a neat manner without excessive bends or twists. Minimize use of fittings.

.3 Fittings, joints and other connections to equipment shall be minimized in all inaccessible areas, including but not limited to areas above drywall ceilings, shafts etc.

.4 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.5 Provide trap at base of risers greater than 2.4m (8') high and at each 7.6m (25'-0") thereafter.

.6 Provide inverted deep trap at top of each riser.

.7 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified above.

.2 Small riser: size for 5.1 m/s (1000 ft/min) at minimum load. Connect upstream of traps on large riser.

3.6 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa (290 psi) and 1 MPa (145 psi) on high and low sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa (5 psi) with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

.4 Testing shall be completed to the standards of CSA B52, section 5.10 so that the exemption contained in Annex N (N.1.2) allowing areas (such as those above fully enclosed drywall ceilings) to have joints and connections installed within them is met.

3.7 DEHYDRATION AND CHARGING

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa (0.02" WC) absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14 Pa (0.056" WC) absolute and hold for 4 h.

.2 Break vacuum with refrigerant to 14 kPa (0.056" WC).

.3 Final to 5 Pa (0.02" WC) absolute and hold for at least 12 h.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit all test results to Consultant.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report all measurements to Consultant.

3.8 INSTRUCTIONS

.1 Post instructions in frame with glass cover in accordance with Operation and Maintenance Manual Section and CSA B52.

3.9 PREFABRICATED PIPE CHASE

.1 Install on prefabricated, insulated roof curb.

.2 Install pipe chase and pipe entry to manufacturers installation instructions.

.3 Provide field installed insulation on roof deck to match roof insulation thickness.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 SMACNA HVAC Duct Leakage Test Manual.

.4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).

.6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements.

.2 Indicate following:

- .1 Sealants
- .2 Tape
- .3 Proprietary Joints
- .4 Fittings

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 DUCTWORK

.1 Galvanized Steel:

.1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

Size Type	**Class A Gauge**	**Class B Gauge**	**Class C Gauge**
Square and Rectangular			
Up to 600 mm (24”)	22	24	24
625 mm to 1000 mm (25” to 40”)	20	22	24
1025 mm to 1800 mm (41” to 72”)	18	20	22
1825 mm to 2400 mm (73” to 96")	16	18	20
2450 mm and over (97")	16	16	16
Round and Oval			
Up to 300 mm (12”)	24	24	24
325 mm to 600 mm (13” to 24”)	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37” to 48”)	18	20	22
1225 mm (49”) and over	18	18	20
Residential Suite Ductwork:			
Square and Rectangular			
Up to 300 mm (12”) *	26	26	26
Round and Oval Snap Lock *			
Up to 200mm (8”) *	30	30	30

*****Following SMACNA for low pressure ductwork.

.3 All ductwork between HVAC unit connections and 3.0 m (10'-0") downstream or to silencers shall be 1.4 mm (18 gauge).

.2 Aluminum

.1 To ASHRAE and SMACNA. Aluminum type: 3003-H-14.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA or as indicated.

.3 Joints: to ASHRAE and SMACNA.

.1 Acceptable Manufacturers:

.1 Ductmate Canada Ltd.

.4 Foil tape all transverse and longitudinal joints.

2.2 DUCT CONSTRUCTION

.1 Round and oval:

.1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.

.2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.

.3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexas Duct System.

.2 Square and rectangular:

.1 Ducts: to SMACNA.

.2 Transverse joints, longest side:

up to and including 750 mm (30"): SMACNA proprietary duct joints.

.3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA ”E” or “G” Type connection). Weld all corners.

.1 Acceptable Manufacturers:

.1 Ductmate Canada Ltd.

.2 Nexus, Exanno Corp.

.3 WDCI

.4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA “J” Type connection). Weld all corners.

.1 Acceptable Manufacturers:

.1 Ductmate Canada Ltd.

.2 Nexus, Exanno Corp.

.3 WDCII.

2.3 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.

.2 Round:

.1 In exposed areas one-piece smooth radius, 1.5 times diameter.

.2 In concealed areas 3-piece adjustable, 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm (16"): with double thickness turning vanes.

.2 Over 400 mm (16"): with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45º entry on branch.

.2 Round main and branch: enter main duct at 45º with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Diffuser connection to main:

.1 90º round spin in collars with balancing damper and locking quadrant.

.6 Transitions:

.1 Diverging: 20º maximum included angle.

.2 Converging: 30º maximum included angle.

.7 Offsets:

.1 Full short radiused elbows.

.8 Obstruction deflectors: maintain full cross-sectional area.

2.4 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class	Acceptable Leakage Classification (Rectangular)	Acceptable Leakage Classification (Round)
2500 (10")	A	4	2
1500 (6")	A	4	2
1000 (4")	A	4	2
750 (3")	A	8	4
500 (2")	B	16	8
250 (1")	B	16	8
125 (0.5")	C	16	8

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

2.5 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).

.2 Flame-spread rating not more than 25.

.3 Smoke developed classification not more than 50.

.4 Acceptable Manufacturers:

.1 Duro Dyne S-2

.2 Foster

2.6 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.

.1 Acceptable Manufacturers:

.1 Duro Dyne FT-2

2.7 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.8 FIRESTOPPING

.1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

.3 All ductwork passing through partition walls shall be firestopped.

2.9 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.

2.10 HANGERS AND SUPPORTS

.1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Acceptable Manufacturers:

.1 Myatt fig. 485

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Acceptable Manufacturers:

.1 Grinnell fig. 61 or 60

.3 For steel beams: manufactured beam clamps:

.1 Acceptable Manufacturers:

.1 Grinnell Fig. 60

Part 3 Execution

3.1 GENERAL

.1 The following systems shall conform to these requirements:

System	Pressure	Class	Material
VAV Supply	+/-	A	Galvanized steel
General Exhaust	+	A	Galvanized Steel/Aluminum
Individual Exhaust	+	A	Galvanized Steel/Aluminum
Dryer Exhaust	+	A	Aluminum
Exhaust Plenum	+/-	A	Galvanized steel
HVAC Supply and Return	+/-	B	Galvanized steel
General Exhaust	-	B	Galvanized steel
Ventilation Plenum	+/-	B B	Galvanized steel
Individual Exhaust	-	C	Galvanized steel/Aluminum
Commercial Kitchen Exhaust	+/-	Welded	Black Steel
Dust Collector	+/-		
.1 Between non return valve and inlet		Welded	14ga. Steel
.2 Suction before non return valve and unit discharge	+/-	A	Galvanized Steel

.2 Do work in accordance with ASHRAE and SMACNA.

.3 Do not break continuity of insulation vapour barrier with hangers or rods.

.4 Support risers in accordance with ASHRAE and SMACNA.

.5 Install breakaway joints in ductwork on each side of fire separation.

.6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE, SMACNA and as follows:

Duct Size mm (")	Spacing mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

.4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

3.3 WATERTIGHT DUCT

.1 Slope horizontal branch ductwork down towards hoods served. Slope header ducts down toward risers.

.2 Fit base of riser with 150 mm (6") deep drain sump and 25 mm (1") drain connected, with deep seal trap and valve and discharging to open funnel drain.

3.4 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

.1 Co-ordinate leakage testing with TAB contractor **and commissioning agent**. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Leakage tests to be done in sections.

.4 Trial leakage tests to be performed as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial test has been passed.

.6 Test section to be minimum of 15 m (50'-0") long with not less then 3 branch takeoffs and two 90º elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.

.7 Complete test before insulation or concealment.

.8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.

.9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

3.6 CLEANING

.1 Keep ducts clear from dust and debris

.2 Keep duct liner clean from dust, debris, and moisture.

.3 At completion of project vacuum ducts if dirt or dust is present.

.4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.

.5 Ensure all systems are clean prior to start up.

3.7 INSTALLATION REQUIREMENTS

.1 All ductwork is to be protected from the weather and precipitation. The top and sides of all ductwork are to be completely covered with 6mil poly to the satisfaction of the consultant. Maintain protection of the ductwork until the building is made watertight and hollow cores drained. Tape all joints.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM C423, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.4 ASTM E90, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.5 ASTM E477, Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each piece of attenuation equipment complete with product data.

1.3 PERFORMANCE RATING DATA

.1 Provide performance rating data, certified by an accredited test laboratory and supported by calculations and verified by test results in accordance with referenced standards as follows:

.1 Silencer: insertion loss, pressure drop at design conditions, generated noise level.

.2 Acoustic plenums: transmission loss and acoustical absorption.

Part 2 Products

2.1 ABSORPTION AND INSULATING MEDIA

.1 Acoustical performance measurements to be made in accordance with ASTM E477, ASTM E90 and ASTM C423, except where specified otherwise.

.2 Acoustic quality, glass fibre, free of shot and odor; bacteria and fungus resistant; free of corrosion causing or accelerating agents; packed to density to meet performance requirements; and meet NBC fire requirements or requirements of authority having jurisdiction for duct lining.

2.2 ACOUSTIC SOUND PLENUMS

.1 Panels: 50 mm thick tongue and groove connection type, designed for individual panel removal for equipment access without major dismantling of plenum.

.1 Outer sheet: 1.3 mm (18 gauge) thick galvanized steel to ASTM A526/A526M, with coating designation Z90.

.2 Inner sheet: 0.085 mm (4 mil) thick galvanized steel to ASTM A526/A526M, with coating designation Z90 with 2 mm (79 mil) diameter clean cut perforations on 5 mm (3/16") staggered centres.

.3 Fully framed with 1.3 mm (18 gauge) thick galvanized steel channels.

.4 Horizontal stiffeners: 0.85 mm (22 gauge) minimum galvanized steel on 800 mm (32") centres to control media settlement.

.5 Deflection: not to exceed 1/240 of unsupported panel span at design pressure differential of 2500 Pa (10" w.c.).

.6 Connections: as per manufacturers requirements.

.2 Assembly:

.1 Panel and flashing joints externally sealed with 6 mm (1/4") diameter bead of non sag, non hardening sealant. Floor channel to floor connection sealed with 3 mm x 15 mm (1/8" x 1/2") monolastomeric tape.

.2 Factory cut and frame openings where greatest dimension exceeds 300 mm (12"). Smaller panel openings, to be site located and cut 50 mm (2") larger in diameter, sleeved with 0.7 mm (22 gauge) minimum galvanized steel.

.3 Fill space between pipe or conduit and sleeve with acoustic media, covered and mastic sealed in accordance with manufacturer's instructions.

.4 No sensory leakage at design pressure differential of 1000 KPa (145 psi).

.5 Assembly RSI not less than 1.2 m2°C/W (6.81 ft2°F/Btuh) at 10°C (50°F).

.3 Acceptable Manufacturers:

.1 BVA Systems

.2 Vibron

.3 VAW Systems

.4 IAC Acoustics

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Noise flanking: where indicated, install in wall sleeve with uniform clearance all around to ensure no contact of silencer with wall sleeve. Pack with flexible, non hardening caulking on both sides of sleeves.

.3 Instrument test ports: install at inlet and outlet to permit measurement of insertion loss and pressure loss.

.4 Suspension: to manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.

.3 Gaskets: neoprene

.4 Hardware:

.1 Up to 300 mm (12"): 2 sash locks

.2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.

.3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

.5 Acceptable Manufacturers:

.1 Nailor

.2 E. H. Price

.3 Titus

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.

.2 Acceptable Manufacturers:

.1 Duro Dyne

.2 Ductmate

2.5 INSTRUMENT TEST PORTS

.1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.5 Acceptable Manufacturers:

.1 Duro Dyne IP1 or IP2

.2 Duct mate

2.6 PREFABRICATED ROOF CURB

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: 1.3 mm (18 gauge) galvanized steel with raised cant and wood nailer.

.3 25 mm (1") insulation 3 lb density.

.4 Acceptable Manufacturers:

.1 Greenheck GPR – 600 mm (24") high

.2 Penn

2.7 SPIN-IN COLLAR

.1 Construction: galvanized straight or conical spin-in collar complete with spin-in bead and crimped collar connection.

.2 Provide balancing damper where indicated.

.3 Acceptable Manufacturers:

.1 Ecco Manufacturing

.2 Flex Master

Part 3 Execution

3.1 INSTALLATION

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans. (Unless internally isolated)

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm (4").

.3 Minimum distance between metal parts when system in operation: 75 mm (3").

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

.1 Size:

.1 600 mm x 600 mm (24" x 24") for person size entry.

.2 600 mm x 1000 mm (24" x 40") for servicing entry.

.3 300 mm x 300 mm (12" x 12") for viewing.

.4 As indicated.

.2 Location:

.1 At fire and smoke dampers.

.2 At control dampers.

.3 At devices requiring maintenance.

.4 At locations required by code.

.5 At inlet and outlet of reheat coils.

.6 Elsewhere as indicated.

.7 Inlet and outlet of duct mounted coils.

.3 Instrument test ports.

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments

.3 Install insulation port extensions as required.

.4 Locations.

.1 For traverse readings:

.1 At ducted inlets to roof and wall exhausters.

.2 At inlets and outlets of other fan systems.

.3 At main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Consultant.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

.2 Install on supply ducts only.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements

.2 Indicate the following: performance data.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").

.3 Shaft extension to accommodate insulation thickness and locking quadrant.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height:

.1 50 mm (2") up to 375 mm (15") high duct.

.2 100 mm (4") max 400 mm (16") high duct and over.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Shaft extension to accommodate insulation thickness and locking quadrants.

.8 Acceptable Manufacturers:

.1 Duro Dyne

.2 E.H. Price

.3 Nailor

.4 T.A. Morrison

.5 Tamco

.6 Ruskin

.7 Ventex/Alumavent

.8 United Enertech

2.4 LOCKING QUADRANTS

.1 6 mm (1/4") dial regulator with square bearing shaft.

.1 18 gauge oval frame, cadmium plated, clearly shows damper position.

.2 18 gauge formed handle for easy adjustment.

.3 Bolt and wing nut lock damper securely.

.4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.

.2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.

.1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.

.2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.

.3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.

.4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.

.5 Screw holes for mechanically fastening to ductwork.

.3 High pressure system locking quadrant:

.1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.

.2 Handle design for easy recognition of damper position.

.3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.

.4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.

.5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.

.4 Acceptable Manufacturers:

.1 Duro Dyne

.2 Ductmate

.3 Pottorff

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.1 Single blade dampers up to 200 mm (8").

.2 Multi-blade dampers over 200 mm (8").

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Leave all dampers in open position for T.A.B.

.7 Fasten locking quadrants to ductwork and shaft.

.8 Place locking quadrants on standoffs where ductwork insulated.

.9 Lock down quadrant arm in the open position.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.

.4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.5 ULC-S505, Fusible Links for Fire Protection Service.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Fire dampers.

.2 Operators.

.3 Firestop flaps.

.4 Fusible links.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide the following:

.1 Six (6) fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FIRE DAMPERS (DYNAMIC)

.1 Multi blade or roll type, fire damper suitable for HVAC system velocities up to 2000 fpm (610 m/mm), dual direction air flow, max 4" wg pressure.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.

.4 Stainless closure spring to positively close damper upon fusible link release, for horizontal or vertical orientations.

.5 Linkage concealed in frame.

.6 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.7 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.

.8 Acceptable Manufacturers:

.1 Ruskin

.2 Nailor

.3 E.H. Price

.4 T.A. Morrison

.5 Tamco

.6 Greenheck

.7 Ventex/Alumavent

.8 Pottorff

Part 3 Execution

3.1 INSTALLATION

.1 Provide where indicated and at all fire rated partitions indicated, on architectural drawing.

.2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper.

.6 Coordinate with installer of firestopping.

.7 Static fire dampers: Only on transfer air ducts where ductwork is not connected to a fan/blower.

.8 Dynamic fire dampers: In all duct work where air is moved by a fan/blower.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.1 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.

.4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.5 ULC-S505, Fusible Links for Fire Protection Service.

.6 CAN/ULC-S524, Installation of Fire Alarm Systems

.7 CAN/ULC-S1001.11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements indicating the following:

.1 Damper type

.2 Operators

.3 Fusible links

.4 Smoke detectors (provided/installed/wired by Electrical division)

.5 Power requirements

.6 Size, orientation, construction

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide the following:

.1 Six (6) fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Damper:

.1 E H Price
.2 NCA Ltd.
.3 Nailor Industries Inc.
.4 Ruskin
.5 Alumavent
.6 United Enertech
.7 Pottorff
.8 Safeair-Dowco (stainless steel)

.2 Detector:

.1 Refer to Electrical Specifications

2.2 SMOKE DAMPERS

.1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sample tube (**smoke detector and sampling tube provided by Electrical division**), sleeve and all other components necessary for a complete and operable system. Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.

.2 Damper

.1 Damper shall be ULC listed and labelled
.2 Both damper and damper actuator to be ULC listed and labelled.
.3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.
.4 Damper shall have Class I leakage rating.
.5 Suitable for horizontal or vertical installations.
.6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.

.3 Actuator

.1 Actuator shall be ULC listed and labelled
.2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.

.3 Exterior visualization of damper position.

.4 Damper actuator end switches for monitoring damper position by the BAS.

.5 Provide modulating actuator where damper is operating as part of a VVT system.

.4 Factory sleeve.

.1 Type and style: matching application.

.5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

.6 Smoke Detector:

.1 Provided, installed, and wired by Electrical division.

.7 Damper assembly to operate at 120V with single point power connection.

.8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer's installation guidelines.

.9 Size: as indicated on drawings.

.10 Detectors and electrical components within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code).

2.3 COMBINATION FIRE AND SMOKE DAMPERS

.1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sampling tube (**smoke detector and sampling tube provided by Electrical division**), sleeve and all other components necessary for a complete and operable system. Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.

.2 Damper

.1 Damper shall be ULC listed and labelled

.2 Both damper and damper actuator to be ULC listed and labelled.

.3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.

.4 Damper shall have Class I leakage rating.

.5 Suitable for horizontal or vertical installations.

.6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.

.3 Actuator/Link

.1 Actuator shall be ULC listed and labelled

.2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.

.3 Exterior visualization of damper position.

.4 Damper actuator end switches for monitoring damper position by the BAS.

.5 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

.6 Fusible link, or electric re-settable link (ERL).

.7 Electric fire sensor capable of remote openable control is to be provided in place of fusible link where specifically indicated in project documents.

.8 Where ERL or electric fire sensor is used in place of fusible link, this device shall fail closed upon power failure.

.9 Provide modulating actuator where damper is operating as part of a VVT system.

.4 Factory sleeve.

.1 Type and style: matching application.

.5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

.6 Smoke Detector:

.1 Provided, installed, and wired by Electrical division.

.7 Damper assembly to operate at 120V with single point power connection.

.8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer's installation guidelines.

.9 Fire rating to match wall assembly i.e. 1 hour/1 ½ hour/2 hour/ 3 hour.

.10 Size: as indicated on drawings.

.11 Detectors and electrical components within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code).

2.4 LOCATION OF SMOKE DETECTORS

.1 Ontario Building Code Section 3.1.8.11 requires the smoke detector to be installed downstream of the damper.

.2 Ship units to site to suit supply or return/exhaust configuration.

.3 The contractor shall be responsible to cover all costs of a qualified Electrician/Fire Alarm Technician should field relocation of the damper components be required.

.4 Smoke detectors provided, installed, and wired by Electrical division.

2.5 TRANSFER DUCTS

.1 In accordance with OBC 3.1.8.11, provide secondary smoke detector at all transfer ductwork. Smoke detector shall be installed on both sides of rated separation.

.2 This contractor shall extend transfer ductwork and acoustic lining to facilitate proper installation and clearance requirements.

2.6 NUMBER OF AIR TYPE SMOKE DETECTORS

.1 Where air velocities are greater than 1.5 m/s (300 feet per second), one air duct type detector shall be installed for every 1.5 meters square (16 square feet) of cross-sectional duct area.

.2 Where air velocities are less than 1.5 m/s (300 feet per second), one duct type smoke detector shall be installed for every 0.5 meters square (5.3 square feet) or cross-sectional duct area.

.3 Smoke detectors provided, installed, and wired by Electrical division.

2.7 PRESSURE RELIEF DOORS

.1 Frames shall be Z-shape, 12 gage (2.8) galvanized steel.

.2 Door shall be 12 gage (2.8) galvanized steel, hinged on one side.

.3 Seal shall be around the door perimeter allowing no more than 7 cfm/ft2 at 1.0 inch w.g..

.4 Door shall include stainless steel springs to close door upon pressure relief and system shutdown.

.5 All release mechanisms, springs and parts shall be completely out of airstream.

.6 Pressure relief settings available from 2" (0.5 kPa) to 10" (2.49 kPA) increments of 1" w.g. (0.25 kPa). Supplier shall examine plans to provide appropriate pressure relief based on associated air handling system.

.7 Pressure relief mechanism shall be factory calibrated in an AMCA Registered Laboratory.

.8 Pressure Relief Doors shall be provided as indicated in the execution section.

Part 3 Execution

3.1 INSTALLATION

.1 Provide smoke dampers where indicated and at all duct penetrations through smoke barrier partitions indicated on architectural drawings.

.2 Provide combination fire and smoke dampers where indicated and at all duct penetrations through fire rated smoke barrier partitions indicated on architectural drawings. To provide separated fire dampers and smoke dampers, obtain approval from the consultant for the alternate arrangement.

.3 Provide pressure relief doors (both positive and negative as applicable) as follows:

.1 For all systems with a combination fire smoke or smoke damper in the duct main of the system when:

.1 The system operates at static pressure of 1.0 inches w.g. or higher; and

.2 More than 50% of the system airflow passes through the combination fire/smoke or smoke damper.

.2 Where/as indicated on the plans.

.4 Install in accordance with ANSI/NFPA 90A, in accordance with conditions of ULC listing and manufacturer's recommendation.

.5 Maintain integrity of smoke separation and fire rating.

.6 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.7 Install access door adjacent to each damper and smoke detector.

.8 Front grille access for through wall dampers that terminate in a grille is acceptable.

.9 Provide proper firestopping and duct seal to fire barrier wall.

.10 Confirm proper operation and test sheets.

.11 Should contractor provide separated devices mount smoke detector downstream of damper and within 1.5 m (5 ft) of damper.

.12 Ensure access doors/panels, fusible links, damper actuators and sensors are easily observed and accessible.

3.2 LOCATION OF SMOKE DETECTORS

.1 Ontario Building Code Section 3.1.8.11 requires the smoke detector to be installed downstream of the damper.

.2 Ship units to site to suit supply or return/exhaust configuration.

.3 The contractor shall be responsible to cover all costs of a qualified Electrician/Fire Alarm Technician should field relocation of the damper components be required.

.4 Smoke detectors provided, installed, and wired by Electrical division.

3.3 TRANSFER DUCTS

.1 In accordance with OBC 3.1.8.11, provide secondary smoke detector at all transfer ductwork. Smoke detector shall be installed on both sides of rated separation.

.2 This contractor shall extend transfer ductwork and acoustic lining to facilitate proper installation and clearance requirements.

.3 **Smoke detectors provided, installed, and wired by Electrical division.**

3.4 PROTECTION

.1 Contractor is to ensure all fire smoke dampers detectors are protected from dust, dirt, humidity, and water at all times during construction. This applies to detectors installed, stored on site or stored in storage containers. Contractor shall seal all open-ended ductwork on site at all times. Failure to properly protect dampers, ductwork and detectors will result in the Contractor cleaning all dampers and ductwork. Any detectors that are damaged or dirty shall be replaced at the contractor's expense.

3.5 WIRING

.1 All fire alarm wiring shall be 1 hour rated and in conduit or as per electrical fire alarm wiring requirement.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.7 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 Prior to the building Integrated Life Safety Systems Testing the mechanical contractor shall commission/verify the operation of all installed smoke dampers.

.2 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all operating smoke dampers and associated Life Safety Systems (i.e. fire alarm).

.3 This contractor shall work with the Integrated Life Safety Contractor and reset all systems back into proper operation.

.4 Include all costs associated with participation Integrated Life Safety System Testing in the tender value.

3.8 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.1 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section applies to operating dampers not specified in Controls Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Performance data.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

Part 2 Products

2.1 DISC TYPE DAMPERS

.1 Frame: brake formed, welded, 1.6 mm (16 gauge) thick, Type Z90 galvanized steel to ASTM A653/A653M.

.2 Disc: spin formed, 1.6 mm (16 gauge) thick, Type Z90 galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position to be less than 0.001% of rated air flow at 100 kPa (15 psi) pressure differential across damper.

.2 Pressure drop: at full open position to be less than 100 kPa (15 psi) differential across damper.

.7 Acceptable Manufacturers:

.1 Duro Dyne

.2 Henderson Industrial

.3 Pottorff

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.

.2 Acceptable Manufacturers:

.1 T.A. Morrison

.2 Tamco Series 7000

.3 Ruskin

.4 Nailor

.5 E.H. Price

.6 Henderson Industrial

.7 Ventex/Alumavent

.8 Pottorff

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Duct Accessories Section.

.5 Insulated dampers on all outside air intake and exhaust damper.

.6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

3.2 ELECTRICAL ROOM DAMPER OPERATION

.1 Outdoor air damper modulates open on increase of room temperature above 80°F.

.2 When damper is fully open end switch start exhaust fan.

.3 When temperature reaches below setpoint damper is closed and exhaust fan off.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Disk type dampers gasket: Ten (10) years warranty.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.

.3 UL 181, Factory Made Air Ducts and Air Connectors.

.4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC – UNINSULATED

.1 Spiral wound flexible aluminum, Class 1 duct material.

.2 Performance:

.1 Factory tested to 2.5 kPa (10" w.c.) without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Operating pressure: 300 mm (12").

.3 Acceptable Manufacturers:

.1 Flexmaster T/L

.2 Ductmate

2.3 METALLIC –INSULATED

.1 Spiral wound flexible aluminum with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.

.2 Performance:

.1 Factory tested to 2.5 kPa (10" w.c.) without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Operating pressure: 300 mm (12").

.3 Acceptable Manufacturers:

.1 Flexmaster T/L – VT

.2 Ductmate

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

.2 Maximum length of flexible duct: 1.8 m (6' 0").

.3 Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.

.4 Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.

.5 Insulated flexible ductwork in areas where ceilings are not utilized as return air plenums.

.6 Uninsulated flexible ductwork in areas where ceilings are utilized as return air plenums.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C916 Standard Specification for Adhesive for Duct Thermal Insulation.

.5 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.6 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

Part 2 Products

2.1 RECTANGULAR/SQUARE DUCT LINER

.1 General:

.1 Acoustical duct liner to be fibreglass duct liner meeting or exceeding requirements of ASTM C1071, Type I, Flexible or Type II, Rigid, and NFPA 90A/90B.

.2 Bonded with formaldehyde free bio-based binder

.3 Mat faced airstream surface

.4 Factory applied edge coating

.5 Shall not contain formaldehyde, PBDE's, asbestos, mercury, mercury compounds, lead, contain 50% or greater recycled glass content.

.6 Thermal conductivity, ASTM C177/C518/C1114 .24BTU (sf•hr•°F) @ 75°F mean temp).

.7 Noise Reduction Coefficient (NRC) 1.5 PCF 1" = .70, 1 ½ " = .80, 2" =.95
ASTM C423, Type A mounting.

.8 Noise Reduction Coefficient (NRC) 2.0 PCF 1/2" = .50, 1" = .70, 1 ½ " = .85
ASTM C423, Type A mounting

.9 Corrosiveness/corrosion, ASTM C665/C1617. Does not accelerate/pass.

.10 Mold and mildew growth/fungi resistance, ASTM C1338, ASTM G21/G22, UL2824. Pass/resistant to mold.

.11 Maximum service temperature, ASTM C411, 250°F (121°C).

.12 Maximum rate air velocity, ASTM C1071, 6,000 ft./min. (30.5 m/sec.)

.13 Water vapor sorption, ASTM C1104, less than 3%.

.14 Surface burning characteristics, ASTM E84, UL 273, CAN/ULC S102, 20/50 flame spread/smoke development.

.15 Acceptable Manufacturers:

.1 Knauf Atmosphere Duct Liner

.2 Manson

.3 Johns Manville

.4 Owen Corning

.2 Rigid:

.1 Use on flat surfaces.

.2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.

.3 Density: 96 kg/m^3 (6 lb/ft^3).

2.2 ADHESIVE

.1 Meet requirements of ASTM C916.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).

.3 Acceptable Manufacturers:

.1 Duro Dyne 1A-22

.2 Ductmate

2.3 FASTENERS

.1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.

.2 Acceptable Manufacturers:

.1 Duro Dyne

.2 Ductmate

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.

.2 Acceptable Manufacturers:

.1 Duro Dyne FT2

.2 Ductmate

2.5 SEALER

.1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90F) to 93°C (200°F).

.3 Acceptable Manufacturers:

.1 Duro Dyne 1A-94

.2 Ductmate

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with recommendations of MAIMA Fibrous Glass Duct Liner Standards (FGDLS) or SMACNA duct liner standards.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

.4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.

.2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.

.3 Store foam liners away from sunlight.

3.3 JOINTS

.1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply 2 coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Consultant.

.3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 AMCA 99, Standards Handbook.

.3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.

.4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.

.5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.

.7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

Part 2 Products

2.1 FANS GENERAL

.1 Capacity: Flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.

.2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.

.3 Sound ratings: Comply with AMCA 301, tested to AMCA 300.

.4 Performance ratings: Based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

.5 Bearings: Sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.

.6 Provide vibration isolation hangers/pads for all fans.

.7 Electrical components and motors within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code) when connected to ductwork systems served by refrigerant containing air handling systems.

.8 Provide factory mounted speed control for all direct drive motors.

.9 Acceptable Manufacturers:

.1 Greenheck
.2 Penn-Barry
.3 Cook
.4 Jenco (S & P)/Jenn
.5 Carnes
.6 Acme
.7 Zonex
.8 Nutone (Range hood)
.9 Broan (Range hood)
.10 Twin-City
.11 Reversomatic
.12 Fantech
.13 Aerovent

2.2 ROOF EXHAUSTERS

.1 Centrifugal V belt or direct driven as indicated.

.1 Housing: Spun aluminum complete with resilient mounted motor and fan.
.2 Impeller: Aluminum non-overloading.
.3 Adjustable motor sheave.
.4 15 mm (1/2") mesh 2.0 mm (79 mil) diameter aluminum birdscreen.
.5 Automatic gasketted aluminum backdraft dampers.
.6 Disconnect switch within fan housing.
.7 Continuous curb gaskets, cadium plated securing bolts and screw, and sound insulating.

.2 Roof curbs: of same manufacturer as fan and built to suit model specified. Roof curbs to be minimum 500 mm (20") high except where indicated otherwise. Roof curbs for NFPA 96 fans are to be vented.

.3 Size, type, and capacity: As indicated.

.4 Power feed shall be through roof curb.

.5 To NFPA 96 requirements where indicated.

2.3 CEILING DISCHARGE FANS

.1 Centrifugal direct drive, with plug in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.

.2 Sizes and capacity: As indicated.

.3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.

.4 Side duct outlet with integral backdraft damper, size as indicated.

.5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.

.6 Silver anodized aluminum grille paint finish.

2.4 RANGE HOOD EXHAUST FANS (USE WITH GUARDIAN FIRE SYSTEM ONLY)

.1 Centrifugal direct drive 750 mm (30") wide, suitable for under cabinet installation, enamel steel metal housing complete with single 75 W LED equivalent light bulb, colour selected by Consultant.

.2 Sizes and capacity: As indicated.

.3 Internal Toggle switch operated fan and light.

.4 Top or rear side 80 mm x 250 mm (3" x 10") rectangular duct outlet with integral backdraft damper.

.5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.

.6 Aluminum mesh cleanable grease filter.

.7 Acceptable Manufacturers:

.1 Broan BU330

.2 No alternates.

.8 Co-ordinate installation with fire suppression system specified elsewhere.

2.5 DRYER BOOSTER FAN (RESIDENTIAL)

.1 Provide a fully automatic dryer booster fan where indicated.

.2 Provide a Fantech DBLT or equal 100 mm (4") paintable galvanized lint trap complete with removable filter and 15 mm flange for flush mounting.

.3 Fan shall be inline complete with low profile, self cleaning backward inclined impeller and high efficiency meter suitable for 120/1/60.

.4 Provide a current sensing relays in electrical junction box on the power feed to the dryer to operate the dryer booster fan in sequence. Dryer and power relay to be ORTECH Amp Sensor Model as without time delay or equal. Co-ordinate installation with the electrical contractor, providing power to the dryer.

.5 All wiring shall be by Electrical Division.

.6 Acceptable Manufacturer:

.1 Reversomatic 'TLD' Series with DAS 200 sensor.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Provide flexible duct connection for all fans.

.3 Provide backdraft damper at building exterior penetration.

.4 Provide and install vibration isolation.

.5 Provide and install roof curb for all roof mounted fans.

.6 Provide and install sleepers for utility set style roof mounted fans; provide roof curb for duct penetration.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Performance data.

.2 Noise data.

.3 Physical dimensions.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by an independent testing agency.

Part 2 Products

2.1 VARIABLE AIR VOLUME BOXES

.1 Single duct, variable volume air distribution assemblies of the sizes and capacities as shown on the plans.

.2 **All variable volume air boxes are to be provided in their oversized/large capacity version to limit pressure drop across the heating coil**.

.3 The assemblies shall be pressure independent and shall reset to any air flow between zero and the maximum catalogued air volume.

.4 At an inlet velocity of 610 m/min (2,000 fpm), the differential static pressure for any unit with attenuator section, sizes 4 through 16, shall not exceed 25 Pa (0.10" w.c.).

.5 Sound ratings of air distribution assemblies, shall not exceed 30 NC at 25 Pa (0.10" w.c.) static pressure.

.6 Pressure shall be ARI Certified.

.7 The air flow sensor shall be of a cross configuration located at the inlet of the assembly and shall have multiple pickup points, designed to average the flow across the inlet of the assembly. The air flow sensor shall amplify the sensed air flow signal.

.8 Provide a discharge air temperature sensor on discharge of VAV box. Temperature sensor shall be capable of display on BAS.

.9 The assembly casing shall be constructed of 0.7 mm (22 gauge) zinc coated steel, internally lined with 20 mm (¾") thick, dual density fiberglass insulation, which complies with UL-181 and NFPA-90A. Any cut edges of fiberglass exposed to the air stream shall be coated with NFPA-90A approved sealant.

.10 The primary air valve damper shall be heavy gauge metal, with peripheral gasket, pivoted in self-lubricating bearings. In the full closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalogue rating at 750 Pa (3" w.c.) inlet static pressure, as rated by ARI Standard 880.

.11 Provide 900 mm (36") long discharge sound attenuator for each unit. **Attenuator shall be non fibrous for hospitals, long term care homes, and medical/dental clinics.**

.12 Electric reheat coils, if provided, shall accept a low voltage, digital, input signal from the associated HVAC unit's refrigeration detection system. On receipt of the signal the electric reheat coil will be de-energized. The shut off shall automatically reset upon stop of the signal.

.13 DDC controls including controller, flow transducer, electric actuator and protective shroud if required to be provided by controls manufacturer.

.14 Electrical components and motors within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code) when connected to ductwork systems served by refrigerant containing air handling systems.

.15 Terminal unit manufacturer shall factory mount controller and actuator including tubing from cross flow sensor to controls, wiring controller to motor and calibration.

.16 Size and capacity: as indicated.

.17 Acceptable Manufacturers:

- .1 E.H. Price
- .2 Nailor
- .3 Titus
- .4 Krueger
- .5 Carnes
- .6 Metalaire

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Install quick opening access door (with sash locks) adjacent to each damper.

.4 Install controls as per manufacturer's requirements.

.5 Install with at least 100 mm (4") of flexible inlet ducting.

.6 Wire associated HVAC unit's refrigeration detection system alarm to all damper actuators and electric reheat coil input signal connection locations.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.1 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

- .1 Capacity.
- .2 Throw and terminal velocity.
- .3 Noise criteria.
- .4 Pressure drop.
- .5 Neck velocity.

1.2 MAINTENANCE MATERIALS

.1 Include:

- .1 Keys for volume control adjustment.
- .2 Keys for air flow pattern adjustment.

1.3 MANUFACTURED ITEMS

.1 Grilles, registers, and diffusers of same generic type to be product of one manufacturer.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by them from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board and as specified.
- .3 Concealed fasteners.

.3 Concealed operators.

.4 Colour and Finish: standard as directed by Consultant.

.5 Acceptable Manufacturers:

.1 E.H. Price
.2 Nailor
.3 Krueger
.4 Titus
.5 Carnes
.6 Seiho
.7 Metalaire
.8 Tuttle and Bailey

2.2 RETURN AND EXHAUST GRILLES

.1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets. Refer to schedule.

.2 Type, size, and capacity: as indicated.

2.3 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets. Refer to schedule.

.2 Type, size, and capacity: as indicated.

2.4 OPEN MESH SCREEN

.1 15 mm x 15 mm (½"x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.

.2 On all open ends of ductwork and where indicated.

.3 Size: To match ductwork size.

2.5 SPOT DIFFUSER

.1 The diffuser shall consist of a ball and socket arrangement and shall provide means for directional control of the supply air in both the horizontal and vertical planes up to a 75 degree total angle.

.2 Constructed of machined aluminum assembled to the outer frame without the use of rivets, screws, or welding. The mounting frame shall include gaskets around the perimeter to prevent leaks and smudging between the mounting surfaces and the frame. The supply outlet shall also include deals between the ball and mounting frame to prevent leaks.

.3 Provided with the appropriate frame for the installation shown. The mounting panels shall be satin polished stainless steel material.

.4 Integral volume control damper shall be included with each diffuser to change the effective discharge area of the supply diffuser, and shall be operable from the face of the diffuser by rotating a knurled knob.

.5 The finish shall be baked on white to match T-bar ceiling.

.6 Acceptable Manufacturers:

.1 Krueger Model RPN

.2 Anemostat Model SPT

.3 Price Model JNA

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place

.4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.

.5 Clean grilles upon completion.

.6 Paint ductwork beyond grilles, matte black where visible.

.7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.4 Colour and finish.

1.3 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 TEST REPORTS

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

Part 2 Products

2.1 GOOSENECK HOODS

.1 Thickness: to ASHRAE and SMACNA.

.2 Fabrication: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA and or proprietary manufactured duct joint.

.1 Acceptable Manufacturers:

.1 Ductmate Canada

.2 Exanno Nexus

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm (12 gauge) diameter aluminum wire. Use 15 mm (1/2") mesh on exhaust 20 mm (3/4") mesh on intake.

.6 Vertical or Horizontal backdraft dampers as required.

.7 Prefabricated roof curb through roof complete with insulation and counter flashing.

2.2 FIXED LOUVRES – ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: drainable blade pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").

.4 Frame, head, sill and jamb: 100 mm (4") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm (60") maximum centres.

.6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 15 mm (1/2") exhaust 20 mm (3/4") intake mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish:

.1 Powder coated

.2 Colour: to Consultant's approval.

.9 Acceptable Manufacturers:

.1 Ventex 2435

.2 Greenheck

.3 Construction Specialties

.4 E.H. Price

.5 Krueger

.6 Ruskin

.7 Ventmaster

.8 Nailor

2.3 ALUMINUM WALL CAPS (CLOTHES DRYER)

.1 Application: Clothes dryer or as noted on drawings.

.2 0.3 mm (16 gauge) aluminum wall sleeve sized as noted on plans.

.3 0.3 mm (16 gauge) sloping exterior wall cap with integral sides, base plate, and 25 mm (1") perimeter flange with 4-hole screw fasten. Fasteners at each corner.

.4 Bottom outlet with removable 15 mm x 15 mm (1/2") x (1/2") aluminum screen.

.5 Neoprene backdraft damper with aluminum crimp on bottom edge.

.6 Acceptable Manufacturers:

.1 Reversomatic

.2 Broan

.3 Ventex

.4 AirVent

.5 Shop fabricated (submit sample for approval).

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks as indicated.

.3 Anchor securely into opening.

.4 Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Indicate following: performance.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

Part 2 Products

2.1 GENERAL

.1 Comply with ASHRAE.

2.2 HEAT WHEEL AIR TO AIR ENERGY RECOVERY VENTILATOR

.1 General

.1 Packaged, energy recovery ventilator(s) (outdoor or indoor as shown in equipment schedule) consisting of enthalpy wheel, wheel drive system, ventilation air fan, exhaust air fan, necessary dampers, temperature sensors, and microprocessor controls.

.2 Unit Cabinet

.1 Cabinet shall be constructed of 20 gauge G-90 galvanized steel with 12 gauge galvanized frame.

.2 Outdoor units to have series 8,000 exterior pre-paint surface consisting of baked-on polyester paint on G-90 base metal. Metal finish shall withstand a minimum of 10 years of exterior exposure without cracking, chipping, peeling, brazing, or spotting.
Outdoor units shall have no screw penetrations on the roof and shall be airtight and waterproof.

.3 Outdoor units shall have lifting holes at unit base for rigging onto rooftop.

.3 Access

.1 Access to all components that require servicing shall be provided through sealed and easily removable access panel(s).

.2 Enthalpy wheel shall be easily removable from the unit.

.4 Enthalpy Wheel

.1 The enthalpy wheel shall be constructed of fluted synthetic fibrous media, impregnated with a non-migrating water selective 4 angstrom molecular sieve desiccant. Wheel media shall be 4 inch (6 inch) thick. Energy transfer ratings shall be ARI certified in accordance with the ARI *Air-to Air Energy Recovery Ventilation Equipment Certification Program,* based on ARI Standard 1060-2000.

.2 Energy recovery effectiveness values shall be tested in accordance with ASHRAE 84 and ARI Standard 1060.

.3 Manufacturer shall provide verification (in writing) confirming that the internal pore diameter distribution inherent in the desiccant limits adsorption to materials no larger than the critical diameter of a water molecule (4.0 Angstrom).

.4 Energy recovery wheel shall be constructed of aluminum and must comply with NFPA-90A for flame spread and smoke generation.

.5 Enthalpy wheel drive belt shall be designed so that there is no need for a take-up pulley and no field adjustments required (0% stretch after initial tension).

.6 Enthalpy wheel cassette shall be complete with face seal and perimeter seal to prevent cross leakage between the two airstreams. Both seals shall be contact seals (non-wearable) to prevent leakage from occurring at the seal.

.7 Enthalpy wheel shall come complete with an adjustable purge section to eliminate carry over of exhaust air stream contaminates from wheel rotation.

.8 Enthalpy wheel shall be self cleaned by two counter flow airstreams.

.9 Enthalpy wheel shall be installed in removable cassette to allow for inspection, removal and cleaning.

.5 Operating Characteristics

.1 Unit shall be capable of providing a constant volume of air at a specified external static pressure at all fan operating speeds.

.6 Blowers

.1 Fan ratings are based on tests made in accordance with AMCA Standard 210.

.2 Blowers must be selected to operate on a stable efficient part of the fan curve when delivering air quantities scheduled against static of the system.

.3 Fan blades shall be statically and dynamically balanced and tested prior to shipment.

.4 Fan shall be provided with internal vibration isolation mounts.

.5 Fan discharge shall be as noted on the plans.

.7 Motors

.1 Motors shall be continuous duty, permanently lubricated, and matched to the fan loads.

.2 Motors shall meet new EPAC regulations for efficiency and shall have inverter spike resistance wire for protection.

.8 Electrical Requirements

.1 Unit shall have single point power connection only.

.2 Unit voltage as per schedule.

.3 Unit must be equipped with a non-fused disconnect.

.4 All controls shall be factory mounted and wired, requiring only field installation of remote sensing devices and wiring to unit mounted terminal strips.

.5 Unit shall have 24 VAC (30VA) for field installed sensing devices, etc.

.9 Filtration

.1 Unit must come equipped with standard size medium efficiency filtration (30% DSE.)

.10 Integration with A2L Containing Ductwork Systems

.1 ERV is integrated/connected to an air handling system containing an A2L refrigerant. All electrical components, (actuators, motors etc.) within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code).

.11 Controls

.1 Unit shall be provided with a factory mounted and factory wired microprocessor control for internal operation.

.2 All service connectors shall be quick disconnect type.

.3 Provide BACNet Card

.12 Accessories

.1 Frost Protection

.1 Electrical Pre-Heat

.1 Capacity: As scheduled.

.2 Exhaust Only Defrost

.1 If outdoor air ambient drops below 5°F (-15°C) (adjustable at unit) the outdoor air damper closes, supply fan shuts off, and the exhaust air fan continues to run. Set point based on 40% relative humidity.

.2 Hoods (for roof mounted units only)

.1 Unit shall include intake and exhaust hoods with birdscreen.

.2 Maximum design velocity on intake hood must not exceed 200 ft/min.

.3 Hoods to include dampers with spring return, two way driven actuators, and/or and exhaust backdraft damper.

.3 Double Wall Construction

.1 Cabinet shall be insulated throughout and lined with a 26 ga. galvanized wall to eliminate potential puncture of insulation membrane.

.4 Disconnect Switch

.1 Unit shall include fused or non-fused disconnect switch.

.5 Access Panels

.1 Unit shall have deluxe door access for filters and blower doors consisting of ¼ turn fasteners and polymide handles.

.6 Wheel Rotation Sensor

.1 Sensor device and contacts shall be included to provide a low voltage signal when wheel rotation stops longer than the sensor set point.

.7 Enthalpy Wheel Purge Section

.1 Enthalpy wheel cassette shall include a purge section which is field adjustable from 7.5 to 12.5 rpm.

.8 CO2 Controller

.1 Non-dispersed infra-red control shall be provided to trigger ventilation at levels above 1000 ppm of CO2.

.9 Roof curb

.1 Roof curb shall be constructed of galvanized steel.

.2 Roof curb shall be knock down type complete with instructions for field assembly matched to unit specifications.

.10 Free Cooling Enthalpy Control

.1 Free cooling enthalpy control shall be provided to stop wheel when applicable on calls for cooling.

.13 Acceptable Manufacturers:

.1 Daikin

.2 Aaon

.3 Aldes

.4 Greenheck

.5 Ruskin

.6 Cook

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

.3 Install access doors in accordance with Sections for access to coils and dampers.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 Five (5) year warranty on wheel.

.2 One (1) year warranty on all other components.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA-90A, Installation of Air Conditioning and Ventilating Systems.

.3 AMCA 99 – Standard Handbook.

.4 AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes.

.5 ARI 270, Standard for Sound Rating of Outdoor Unitary Equipment.

.6 ANSI/AHRI 340/360 – Performance Rating of Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment.

.7 AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

.8 AHRI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment.

.9 NFPA 90A – Installation of Air Conditioning and Ventilation Systems.

.10 UL-1995 – Standard for Safety for Heating and Cooling Equipment.

.11 C.1 CSA B52-2023, Mechanical Refrigeration Code.

.12 C.2 CAN/CSA-C22.2 No 60335 Safety of Household and similar electrical appliances – Heat Pumps, Air-conditioners and dehumidifiers.

1.2 QUALITY ASSURANCE

.1 Manufacturer shall have a minimum 15 years of experience in designing, manufacturing and servicing large air handling units.

.2 Units shall be factory tested prior to shipment.

1.3 ALTERNATES CO-ORDINATION

.1 The design indicated on the schedules and shown on the drawings is based upon the products of the named manufacturer. Alternate equipment manufacturers named in this specification are acceptable if equipment meets scheduled performance requirements. **Refer to alternate price in Specification Section 00430**.

.2 If equipment is supplied by a manufacturer other than the one named as the basis of design, coordinate with the General Contractor and affected subcontractors to ensure the specified performance is met. This coordination shall include (but is not limited to) the following:

.1 Structural supports for units.

.2 Size and location of concrete bases/housekeeping pads.

.3 Location of roof curbs, unit supports and roof penetrations.

.4 Ductwork sizes and connection locations.

.5 Piping size and connection/header locations.

.6 Interference with existing or planned ductwork, piping and wiring.

.7 Electrical power requirements and wire/conduit and over current protection sizes.

.3 The Mechanical Contractor shall be responsible for costs incurred by the General Contractor, Subcontractors, and Consulting Engineers to accommodate units furnished by a manufacturer other than manufacturer named as basis of design.

.4 Substitution of products from manufacturers not listed in the list of acceptable manufacturers shall not be accepted.

1.4 RATINGS AND CERTIFICATIONS

.1 Unit shall conform to AMCA 210 for fan performance ratings.

.2 Unit sound ratings shall be reported in accordance with AHRI 260 for inlet and discharge sound power levels.

.3 Unit casing radiated sound ratings shall be reported in accordance with ISO 9614 parts 1&2 and ANSI S12.12.

.4 Unit shall conform to AHRI 410 for capacities, pressure drops, and selection procedures of air coils.

.5 Unit shall conform to ANSI/AHRI 430 for all fabrication procedures of air handling units.

.6 Control Wiring comply with NEC codes and all other requirements of the Authority Having Jurisdiction.

.7 Units shall comply with energy use AHSRAE 90.1 and meet all Government of Canada and Ontario Building Code energy requirements, including SB-10 energy efficiency requirements. Energy Efficiency shall be verified by third party laboratory testing.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements. Ensure the following information is included:

.2 Furnish fan performance ratings and fan curves with specified operating point clearly plotted.

.3 Furnish drawings indicating unit dimensions, required clearances, field connection locations, wiring diagrams, shipping drawings, and curb drawings.

.4 Furnish performance report showing unit level performance data including: fan(s), motor(s), coil(s) and other functional components. Performance report shall also include unit casing performance.

.5 Furnish operation and maintenance data, including instructions for lubrication, filter replacement, motor and drive replacement, and condensate pan cleaning; spare parts lists, and wiring diagrams.

.6 Adjust and report performance ratings for the proper altitude of operation.

.7 Report air-handling unit performance ratings in accordance with ANSI/AHRI-430 (static pressure, airflow, fan speed, and fan brake horsepower).

.8 Report coil ratings in accordance with AHRI-410 (capacities and pressure drops).

.9 Report unweighted octave band AHU sound power for inlets and outlets rated in accordance with AHRI Standard 260. Provide eight data points, the first for the octave centered at 63 Hz, and the eighth centered at 8,000 Hz. Manufacturer shall not use sound estimates based on bare fan data (AMCA ratings), nor use calculations like the substitution method based on AHRI 260 tests of other AHU products. Provide data for inlets and outlets as scheduled. Report unweighted casing radiated sound power over the same 8 octave bands in accordance with ISO 9614 Parts 1&2 and ANSI S12.12.

.10 Report weight loads and distributions by component section.

.11 Report product data for filter media, filter performance data, filter assembly, and filter frames.

.12 Report electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

.13 Report motor electrical characteristics.

1.6 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

1.8 UNIT ASSEMBLY

.1 Unless stated otherwise, air handling units are to be shipped to the job in one piece, factory assembled. All equipment shall be factory tested prior to shipment.

.2 Units that are shipped in segments must be re-assembled by manufacturer's factory trained service personnel.

1.9 PERFORMANCE RATINGS

.1 Unit certification: Units shall conform to CSA-C746-2006 and ARI 340/360-2007, be listed by NRCan as approved for sale in Canada and be compliant with the SB-10 Supplement of the Ontario Building Code. Manufacturers shall have performance certified by an AHRI-sponsored, independent, third party laboratory and be able to provide a Certificate of Product Ratings.

Part 2 Products

2.1 GENERAL

.1 Field Factory assembled components to form units supplying air at design conditions as indicated and specified.

Acceptable Manufacturers:

.1 Daikin Applied Rebel/Skyline

.2 Valent VX Series (Direct Drive Fans Only)

.3 Engineered Air

.4 Aaon (Alternate Price – Refer to Specifications)

2.2 GENERAL DESCRIPTION

.1 The air handling unit (AHU) shall consist of the following components:

.1 Structural frame, including base. Frame must maintain it's integrity when all wall panels are removed.

.2 Wall panels complete with access doors.

.3 Filters, motors, motor controls, dampers and other components as specified.

.4 A supply air fan.

.5 A return air fan

.6 A modulating gas burner.

.7 Packaged DX cooling.

.8 A mixed air section complete with economizer operation.

.9 Integral energy recovery wheel complete with bypass damper and purge.

.10 Single point power connection.

.11 Refrigerant detection and safety system.

2.3 UNIT CONSTRUCTION

.1 Base Rail:

.1 Units shall be provided with a structural steel base rail under the full perimeter of the unit, formed from mill galvanized steel, or welded structural steel if determined to be necessary based on unit size by the manufacturer.

.2 Base rail shall allow for clearances for proper trapping of drain pans and condensate.

.3 Base rail shall have a lifting lug system that does not require additional support for rigging on site. Alternatively, lifting lugs or forklift openings on cabinet are acceptable if designed for on site rigging.

.2 Casing:

.1 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include for the prevention of infiltration of rain and snow into the unit, and louvres or hoods on air intakes and exhaust openings with 25 mm (1") galvanized inlet screens. Provide rain gutters over all access doors and caulk all joints with a water resistant sealant.

.2 Casing construction shall not be relied upon to provide structural integrity.

.3 Casing panels shall be 2" double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework.

.4 Unit casing shall be of minimum 1.3 mm (18 gauge) satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two-part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.

.5 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.

.6 Provide casing with minimum thermal resistance (R-value) of 13 hr-ft2-°F/BTU. Exposed insulation is not acceptable.

.7 Casing panel insulation shall be injected polyurethane foam. Rigid foam board panels are acceptable provided the above noted R value is met.

.8 Insulation system provided shall be resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.

.9 Encapsulate insulation with sheet metal so that air does not contact insulation. Solid lined double-walled panels insulated with injected foam shall be hermetically sealed at each corner and around their entire perimeter to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.

.10 Casing panels with perforated interior liners (perforated panels) shall be provided where indicated on the drawings and/or schedule. Perforated panels shall be a hybrid combination of 1" fiberboard and 1" injected polyurethane foam. Rigid foam board panels shall not be used. Minimum perforated panel thermal resistance (R-Value) shall be R11 hr-ft2-°F/BTU.

.11 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage.

.12 Provide wall panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +5 inches w.g. in positive pressure sections and -5 inches w.g. in negative pressure sections. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.

.13 Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb static load at mid-span. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.

.14 Provide outdoor AHUs with a roof system that deflects no more than L/240 when subjected to a static snow load of 30 lb./ft2. 'L' is defined as the panel-span length and 'L/240' is the deflection at the panel midpoint.

.3 Access Doors

.1 Units shall be provided with double wall gasketed access doors that meet the requirements of the AHU casing.

.2 Access doors shall be provided to the following components: fans and motors; filters; dampers and operators; and access plenums. Access doors shall be large enough for easy access. Removal of screwed wall panels will not be acceptable.

.3 Provide hinged access doors, fully lined, with hinges, with a minimum of two camlock fasteners for all units over 1200 mm (48") high.

.4 Whenever possible, hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. Where space constrictions require the use of outward opening doors to an area of positive pressure, a clear warning label must be affixed.

.5 Hinged access doors shall be provided with tie back clips.

.6 Doors shall have a drip guard above the door frame, extending 50 mm (2") beyond door surface.

2.4 DX COOLING COILS

.1 General

.1 Coils shall meet or exceed performance scheduled on drawings.

.2 Coils shall be provided with performance certified in accordance with AHRI Standard 410 for coil capacity and pressure drop, wherever applicable. Coils circuits shall be designed such that the fluid velocity is within the range of certified rating conditions at design flow.

.3 Cooling coils shall be provided with a maximum face velocity of 500 feet per minute. Face velocity calculations shall be based on the finned area of the coil.

.4 Cooling coil shall be provided with drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of 10” downstream of the face of the coil.

.5 Coil segment casing shall accommodate full-face or reduced-face coils as scheduled. Face and bypass coil shall only be allowed when specifically specified. Where specified segments shall be provided with factory installed bypass damper.

.6 Access shall be provided of at least 24" between coils. Access panel or door shall be easily operable and are easily removable with no special tools, as shown on drawings.

.7 Access doors shall be located to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.

.8 Coils shall be built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall not block finned area.

.9 Individual coils shall be removable from the side of the AHU.

.10 Continuous aluminum or copper fins shall be provided for coils with die-formed fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.006" or 0.008 or 0.01" thick.

.11 DX Cooling Coils

.1 The coil shall be installed in a blow through configuration, upstream of the supply air fan.

.2 The coil shall be multirow, with a minimum of 3 rows. All coils shall have interlaced coil circuiting that keeps the full coil face active at all load conditions.

.3 Direct expansion (DX) coils shall conform to UL-207, "Standard for Safety: Refrigerant - Containing Components and Accessories, Nonelectrical," when operating with a maximum refrigerant pressure of 325 psig. Factory shall test DX coils with 325 psig compressed air under water. DX coils shall be dehydrated and sealed prior to installation.

.4 Coils shall be provided with a tube OD of 1/2" or 5/8". Mechanically expand tubes shall form fin bond and provide burnished, work-hardened interior surface.

.5 DX coils shall be provided with brass distributor and solder-type connections. Suction and discharge connections shall be on the same end regardless of coil depth.

.6 Refrigeration Circuits:

.1 The system shall be equipped with minimum [XX] compressors and independent refrigeration circuits to limit the volume of refrigerant that may be released in the event of a leak.

.2 The maximum charge allowed per circuit is [XX] lbs. Provide additional compressors/circuits if required to keep charge below this value.

.3 Refrigerant coils with multiple compressors shall be alternate tube circuited in order to distribute the cooling effect over the entire coil face at reduced load conditions. (split face coils are not acceptable). Provision for use of thermal expansion valves must be included for variable air volume applications.

2.5 PRIMARY DRAIN PANS

.1 Unit(s) shall be provided with a drain pans under each cooling coil and where applicable, humidifier.

.2 Provide drain pan under the complete width and length of cooling coil and humidifier sections. Drain pan shall be full width, and extend a minimum of 6" downstream of cooling coil.

.3 Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62.

.4 Drain connection shall be made of same material as drain pan. Dissimilar metals shall not be used to mitigate risk of galvanic corrosion. Drain connection shall be welded to the drain pan.

.5 Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.

.6 Provide a minimum of 1" clearance between the drain pan and any coil casing, coil support or any other obstruction.

.7 Provide drain pan that allows the design rate of condensate drainage regardless of fan status.

.8 Provide drain pan sloped in at least two planes by at least 1/8" per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

.9 Drain pans shall be stainless steel or fibre reinforced plastic.

2.6 FANS

.1 General Description

.1 Units shall be provided with fans as shown on equipment schedule and drawings.

.2 Fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA.

.3 The fan section shall be provided with an access door on the drive side of the fan.

.4 Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the AHU floor and mount directly to the AHU frame.

.1 Provide vibration isolation, as follows:

.1 ¼ hp thru to 1 ½ hp: Rubber isolation.

.2 Over 1 ½ hp: Internal Spring Isolation

.3 Rubber isolation is acceptable for direct drive plenum fans.

.5 DWDI fans shall be connected to the unit casing or bulkheads with canvas flexible connection.

.6 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance prior to shipment.

.7 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled design airflow. The fan shall not operate in a state of surge at any point within the modulation range.

.2 Belt Drive Fan, Bearings, and Drives

.1 Fans shall be provided with polished steel shafts with first critical shaft speed at least 125% of the maximum operating speed for the fan pressure class. Shaft shall have an anti-corrosion coating.

.2 Fan wheels shall be keyed to the fan shaft to prevent slipping.

.3 Fan shall be provided with an OSHA-approved belt guard to deter incidental contact with rotating sheaves and belts.

.4 Airfoil (AF) Fan

.1 Provide airfoil fans with blades formed of extruded aluminum, as scheduled. Bent sheet metal blades are not acceptable.

.2 Airfoil fans shall comply with AMCA standard 99 2408 69 and 99 2401 82. Provide an AMCA Seal on airfoil fans. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air performance.

.5 Bearings and Drives

.1 Units fans shall be provided with bearings complying with ANSI/AFBMA 9 for fatigue life ratings and with an average life L10 of at least 200,000 hours, as scheduled.

.2 DWDI fans shall be belt driven complete with VFD. SWSI fans shall be belt drive or direct driven complete with VFD.

.3 Forward curved fans smaller than 18" shall be provided with permanently lubricated bearings. For other fans, manufacturer shall provide re-greaseable bearings with hydraulic grease fittings and lube lines extended to the motor side of the fan or to the exterior of the unit primary access side.

.4 Fans shall be provided drives selected with a 1.5 service factor. Sheaves shall be machined from a close grain cast iron and statically balanced by the manufacturer.

.5 Fixed pitch sheaves shall be provided on both the fan and motor. Fans with motors rated at 15 HP or less may be field balanced using variable pitch sheaves. Fixed pitch sheaves shall be provided when final balance is complete. Air balancer shall select and provide final set of sheaves.

.6 For Belt-driven fans with 10 HP motors or greater shall be provided with multiple belt drives. Belts shall be V-type, precision molded, raw edge construction, anti-static, oil- and heat-resistant.

.3 Direct Drive Fans

.1 Plenum (SWSI) Fan

.1 Plenum fan wheel shall be single-width, single-inlet.

.2 Plenum fan blades shall be aluminum backward-inclined airfoil.

.3 Plenum fan shall be direct-driven.

.4 Provide VFD with all direct drive fans.

.4 Fan Motors

.1 Fan motors shall be built in accordance and comply with the latest standards of the NEMA and IEEE.

.2 Fan motors shall be provided with the following characteristics:

.1 Voltage, Frequency and Phase, as scheduled.

.2 Motor RPM, maximum 1800 rpm.

.3 Minimum service factor of 1.15.

.4 Premium efficiency, or as required to meet ASHRAE 90.1.

.5 NEMA design ball bearing type.

.6 Rated for continuous duty at full load in a 104°F (40°C) ambient.

.7 Electronically Commutated (EC).

.8 Suitable for use in variable frequency application, per NEMA MG-1 Part 30.

.9 Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2.

.5 Fan Motor Disconnects

.1 Manufacturer shall provide UL or ETL listed fan-motor disconnects and associated components. Disconnects shall comply with applicable provisions of the National Electric Code.

.2 Fused or non-fused fan-motor disconnects shall be provided in NEMA 3R enclosures.

.3 Provide single dead front disconnect.

.4 Disconnect shall be suitable for use as an OSHA lockout/tagout disconnect.

.5 Disconnect handles shall be lockable in the “off” position with up to three padlocks. Switch mechanism shall be directly lockable in the “off” position via padlock when door is open.

.6 Disconnects shall be provided with integral ground lug sized to be industry standard.

2.7 GAS HEAT SECTION

.1 The rooftop unit shall include a natural gas heating section. The assembly shall be an indirect fired type, having 80% minimum thermal efficiency.

.2 The gas furnace shall be factory installed downstream of the supply air fan in the heat section.

.3 The gas furnace shall be tubular in design with in-shot gas burners. It shall be of a floating stress relief design and be provided with a condensate drain connection.

.4 The heat exchanger shall be constructed of stainless steel.

.5 The heating section shall have modulating control with minimum 8:1 turn down.

.6 The heating section shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

.7 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber. The burner controller shall control pre-purge and post-purge fan operation.

.8 The ignition system, consisting of an electronic ignitor and pilot light will operate continuously with the furnace. The pilot light must extinguish when heating is not required.

.9 The factory-installed DDC unit control system shall control the gas heat module. The manufacturer's unit certification shall cover the complete unit including the gas heating modules.

.10 All operating controls and functions shall be factory tested prior to shipment.

.11 Operating natural gas pressure shall be 7" (1750 Pa) W.C. The burner shall be capable of operating on propane systems with field conversion of orifices and other components as necessary.

2.8 PACKAGED MECHANICAL COOLING

.1 General

.1 Provide an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

.2 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

.3 Refrigerant shall be A1 or A2L classification.

.2 Condensing Section

.1 Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

.2 Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0-120°F. Mechanical cooling shall be provided to 0º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

.3 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.

.4 The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection.

.5 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

.6 Each circuit shall be dehydrated and factory charged with Refrigerant and oil.

.7 Compressors shall be set on neoprene pads.

.8 Compressors shall be located on the side of the unit in a service enclosure complete with hinged access doors c/w lever lock handles for ease of service.

.9 Compressors shall have inbuilt overload and temperature protection.

.10 Compressors shall be supplied with vibration isolation pads and acoustic blankets.

.3 Hot Gas Reheat

.1 Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.

.2 Hot gas reheat coil shall be a copper tube/aluminum fin design. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

.3 The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

.4 Each coil shall be factory leak tested with high- pressure air under water.

2.9 REFRIGERANT LEAK DETECTION

.1 The refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:

.1 Utilize a set point nonadjustable in the field to generate a digital output signal to initiative mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0$, -1%)

.2 Sensor within the equipment, near potential source of leaks.

.3 Field calibration of the system is not allowed.

.4 Be capable of detecting the refrigerant used in the system.

.5 Have self diagnostics

.6 Energize fans upon failure of a self-diagnostic check

.7 Activate refrigerant safety shut off valves in the event of a leak being detected.

2.10 ENERGY RECOVERY WHEEL SECTION

.1 The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.

.2 The wheel capacity, air pressure drop and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment.

.3 The unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.

.4 The unit shall have 2" Merv 7 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door.

.5 The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

.6 The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

.7 Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Where segments are provided, segments shall be removable without the use of tools to facilitate maintenance and cleaning.

.8 Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.

.9 Wheel seals shall be contact brush seal on both the periphery of the wheel and the face. Seals shall be easily adjustable.

.10 The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. The DDC controller shall have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature. These temperatures shall be displayed at the rooftop units DDC controller LCD display. All of these temperatures shall be made available through the BACnet interface if a BACNet interface has been specified.

.11 The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall (stop, slow down) the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

.12 A mechanical purge shall be available and be field adjustable. Purge shall be capable of limiting Exhaust Air Transfer Ration (EATR) values to 0.4% through proper fan and purge adjustment.

.13 The energy recovery wheels shall have bypass dampers that allow for 100% outdoor air economizer operation of the unit.

2.11 FILTERS

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side as noted on the drawings.

.2 Provide 2" filter rack on outdoor air intake for all units with energy recovery. (MERV 8)

.3 Provide 2" filter rack on return air (MERV 8)

.4 Provide final rack for MERV **13.**

.5 Units shall be provided with filter segments consisting of filters and frames as follows:

.1 A 2 inch (50mm) 4 inch (100mm) final filter rack

.6 Two sets of filters, as well as a construction set of filters shall be provided.

.7 For units with filter banks 1825 mm (72") high or less, the filter modules shall be designed to slide out of the unit. Side removal filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.

2.12 ECONOMIZER SECTION

.1 Unit shall be provided with an outdoor air economizer section.

.2 The economizer section shall include outdoor, return, and exhaust air dampers.

.1 Dampers provided shall be tested in accordance with AMCA 500.

.2 Dampers shall be formed damper blades or airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.

.3 Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g., and shall comply with ASHRAE 90.1.

.4 Damper frames shall be u-shaped galvanized metal sections securely screwed or welded to the air handling unit chassis. Pivot rods of 15 mm (1/2") aluminium, shall turn in bronze bushings, fabricated from self- oiling bronze. Rods shall be secured to the blade by means of straps and set screws.

.5 Blades shall be 1.3 mm (18 gauge) galvanized metal with two breaks on each edge and three breaks on centreline for rigidity. The pivot rod shall "nest" in the centreline break. Damper edges shall interlock. Maximum length of damper between supports shall be 1067 mm (42"). Damper linkage brackets shall be constructed of galvanized metal.

.6 Two position inlet dampers shall be parallel blade type complete with actuator.

.7 The outside and return air dampers shall be sized to handle 100% of the supply air volume.

.3 The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature.

.4 An outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The hood shall also include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

.5 A barometric exhaust damper shall be provided to exhaust air out of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.

.6 Damper Control

.1 Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

2.13 POWER EXHAUST

.1 Units without a return fan shall be equipped with a power exhaust fan.

.2 Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

.3 The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

.4 Fan Control:

.1 The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field installer shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

.2 The unit's internal controller shall modulate the power exhaust fan based on OA damper position.

2.14 FAN MOTOR VARIABLE FREQUENCY DRIVES (VFDS)

.1 Manufacturer shall provide UL or ETL listed VFDs and associated components, as scheduled and shown on drawings. VFDs shall comply with applicable provisions of the National Electric Code.

.2 VFDs shall be mounted in a dedicated NEMA 3R compartment located on the primary access side of its associated fan section and wire VFD to motor, unless otherwise indicated on drawings.

.3 After unit installation, VFD shall be started and programmed by a factory trained and employed service technician.

.4 Unit(s) shall be provided with VFD disconnect and bypass.

.5 Unit(s) shall be provided with harmonic distortion feedback protection:

.1 Equivalent 5% impedance input line reactor.

.2 Integral RFI/EMI filtering to meet EMC EN61800-3 for First Environment.

.6 Unit(s) shall be provided with a user interface consisting of following features:

.1 30 Character multi-lingual alphanumeric display.

.2 Parameter set-up and operating data.

.3 Display data shall include:

.1 output frequency (Hz).

.2 speed (RPM)

.3 motor current

.4 calculated % motor torque

.5 calculated motor power (kW)

.6 DC bus voltage

.7 output voltage

.8 heat sink temperature

.9 elapsed time meter (re-settable)

.10 kWh (re-settable)

.11 input / output terminal monitor

.12 PID actual value (feedback) & error

.13 fault text

.14 warning text

.15 scalable process variable display

.7 VFD shall be provided with the following protection circuits:

.1 over current

.2 ground fault

.3 over voltage

.4 under voltage

.5 over temperature

.6 input power loss of phase

.7 loss of reference/feedback

.8 adjustable current limit regulator

.8 VFD shall be UL 508C approved for electronic motor overload.

.9 VFD shall be provided with features for high input transient protection and surge suppression, such as

.1 4 MOVs ahead of diode bridge.

.2 120 Joule rated 1600V diode module.

.3 Compliant with UL 1449 / ANSI 61.4.

.10 VFD shall be provided with the following communication features:

.1 Two programmable analog inputs.

.2 Six programmable digital inputs.

.3 Two programmable analog output.

.4 Three programmable digital relay outputs.

.5 BACNET Communications protocol.

.6 Adjustable filters on analog inputs and outputs.

.7 Input speed signals, including 4-20 mA and 0-10 VDC.

.8 Accel/Decel contacts [floating point control].

.9 Auto restart [customer selectable and adjustable].

.10 Integrated control interface for Siemens FLN, Johnson N2, Modbus RTU, BACnet MS/TP or LONWorks over RS-485.

.11 VFD shall consist of the following functions:

.1 Pre-magnetization on start.

.2 DC braking/hold at stop.

.3 Ramp or coast to stop.

.4 Seven preset speeds.

.5 Three critical frequency lockout bands.

.6 Start function shall include ramp, flying start, automatic torque boost, and automatic torque boost with flying start.

2.15 ELECTRICAL WIRING

.1 Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with CSA standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be CSA recognized.

.2 A terminal block shall be provided for the main single point power connection. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit.

.3 Each compressor and condenser fan motor shall be furnished with contactors and internal thermal overload protection. Supply fan motors shall be supplied with external overload protection.

2.16 KAIC RATING

.1 Kilo Ampere Interrupting Capacity (kAIC) Rating

.1 Equipment shall be rated a interrupting capacity rating of 25 kAIC.

.2 All products supplied to the site shall meet or exceed this kAIC rating.

.3 **The kAIC rating may be lowered to match or exceed the available fault current indicated on the Short Circuit Co-ordination Study completed by the electrical trade.**

2.17 UNIT CONTROLS

.1 The unit shall be equipped with a microprocessor based control system. The unit's control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interfaces required for the operation of the unit.

.2 The unit control system shall be able to perform all unit control functions, including scheduling, unit diagnostics and safeties with and without connection to a building automation system.

.3 The controller shall have a 4 line x 20 character display with all information and instructions shown in plain English. A keypad shall allow information and controls to be accessed. The microprocessor shall have a programmable time clock, store current and past alarm conditions.

.4 All factory wiring shall be internal to the unit to maintain product standards for less than 1% air leakage.

.5 All wiring at unit splits shall be connected with quick-connects - no field splicing of wiring is allowed.

.6 Control panels shall be factory mounted and all end devices shall be terminated either directly to the controller or to a terminal block.

.7 Control panels shall include integral 24VAC transformers with circuit breaker overloads.

.8 No low voltage controls or communication wiring shall be running in the same tray, conduit or proximity as any high voltage wiring.

.9 Averaging temperature sensors shall be mounted to cover as much cross-sectional area of the interior unit as possible. End and support brackets shall be provided to support sensing element and eliminate strain.

.10 For mounting probe temperature sensing elements at discharge and air inlet openings, support brackets shall be provided a solid mounting location to minimize vibration effects.

.11 All actuators for control dampers shall be mounted within the frame of the damper. Actuators shall be mounted on the access side of the damper to facilitate commissioning and servicing.

.12 Low temperature cut out sensors shall be mounted on downstream face of first water coil within the coil housing frame.

.13 High temperature cut out sensors shall be mounted, so that the manual reset switch is accessible from the fan section access door. The temperature sensor shall be mounted in the discharge air stream.

.14 High and low pressure cutout devices shall be mounted so that the manual reset switch is accessible from the fan section access door without putting operator at risk.

.15 Factory mounted control panels shall be mounted to the exterior wall of the supply fan section. Internal unit wiring is brought into the panel through a single rear knockout. The penetration shall be sealed to prevent air and leakage moisture leakage. Power shall be provided from the single point power connection on the unit.

.16 Factory packaged controls shall be factory tested using a functional test method. All inputs [AI, BI, DI] and outputs [AO, BO, DO] shall be tested. All sensors and switches shall be cycled through a change of state. All actuators shall be stroked to verify correct operation and rotation through the full operating range. The factory test data results shall be fully documented including all operational conditions. A factory test report document shall be available for each unit. The factory test report shall be provided to the commissioning agent.

2.18 BAS INTEGRATION

.1 Provide BACNet integration card.

2.19 ACCESSORIES

.1 Roof Curb

.1 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of **600 mm (24") high** and complete with wood nailer, neoprene sealing strip, and fully welded "Z" bar with 25 mm (1") upturn on inner perimeter, to provide a complete seal against the elements. Provide on the interior of the roof curb 100 mm (4") thick rigid foil faced insulation over entire surface. Foil tape all joints including joints at curb. External insulation of the roof mounting curb shall be provided by the Roofing Subcontractor.

.2 Roof curb shall be matched to the roof slope, and be level in both axes.

2.20 CAPACITY

.1 Provide unit capacity indicated on schedules.

Part 3 Execution

3.1 INSTALLATION

.1 Fabricate to provide smooth air flow through all components. Limit air leakage to 1% of rated air flow at 2.5 kPa (10" w.c.) suction pressure.

.2 Apply sealer into all seams prior to assembly. Secure toe angles continuous along entire length of assembly.

.3 Install to manufacturers requirements.

3.2 FANS

.1 Install flexible connections at fan outlets. Ensure metal bands of connectors are parallel and not touching when fan is running and when fan is stopped. Ensure that fan outlet and duct are aligned when fan is running.

3.3 START-UP/COMMISSIONING

.1 Unit manufacturer shall perform start-up and commissioning.

3.4 SPARE PARTS

.1 Two (2) complete sets of filters.

.2 One (1) set of spare belts.

3.5 REFRIGERATION LEAK DETECTION SYSTEM

.1 This contractor shall provide all wiring between leak detection systems installed within the provided equipment and system components in the spaces served and ductwork system.

.2 Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

.3 All interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52.

3.6 TRAINING

.1 Provide 2 hours training to owner's staff on the care, maintenance, and operation of the equipment. Dedicated visit to site is required as it will not be paired with equipment startup.

3.7 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year on parts on all components.

.2 Five (5) years on Energy Recovery Wheel media.

.3 Ten (10) years on heat exchanger.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM C553, Mineral Fiber Blanket, Thermal Insulation for Commercial and Industrial Applications.

.3 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.4 C.1 CSA B52-2023, Mechanical Refrigeration Code.

.5 C.2 CAN/CSA-C22.2 No 60335 Safety of Household and similar electrical appliances – Heat Pumps, Air-conditioners and dehumidifiers.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general conditions.

.2 Indicate major components and accessories including sound power levels of units.

.3 Type of refrigerant used.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general conditions.

Part 2 Products

2.1 GENERAL

.1 System type:

.1 Air flow arrangement: horizontal

.2 Cooling: direct expansion

.3 Condensing: air cooled

2.2 OUTDOOR CONDENSING UNITS

.1 General: Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant holding charge, and special features required prior to field start-up. Unit shall be rated in accordance with ARI Standard and be CSA approved.

.2 Unit Cabinet:

.1 Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.

.2 A heavy gage roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.

.3 Fans:

.1 Condenser fans shall be direct driven, propeller-type, discharging air horizontally.

.2 Fan blades shall be balanced.

.3 Condenser fan discharge openings shall be equipped with PVC coated steel wire safety guards.

.4 Condenser fan and motor shaft shall be corrosion resistant.

.4 Compressor:

.1 Compressor shall be mounted on vibration isolators.

.2 Compressors shall include overload protection.

.5 Condenser Coil:

.1 Condenser coil shall be air-cooled and circuited for integral subcooler.

.2 Coil shall be constructed of aluminum fins (copper fins optional) mechanically bonded to internally grooved seamless copper tubes which are then cleaned, dehydrated, and sealed.

.6 Controls and Safeties:

.1 Minimum control functions shall include:

.1 Control wire terminal blocks.

.2 Five-minute recycle protection to prevent compressor short-cycling.

.3 Compressor lockout on auto-reset safety until reset from thermostat.

.2 Minimum Safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:

.1 High discharge pressure cutout.

.2 Loss-of-charge cutout.

.7 Electrical Requirements:

.1 Refer to schedule for voltage.

.2 Unit electrical power shall be single-point connection.

.3 Unit control circuit shall contain a 24-v transformer for unit control.

.8 Capacity: Refer to schedule.

.9 Provide the following:

.1 Hail Guard Package.

.2 Winter Start Package.

.10 Acceptable Manufacturers:

.1 Daikin

.2 Carrier

.3 Trane

.4 Lennox

2.3 WALL HUNG FAN COIL UNIT

.1 Indoor, direct-expansion, wall mounted fan coil, complete with cooling coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall-mounting bracket and mounting hardware.

.2 Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.

.3 Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided.

.4 Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header.

.5 Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.

.6 Controls shall consist of a microprocessor based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 18°C to 29°C (64°F to 84°F). The unit shall have the following functions:

.1 An automatic restart after power failure at the same operating conditions as at failure.

.2 A timer function to provide a minimum 24-hour timer cycle for system Auto. Start/Stop.

.3 Temperature-sensing controls shall sense return-air temperature. Indoor-air high discharge temperature shutdown shall be provided.

.4 Indoor coil freeze protection.

.5 Wall mounted thermostat to enter set points and operating conditions.

.6 Auto Stop features shall have integral setback control.

.7 Automatic airsweep control to provide on or off activation of airsweep louvers.

.8 Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.

.9 Fan speed control shall be user-selectable: high, medium, low, or microprocessor automatic operation during all operating modes.

.10 A time delay shall prevent compressor restart in less than three minutes.

.7 Filter track with factory-supplied cleanable filters.

.8 Capacity:

.1 Refer to schedule.

.9 Acceptable Manufacturers:

.1 Daikin

.2 Carrier

.3 Trane

.4 Lennox

2.4 REFRIGERANT

.1 The maximum charge allowed per circuit is **5lbs**. Provide additional compressors/circuits if required to keep charge below this value.

.2 The maximum allowed releasable refrigerant volume is **5lbs**. Provide leak detection and solenoid valves to limit release volume from each circuit.

.3 Refrigerant coils with multiple compressors shall be alternate tube circuited in order to distribute the cooling effect over the entire coil face at reduced load conditions. (split face coils are not acceptable). Provision for use of thermal expansion valves must be included for variable air volume applications.

.4 Provide refrigerant leak detectors for installation in served space. Detector shall close refrigeration leak safety valve to limit charge released into space/atmosphere.

.5 The Refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:

.1 Utilize a set point, nonadjustable in the field, to generate a digital output signal to initiative mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0$, -1%)

.2 Field calibration of the system is not allowed.

.3 Be capable of detecting the refrigerant used in the system.

.4 Have self diagnostics

.5 Energize circulation fans in the event of a leak detection or failed self-diagnostics.

.6 Have a digital output signal for monitoring by other systems

.7 Activate refrigerant safety shut off valves in the event of a leak being detected.

Part 3 Execution

3.1 GENERAL

.1 Install as indicated, to manufacturers' recommendations.

.2 Manufacturer to certify installation.

.3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.

.4 Provide concrete pad complete with 100 mm x 100 mm x 20 mm (4" x 4" x 3/4") neoprene type vibration isolation.

3.2 EQUIPMENT

.1 Preparation and Start-Up

.1 Provide services of manufacturer's authorized factory trained mechanic to set and adjust equipment for operation as specified.

.2 Provide results in operation and maintenance manuals

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Contractor hereby warrants refrigeration compressors for five (5) years.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 GENERAL NOTES

.1 This section is to be read in conjunction with Division 1, the General Conditions, the General Requirements of the Mechanical Trades, the remainder of the Division 25 specifications and the documents required by the BIDDING REQUIREMENTS and CONDITION OF THE CONTRACT SECTIONS.

1.2 BACNET INTEGRATION AND CONTROL POINTS

.1 The BAS contractor is responsible to provide a full and operable system that meets all required specifications and sequences.

.2 The BAS contractor shall provide hard wired control points, sensors and all other components of the system as required to either supplement available BACNet points, or in the absence of a BACNet card make the system completely operable.

.3 Sequences of operation may or may not be achievable through BACNet integration, as not all points required may be available from the unit manufacturer.

.4 Not all equipment in the project has been specified with BACNet cards. The BAS contractor is responsible to review the entirety of the mechanical specification to confirm which equipment is being specified with BACNet integration cards and which equipment will not be provided with BACNet integration.

.5 Quoting or pricing work as BACNet integration only is not acceptable.

1.3 RELATED SECTIONS

.1 This contractor shall review work specified elsewhere in the mechanical specifications to confirm integration methodology:

.1	Sections	Plumbing and Drainage
.2	Sections	Ventilation and Air Conditioning
.3	Sections	Testing and Balancing
.4	Sections	Integrated Automation Systems
.5	Division 26	Electrical

1.4 PRODUCTS FURNISHED BUT NOT INSTALLED BY BAS CONTRACTOR

.1 Refrigerant Piping:

.1 Pressure and Temperature Sensor Wells and Sockets.

.2 Ductwork Accessories:

.1 Automatic Dampers

.2 Airflow Stations

1.5 PRODUCTS INSTALLED BUT NOT FURNISHED BY THE BAS CONTRACTOR

.1 Refrigerant Leak Detection System

.2 Rooftop Air-Handling Equipment:

.1 Thermostats

.2 Duct Static Pressure Sensors

.3 Gas Detection Systems.

.4 Security System.

1.6 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THE BAS CONTRACTOR

.1 Rooftop Air-Handling Equipment:

.1 Discharge Air Temperature Control.

.2 Economizer Control.

.3 Volume Control.

.2 VAV Terminal Units:

.1 Cross-Flow Velocity Sensor.

.2 Damper Control.

1.7 WORK INCLUDED

.1 Provide all labour, materials, products, equipment and services to supply, install and commission the Building Management System, utilizing Direct Digital Control (DDC) and monitoring system with electronic actuation.

.2 Provide all computer hardware and software, operator input/output communication devices, communication units, communication interface to digital system controllers, field sensors and controls as required to meet the specified performance.

.3 Provide all labour, materials, products, equipment and services to supply, install and commission the electronic control and monitoring system to interface with the Owner's Operations Centre under Terminal Service Option communication protocol.

.4 Provide all calibration, commissioning, software programming and data base generation of colour graphics and additional work necessary to provide a complete and fully operating system.

.5 Provide all control wiring in accordance with Electrical Division as necessary to provide a complete and fully operating system as specified in this Section of the Specification.

.6 120 Volt Wiring

.1 New Construction: BAS contractor is responsible to provide and install all 120 volt wiring required for the BAS system from designated junction boxes above electrical panels that have had breakers assigned to "BAS Power." BAS contractor shall review electrical drawings prior to tender. **Any additional breakers or power requirements shall be provided and installed by the electrical contractor at the BAS contractors cost to ensure warranty of the panels.**

.2 Existing Buildings: Provide and install 120 Volt, 20 amp circuits in existing electrical panels as required to power field panels and other devices requiring a main supply from electrical panels. Provide updated, type written panel directories to indicate new breakers.

.3 All wiring shall be to the standards of Division 26.

.7 Obtain Ontario Hydro Permits for work specified in this Section of the Specification and submit final certificates in manual.

.8 Surge transient protection shall be incorporated in design of system to protect electrical components.

.9 Testing, debugging, confirmation of total system operation and owner training on the complete operation of the system and the computer software shall also be provided in this section.

1.8 QUALITY ASSURANCE

.1 Materials and equipment shall be the catalogue products of a single manufacturer regularly engaged in production and Installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

.2 Install system using competent workmen who are fully trained in the installation of temperature control equipment. Single source responsibility of the supplier shall be the complete installation and proper operation of the DDC control system and BAS shall include debugging and proper calibration of each component in the entire system.

1.9 SHOP DRAWINGS

.1 Product Data and Shop Drawings: meet requirements of general conditions on Shop Drawings, Product Data, and Samples. In addition, Contractor shall provide shop drawings or other submittals on all hardware, and installation to be provided. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent.

.2 Submittals shall be provided within 2 weeks of contract award. Submittals shall include:

.1 Direct Digital Control System Hardware:

.1 A complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data.

.2 Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:

.1 Direct Digital Controller (controller panels)

.2 Transducers/Transmitters

.3 Sensors (including accuracy data)

.4 Actuators

.5 Valves

.6 Relays/Switches

.7 Control Panels

.8 Power Supply

.9 Batteries

.10 Operator Interface Equipment

.11 Wiring

.3 Wiring diagrams and layouts for each control panel. Show all termination numbers.

.4 Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware.

.2 Central System Hardware and Software:

.1 A complete bill of material of equipment used, indicating quantity, manufacturer, model number, and other relevant technical data.

.2 Manufacturer's description and technical data, such as product specification sheets and installation/maintenance instructions for the items listed below and other relevant items not listed below:

.1 Central Processing Unit

.2 Power Supply

.3 Battery Backup

.4 Interface Equipment Between CPU and Control Panels

.5 Operating System Software

.6 Operator Interface Software

.7 Color Graphic Software

.8 Third-Party Software

.9 Software License

.3 Schematic diagrams for all control, communication, and power wiring.

.4 Riser diagrams of wiring between central control unit and all control panels.

.5 A list of the color graphic screens to be provided. For each screen, provide a conceptual layout of pictures and data and show or explain which other screens can be directly accessed.

.3 Controlled Systems:

.1 A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.

.2 A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled.

.3 An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.

.4 A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.

.5 A point list for each system controller including both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, and the location of the I/O device. Software flag points, alarm points, etc.

.6 A list of trended points and alarms.

.4 Provide a riser diagram showing the physical location of building control system equipment and the system architecture. DDC controller trunk conductors shall also be shown on a floor plan.

.5 Testing and commissioning plan.

.6 Provide 24 VAC power layout and load calculation for each transformer.

1.10 REFERENCE STANDARDS

.1 Provide electrical material and installation in accordance with the appropriate sections of the current edition of the applicable local codes for signaling systems. Install wiring in conduit or approved totally enclosed raceways. Do not use cable raceways or troughs.

.2 Provide materials and equipment, which are standard components regularly manufactured and guaranteed to be available as regular inventory as replacement parts.

.3 Provide electrical and electronic equipment which is CSA or Ontario Hydro approved where such approvals are required by the regulatory authorities.

.4 Provide ASCII American Standard for Communication and Information Interchange code input/output devices with standard EIA Electronic Industry Association interface.

1.11 DOCUMENTATION – GENERAL

.1 Provide documentation for the BAS before the commencement of acceptance testing.

.2 Provide two (2) sets of operator and programmer manuals to serve the diverse needs of personnel concerned with the operation, and maintenance of the facility.

.3 Provide prior to project completion three (3) sets of maintenance documentation of a standard, which would enable the Owner to undertake planned maintenance, repair, calibration and other adjustments as may be necessary from time to time, on any component provided under this Contract without additional documentation being required and without assistance from others.

1.12 AS BUILT DRAWINGS AND INFORMATION

.1 Upon completion of the work, the BMS Contractor shall submit three (3) copies of all Operating and Maintenance Manuals for equipment and materials supplied, and one set of "As- Built" plans showing reasonably exact routes of all cabling, specifications marked "As-Built", plans and specifications marked "As-Built".

.2 Provide a manual divided into 3 sections describing the following functions:

.1 System Hardware Specification Manual, which provides a functional description of all hardware component installation/configuration with detailed instructions.

.2 System Operator's Manual, which provides concise instructions for operation of each system an explanation recovery route for all system alarms.

.3 System Data Manual, which provides the applications data, programmed into the system including a list of virtual points and a print out of the programs and point labels.

.4 A complete English language description of each control program for each system shall be provided. Clearly identify the function of each point reference used in the program for each system and/or equipment.

.5 Calibrate these points and establish units, limits and alarms;

.6 Incorporate these points in screen displays and reports;

.7 Incorporate these points in software sequences and control loops.

.8 Incorporate these points dynamically in graphic displays.

.9 Modify designation of control and virtual points.

.3 A description of all maintenance procedures for each system's components, including inspection, periodic preventive maintenance, fault diagnosis and repair or replacement of defective module shall be provided. This shall include calibration, maintenance and repair of sensors, transmitters, transducers and panels plus diagnostics and repair or replacement of all system hardware.

.4 Control damper schedules with construction details and dimensions. Identify dampers in accordance with specification and drawings. Dampers shall be identified as parallel or opposed blade, c/w frame style and actuator position.

.5 Valve schedules with construction details calculated, CVs, selected valve CV pressure drops and flows.

.6 Specifications and data sheets for all control system components including relays, switches, thermostats, controllers, dampers, indicators, flow switches, sensors and similar components.

.7 Two (2) copies of all software programs for controlled systems on disk

.8 Revised points list, panel schedule and sequences of operations and all other information submitted with the original shop drawings, reflecting the "as built" condition.

.1 The point list shall consist of the following information:

PHYSICAL POINT IDENTIFIER ON THE DDC	SIGNAL TYPE
POINT TYPE (AI, AO, BI, BO)	TREND / TANTALIZATION
POINT NAME	ALARM
POINT DESCRIPTOR	CALIBRATED
PERIPHERAL DEVICE PART NUMBER	COMMISSIONED
WIRE NUMBER	
COMMENT	

.2 The as-built drawings shall consist of a single page showing the system architecture with BACnet (MSTP & I/P)network numbers, instance and MAC address.

1.13 Units

.1 All equipment and instrumentation shall be graduated in System International (SI) units.

1.14 OWNERSHIP OF PROPRIETARY MATERIALS

.1 All project developed software and documentation shall become property of the owner. These include, but are not limited to:"

.1 Project graphic images

.2 As-built drawings

.3 Project database

.4 Project specific application programming code

.5 All documentation

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS (WRTIER TO EDIT)

.1 The following are the approved Control System Contractors and Manufacturers

Company Name	Product Line	Location	Contact
Siemens	Apogee	Stoney Creek	Jake Rendulic

.2 Notes

.1 The contractor shall use only products from the corresponding manufacturer and product line listed.

.2 The above list of manufacturers applies to operator workstation software, controller software, the custom application program language and controllers.

.3 All other products specified in the Building Automation specifications need not be manufactured by the above manufacturers (i.e. sensors, valves, dampers and actuators)

2.2 DESCRIPTION OF SYSTEM

.1 The BAS shall include control of the following systems as detailed in this Section of the Specification under Sequence of Operation:

.1 FAN PLANT

.1 Air Handling Units.

.2 HVAC Equipment.

.3 Energy Recovery Units.

.2 FLOOR LEVEL CONTROL

.1 VAV Terminal.

.2 Dx Split Systems.

.3 Supply, Return and Exhaust Fans.

.4 Air Conditioning Systems.

.5 Misc. Mechanical and Electrical Room Temperature Control.

.3 OUTDOOR LIGHTING

.4 INDOOR LIGHTING CONTROL

.5 FIRE PANEL MONITORING

.6 SECURITY MONITORING

.7 UTILITY MONITORING

.1 Gas meter monitoring.

.2 Domestic water meter monitoring.

.2 Refer to sequences of operation section for full description of systems.

2.3 LICENSE

.1 The system shall be licensed to the owner.

.2 Provide license for minimum of three years.

2.4 GENERAL SYSTEM REQUIREMENTS

.1 All applications programs shall be pre-engineered and pre-tested.

.1 All the controllers used on the project must use the same programming language, and programs developed for one model of controller must be cross platform transferable to any other model of controller that has sufficient RAM and suitable input/output points.

.2 Temperature control system shall be completely microprocessor based Direct Digital Control (DDC) electrically and /or electronically operated except where otherwise stated. System shall be installed by competent mechanics and electricians regularly employed by the BMS Company. Energy management system shall be an integral part of BMS.

.3 In event of power or system failure, equipment shall fail safe, and heating valves open, dampers closed, cooling off. Provide spring return feature on all valves to ensure this condition. (Exception: valve and damper actuators on radiation, reheat valves, etc.) Floating point valves shall not be accepted. Wax valves shall not be acceptable

.4 All system hardware and associated equipment shall be standard OEM items regularly manufactured for this and/or other systems and not custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use. All electronic circuits shall be self-diagnostic.

.5 Design scope documents establish minimum acceptable system and component capability. They are not all inclusive. All additional construction, equipment, interfaces and software required for a complete and operating systems providing the specified functions are required.

.6 The fire/life safety system (F/LS) shall have priority with respect to control of equipment that is subject to control by both the F/LS and BMS. The BMS Contractor shall coordinate installation of the BMS to ensure that interfacing and connection of BMS to such equipment and H-O-A switches shall not pass or interfere with F/LS operation under either normal mode or failure mode operation of the BMS.

.7 Freeze stats and other safety controls shall have priority with respect to control of equipment that is also controlled by the BMS. Contractor shall co-ordinate installation of the BMS to ensure that interfacing and connections of the BMS and H-O-A switches to such equipment shall not by-pass or interfere with freeze stats or other safety controls.

.8 System shall be fully modular, permitting point expansion by adding computer memory, remote terminal units, or applications software without obsolescence of existing communication or processing equipment.

.1 Provide licences for the software packages normally used by the BMS contractor to create, modify and add programming and graphics to the system. The software shall enable owner to add points to system and to program complex routines. Owner shall be able to add and modify all point information. Owner accessible software shall include:

.1 Direct Digital Control Library.

.2 Report Generation Library.

.3 Energy Management Library.

.4 Graphics Library.

.5 Programming Tool.

.6 Engineering Graphics Tool.

.2 Once programmed, the results may be used to start/stop points, and readjust set points, sequence equipment, report abnormal conditions, etc.

.9 Set points and values given are for initial set-up only. All points shall be adjustable from the operator workstation.

.10 All electrical and electronic components shall be CSA; ULC, UL or Ontario Hydro approved where such approvals are required by the regulatory authorities.

.11 Failure of any Direct Digital Controller Unit (DDC) or its communication link in the system shall not affect the proper operation of the operator workstation or any other Direct Digital Controllers.

.12 If the Host Computer (CPU) or transmission network fails but power to the DDC does not, the DDC shall continue to monitor all changes of state and/or values and shall retain the most recent values. The DDC shall also maintain all analog set points and command positions.

.13 Components shall not require any customizing other than setting of jumpers and switches, adding of firmware modules or software modules or any software programming to perform required functions. System shall be a true distributed processing system without any form of network management device used. All software control functions shall be performed by intelligent field panels and by intelligent unit controllers as appropriate.

2.5 GENERAL MATERIALS REQUIREMENTS

.1 The CPU and peripheral equipment shall operate in the following conditions:

.1	Temperature	15 C to 27 C
.2	Humidity	20% to 80% (non condensing)
.3	Power	120 VAC +/-10%
.4	Frequency	60HZ +/-3HZ
.5	Power factor	0.6 to 1.0

.2 Local field panels and peripheral equipment shall be rated to operate in following conditions:

.1	Temperature	0º C to 50º C
.2	Humidity	10% to 90% RH (non condensing)
.3	Power	120 VAC + 10% on primary side of control transformers and plus or minus 25% of nominal voltage on the secondary side.
.4	Frequency	60 Hz + 3 Hz
.5	Power Factor	0.6 to 1

.3 Controls shall be D.D.C. solid state type as noted elsewhere, and with exception of actuators, contain no moving parts.

.4 Sensor accuracy shall be within 0.6% of maximum range, maximum ± 0.25°C. Mixed air sensors must give a true average across duct cross section.

2.6 GENERAL SYSTEM PERFORMANCE REQUIREMENTS

.1 Comply with the following performance requirements:

.1 Graphic Display: Display graphic with minimum 20 dynamic points with current data within 5 seconds.

.2 Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 5 seconds.

.3 Object Command: Reaction time of less than 5 seconds between operator command of a binary object and device reaction.

.4 Object Scan: Transmit change of state and change of analogue values to control units or workstation within 5 seconds.

.5 Alarm Response Time: Annunciate alarm at workstation within 2 seconds. Multiple workstations must receive alarms within five seconds of each other.

.6 Program Execution Frequency: Programmable controllers shall execute DDC PI control loops, and scan and update process values and outputs at least once per second.

.2 Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

.1 Water Temperature: Plus or minus 0.25°C.

.2 Water Flow: Plus or minus 5% of full scale.

.3 Water Pressure: Plus or minus 2% of full scale.

.4 Space Temperature: Plus or minus 0.25°C.

.5 Ducted Air Temperature: Plus or minus 0.25°C.

.6 Outside Air Temperature: Plus or minus 0.5°C.

.7 Dew Point Temperature: Plus or minus 0.75°C.

.8 Temperature Differential: Plus or minus 0.25°C.

.9 Relative Humidity: Plus or minus 2%.

.10 Airflow (Pressurized Spaces): Plus or minus 3% of full scale.

.11 Airflow (Measuring Stations): Plus or minus 5% of full scale.

.12 Airflow (Terminal): Plus or minus 10% of full scale.

.13 Air Pressure (Space): Plus or minus 0.01-inch wg.

.14 Air Pressure (Ducts): Plus or minus 0.1-inch wg.

.15 Carbon Monoxide: Plus or minus 5% of reading.

.16 Carbon Dioxide: Plus or minus 50 ppm.

.17 Electrical: Plus or minus 5% of reading.

Part 3 Execution

3.1 EXAMINATION

.1 The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/consultant for resolution before rough-in work is started.

.2 The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the consultant for resolution before rough-in work is started.

.3 The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate-or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others-the contractor shall report these discrepancies to the consultant and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by-and at the expense of-this contractor.

3.2 A2L REFRIGERANT CONTAINING EQUIPMENT

.1 A2L refrigerants are classified as mildly flammable. CSA B52-2023 has specific safety clauses related to the use of refrigerants with this classification within buildings.

.2 This contractor shall be responsible to ensure that the installation requirements of CSA B52-2023 are met.

.3 Throughout this specification various pieces of equipment have been specified with refrigerant leak detection systems. Field wiring of the alarm status of this system to various downstream system components is required under Annex P of the standard and is the responsibility of this contractor. These devices include the following:

.1 Open all zone dampers connected to the affected system.

.2 Disable electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves on the affected refrigeration systems

.4 De-energize any potential sources of ignition with the ductwork system of the affected system.

.5 Energize fans within the ductwork system.

.6 Activate any designated refrigeration leak ventilation systems.

3.3 VERIFICATION OF REFRIGERATION LEAK DETECTION SYSTEM OPERATION

.1 The commissioning process shall include the verification of the refrigeration leak detection system.

.2 All interlocks between leak detection systems installed and system components, as well as interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52. Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

3.4 PROTECTION

.1 The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

.2 The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.5 INSTALLATION

.1 Install all equipment, accessories, conduit and interconnecting wiring in a neat and protected manner by skilled and qualified work persons using the latest standard practices of the industry.

.2 Meet Owner's requirements.

.3 Cooperate with the air and water balance technicians during the balancing of the system.

.4 Trip test high and low temperature protection devices to ensure satisfactory operation, in the presence of the Owner.

.5 Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.

.6 Notify Consultant in writing of any conflict between these Specifications and manufacturer's instructions.

.7 Install equipment so as to allow for easy maintenance access and such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.

.8 Shield and ground communication trunk wiring at a single end.

.9 Do not splice trunk line.

.10 Provide complete installation, testing, debugging and interfacing of specified software.

3.6 LABELLING

.1 Provide engraved black and white Lamicoid plastic nameplates, 25 x 65 mm minimum at all duct mounted instruments, reset controls, thermometers and panels so as to clearly indicate service of particular device. All manual switches unless they come with standard nameplate shall be similarly labeled.

3.7 NAMING

.1 Object and Point Naming

.1 All BACnet objects and points programmed under these specifications, shall conform to the following case sensitive convention:

.1 First group of characters = Building Unique Identifier (Enterprise systems only)

.2 Second group of characters = Network number

.3 Third group of characters = Device number

.4 Fourth group of characters = Controller / Equipment Identifier

.5 Last segment = Point name abbreviation

.2 Example: S1156_2_15_HP10_RmTemp

.3 Object name segment shall be delimited by (_) character, however, must be consistent by Vendor across all owner sites

.2 Controller and Device Addressing and Naming

.1 Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

.2 Device Instance

.1 First group of characters = Building Unique Identifier (Enterprise systems only)

.2 Second group of characters = Network number

.3 Third group of characters = Device number

.4 Fourth group of characters = Controller / Equipment Identifier

.5 Example: S1156_2_15_HP10

.3 BACnet Network Number

.1 First group of characters = Building Unique Identifier (Enterprise systems only)

.2 Second group of characters = Network number

.3 Third group of characters = Network and Type

.4 Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

.4 MAC Addresses

.1 B-BC

.2 Maintenance Connection

.3 Reserved

.4 -127. Master Range

.5 128.– 254. Slave Range

.6 255. Broadcast

.5 Object name segment shall be delimited by (_) character, however, must be consistent by Vendor across all owner sites

.3 Controller and Equipment identifiers shall match the standard adopted within the owner's enterprise level network. In the case of no enterprise level network or owner standard identifiers shall match the drawings.

3.8 COORDINATION

.1 Site

.1 Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.

.2 Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

.2 Submittals. Refer to the "Submittals" article in Part 1 of this specification for requirements.

.3 Test and Balance

.1 The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

.2 The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.

.3 In addition, the contractor shall provide a qualified technician to assist in the test and balance process.

.4 The tools used during the test and balance process will be returned at the completion of the testing and balancing.

.5 During the system testing and balancing by an independent agency fully demonstrate the operation of all sensors, dampers, actuators, controls, valves, etc. This contractor shall be present during the testing and balancing and make adjustments as often as necessary to satisfy the testing and balancing agency.

.4 Commissioning

.1 This contractor shall work with the commissioning agent to demonstrate the operation of all systems.

.5 Life Safety

.1 Duct smoke detectors required for air handler shutdown are supplied under the electrical specifications. The electrical contractor shall interlock smoke detectors to air handlers for shutdown as described in Part 3, “Sequences of Operation.”

.2 Smoke dampers and actuators required for duct smoke isolation are provided under mechanical section. The contractor shall interlock these dampers to the air handlers as described in Part 3, “Sequences of Operation.”

.3 Fire/smoke dampers and actuators required for fire rated walls are provided under another Section of mechanical section. Control of these dampers shall be by electrical. The contractor shall monitor the position of these dampers.

.6 Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

.1 All communication media and equipment shall be provided as specified in Part 2, “Communication” of this specification.

.2 Each supplier of a controls product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this section.

.3 The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

.4 The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.

.5 The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.9 ACCEPTANCE TESTING

.1 Upon completion of the system control contractor will request, in writing, to the Engineer and Owner that the acceptance procedures can commence.

.2 After installation forward submittal data relevant to point index, functions, limits, sequences, interlocks, software routines and associated parameters and other pertinent information for the operating system and data base to the Owners authorized representative. Enter software into the central computer and debug.

.3 Prior to on-line operation perform a complete demonstration and readout of the computer real-time responsibilities of surveillance and command in the presence of the Owner's authorized representative.

.4 Adjust all devices and components to ensure that the operations are performed correctly and that all analog values are displays to the accuracy specified. Check all alarms, start/stop and status conditions to ensure proper operation.

.5 Upon successful completion of on-line operation provide the Owner's authorized representative with written confirmation, inspection and approval of the satisfactory operation of the building automation system.

.6 Complete all outstanding deficiencies as determined by the Owner's representative in his inspection report, after which a resubmission of formal acceptance shall be made. Repeat this procedure, if necessary, until acceptable performance has been established.

3.10 CONTROL SYSTEM CHECKOUT AND TESTING BY BAS CONTRACTOR

.1 Start-up Testing: All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. Submit test worksheets to the consultant. This testing shall be completed before the owner's representative is notified of the system demonstration.

.1 The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

.2 Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

.3 Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.

.4 Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are rect.

.5 Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

.6 Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum start/stop routines.

.7 Alarms and Interlocks:

.1 Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

.2 Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

.3 Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

.2 Submit copies of test sheets to the consultant and include in as-built information.

3.11 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

.1 Verify to the Owner's Representative and Architect/Engineer in letter form that supplier has in place support facility. Letter shall show location of support facility, name and titles of technical staff, engineers, supervisors, fitters, electricians, managers and all other personnel responsible for the completion of the work on this project.

.2 Demonstration

.1 Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.

.2 The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the “Control System Checkout and Testing” article in Part 3 of this specification. The consultant will be present to observe and review these tests. The consultant shall be notified at least 10 days in advance of the start of the testing procedures.

.3 The demonstration process shall follow that approved in Part 1, “Submittals.” The approved checklists and forms shall be completed for all systems as part of the demonstration.

.4 The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

.5 As each control input and output is checked, a log shall be completed showing the date, technician’s initials, and any corrective action taken or needed.

.6 Demonstrate compliance with Part 1, “System Performance.”

.7 Demonstrate compliance with sequences of operation through all modes of operation.

.8 Manually generate an alarm at a remote DDC Controller as selected by the Architect/Engineer to demonstrate the capability of the workstation and alarm printer to receive alarms within 5 seconds.

.9 Disconnect an operator workstation in the central control room and manually generate an alarm at a remote DDC Controller to demonstrate the capability of the system printer to receive alarms when the workstation is disconnected from the system.

.10 Disconnect one DDC Controller from the network to demonstrate that a single device failure shall not disrupt or halt peer to peer communication. Panel to be disconnected shall be selected by the Architect/Engineer.

.11 At an ASC of the Architect/Engineer's choice, disconnect the LAN connection to demonstrate its lack of reliance on a DDC Controller to maintain full control functionality.

.12 Demonstrate complete operation of operator interface.

.13 Additionally, the following items shall be demonstrated:

.1 DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

.2 Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.

.3 Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

.4 Interface to the building fire alarm system.

.5 Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/consultant. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

.14 Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

.3 Acceptance

.1 All tests described in this specification shall have been performed to the satisfaction of both the consultant and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the consultant. Such tests shall then be performed as part of the warranty.

3.12 TRAINING

.1 The Contractor shall provide a competent instructor to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed, rather than a general training course.

.2 Provide 16 hours of training for Owner's operating personnel. Training shall include:

.1 Explanation of drawings, operations and maintenance manuals

.2 Walk-through of the job to locate control components

.3 DDC Controller

.4 Explanation of adjustment, calibration and replacement procedures

.5 Review of Operator Work Station Functions (set point adjustment, scheduling etc.)

.3 Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If such training is required by the Owner, it will be contracted at a later date. Provide description of available local and factory customer training.

3.13 WARRANTY AND SERVICE

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warrant in writing, all provided equipment, accessories, installations, software, and firmware against defects in workmanship and materials for a period of one year commencing from the date of issue of the Certificate of Substantial Performance.

.4 Maintain the affected parts operational during repair of defective equipment covered by the warranty.

.5 Provide warranty service at no cost to the owner for the guarantee period, this shall include, but not limited to the following:

.1 Repair service on hour basis during warranty. Provide emergency service where malfunction would result in property damage. If not emergency, respond to site within 24 hours and resolve issue within three (3) days.

.2 Replacing defective parts and components as required.

.3 Servicing by factory trained and employed service representatives of system manufacture.

.6 Supplier shall have an in-place support facility within 100 km of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

.7 Provide all labour, associated travel and expenses, materials, and equipment necessary for the successful operation of this system for a period of 12 months from the date of Ready for Takeover.

.8 In addition, provide three (3) visits for testing and evaluating the performance of the hardware and software installed per this specification, to be coordinated with the owner's Building Automation Manager. One visit shall be during the cooling season, one visit shall be during the heating season, and one visit shall be during a shoulder season, either spring or fall. Provide a written report after each visit is complete. This service visit shall include, but not be limited to, the following:

.1 Check calibration and re-calibrate if needed instrumentation sensors for air flow, liquid flow, pressure, humidity, temperature, and transducers. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

.2 Check the operation of dampers and damper actuators to assure no lock up has occurred and stroke is proper. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

.3 Check the overall system field operations by performing a review of all points. Verify that all monitoring and command points are valid and active. Written records shall be kept indicating the performance of such exercises.

.9 If a problem develops at any time during the warranty/service period, the affected BAS point/object shall be monitored and logged for the remainder of the warranty/service period. "A problem" in the above statement will refer to an incident in which any of the following occur:

.1 An alarm occurs due to a defective control system component(s), improper installation or programming.

.2 Overall performance of the system is compromised due to a defective control component(s), improper installation or programming.

.3 Major recalibration (by greater than 5 times the catalogued accuracy) is required for a sensor during one of the service visits.

.4 Changes required to meet design, compliance, and functionality, that were not part of the Demonstration and Acceptance process, will be made at no cost to the Owner.

.5 Any changes to programming, inclusive of but not limited to set-points, schedules, sequences, alarms, history, network addressing, object naming, etc.

.10 Run all diagnostics and correct all previously diagnosed problems.

.11 Resolve and correct any previous outstanding problems.

.12 Software: Provide all software updates and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation.

.13 Warranty Coverage:

.1 Applies to parts and labour.

3.14 WARNING LABELS

.1 Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.

.1 Labels shall use white lettering (12-point type or larger) on a red background.

.2 Warning labels shall read as follows:

CAUTION

"Operating under automatic control". "Switch disconnect to "Off" position before servicing".

.2 Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

.1 Labels shall use white lettering (12-point type or larger) on a red background.

.2 Warning labels shall read as follows:

CAUTION

"Fed from more than one power source".

3.15 CLEANING

.1 The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

.2 At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

.3 At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

.4 All equipment shall be cleaned, including interior and exterior surfaces at completion of the work.

END OF SECTION

Part 1 General

1.1 SYSTEM ARCHITECTURE DESCRIPTION

.1 All devices supplied under this specification, excluding sensors, shall be connected to the site LAN and shall communicate natively using the following BACnet/IP, BACnet MS/TP, Peer to Peer, or Ethernet (ISO 8802-3), as defined in the ANSI/ASHRAE Standard 135, latest or Peer-to-Peer using Niagara's Fox Protocol or SNMP.

.2 The network architecture shall consist of multiple levels for communication efficiency:

.1 A management level ethernet network based on BACNet IP protocol with other standardized protocols, such as web serices, html, JAVA, SOAP, XML, etc. to transmit data t non-BAS software applications and databases. The BAS Server and Operator workstation shall reside on this level of the network.

.2 Building level ethernet network based on BACNet IP protocol. This network shall connect the building controllers to the BAS Server and Operator Workstation. Controllers for central plant equipment and large infrastructure shall reside on this network.

.3 A floor level network will connect all DDC controlled terminal heating and cooling equipment on a floor or in a system that is controlled by Advanced Application or Application Specific Controllers. Devices on this network shall be connected to a router that connects to the building level ethernet network. A router will be provided for each subnetwork and be cable of handling all of the BACNet interoperability building blocks that are listed for the controllers that reside on the network. This network shall be based on the following communications protocol:

.1 BACNet IP

.3 Program data-bases, data acquisition, and all control sequence logic shall reside in the respective controller. Each device shall, to the greatest extent possible, perform its programmed sequence. Operation of each device shall not be dependent on a connection to a server or master controller.

.4 Mechanical and Electrical Systems i.e., VFD's, chillers, boilers, unitary equipment, etc. units that are equipped with manufacturers furnished controls shall be BTL certified. Gateways are not to be used unless prior written approval has been acquired. A single controller can be used in combination with the manufacturer supplied controls, only where the manufacturer's controls are unable to meet the functional intent.

.5 The use of multiple application controllers used to control a single piece of equipment is strictly prohibited, except those specifically noted.

.6 The network shall permit the automatic transferring of all point values from one controller to the other on a planned, prioritized basis. The transfer of point values shall be performed directly between controllers. Systems that relay on a control, network, master or gateway controllers to perform these functions are not acceptable.

.7 Controller firmware must be flash upgradeable over the network.

1.2 NETWORK TOPOLOGY

.1 Management/Enterprise Level Network

.1 A single ethernet connection shall be provided on site for a controller to reside on the owner's VLAN. This controller shall interface to the owner's existing Management Level Network/Enterprise level server.

.2 Contractor shall connect the operator work station to the Building Level Network.

.2 Building Level Network

.1 Each building level controller shall be provided with a homerun ethernet connection to the building level controller that interfaces to the Management Level Network.

.2 Each building level controller shall be provided with a homerun ethernet connection to the nearest owner provided network switch. The controller shall reside on the owners LAN/VLAN. This contractor is responsible for all wiring to the network switch.

.3 Each building level controller shall be provided with a homerun ethernet connection to the nearest owner provided network switch. The controller shall reside on the owners LAN/VLAN. The data wiring contractor shall provide a network drop in the vicinity of each building level controller.

.3 Floor Level Network

.1 BACNet IP Network:

.1 Ring Topology shall be used.

.2 Daisy Chain Topology shall be used.

.3 Star Topology shall be used

.2 This contractor shall provide all network infrastructure, switches etc. to enable this topology.

.3 BACNet MS/TP Networks: Daisy Chain

1.3 WIRING RESPONSIBILITY OF THIS CONTRACTOR

.1 This contractor is responsible for the following wiring:

.1 All 120V wiring associated with control device power and line voltage control devices, including, but not limited to actuators, line voltage thermostats etc.

.2 All low voltage electrical wiring between sensors, starters, etc. and control device input and output wiring as required to provide a complete and operable system.

.3 All raceways, boxes, cables, circuit breakers, grounding, relays, motors, starters and wirings from existing panel boards or switchgear through splitters, starters and field disconnect switches to complete power supply required for equipment supplied under this Contract not indicated on the electrical plans and specifications.

1.4 PERMITS, INSPECTIONS AND TESTING

.1 Contractor will arrange for submission to the Electrical Safety Authority (ESA) for review of this project and pay all associated fees. Provide Certificate(s) of Acceptance from ESA and other Authorities having jurisdiction upon completion of the Work.

.2 Where modification to mechanical or electrical equipment control wiring is necessary to meet the requirements of the specifications, the contractor is responsible for arranging any testing required by the Authority Having Jurisdiction to maintain the required certification and ensure the safe operation of the equipment modified.

Part 2 Products

2.1 GENERAL

.1 All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

2.2 BACnet ETHERNET COMMUNICATION CABLING

.1 Data cable shall Category 6 or better Ethernet cable.

.2 Data cable shall be four twisted pair 24 AWG solid copper, Plenum Rated FT-6 / CMP or Riser Rated FT-4 / CMR (as required by local codes) unshielded twisted cable meeting EIA / TIA 568B.1 Category 5e classification.

.3 The maximum cable length for each run shall be limited to 90 meters.

.4 All cables must be Power Sum accepted and recognized by the manufacturer.

.5 Cable Skew must be specified as 20Ns or less per 100 meters.

.6 Cables must display the manufacturer's stamp stating that the cable is included in the latest UL verified publication for respective Category standards.

.7 Cables shall be rated for installation in return air plenums (where allowed in this specification).

.8 Cables shall be colored to match owner's BAS standard. If owner does not have a standard a different color than the data contractor shall be used.

2.3 120 VOLT WIRING

.1 This contractor is responsible to provide all of their own power wiring, including 120V to transformers. Wiring shall meet the requirements of the Electrical Division specifications.

2.4 LOW VOLTAGE AND CONTROL WIRING

.1 Minimum #20 AWG stranded copper conductors (larger gauge wire/cable shall be provided where required by BAS equipment and where applications warrant (e.g. rated load, long runs, etc.).

.2 Wire type used for MSTP, RS-485 twisted pair communications must be balanced twisted pair with 100 to 120 Ohms Characteristic Impedance. The wire shall be less than 30 pF per foot, and preferred 20 AWG or lower. A shield wire shall be included for ground connection.

.3 All BMS input/output point wire/cable and communication cable shall be shielded.

.4 Non-shielded cables may be approved for BAS input and output field point wiring following certification from the BAS manufacturer that non-shielded cables will function satisfactorily for the life of the building and that the use of non-shielded cables will not negatively affect other building systems/cabling.

.5 The manufacturers certification shall guarantee to the Board that should it be determined that BAS system performance is negatively affected or another building system or equipment is negatively affected due to the non-shielded cable, the BAS manufacturer shall replace the cable at no cost to the Board.

.6 Provide FT-6 rated cable where cable is run free air.

2.5 POWER SUPPLIES AND LINE FILTERING

.1 Control transformers shall be ULC listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

.1 DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.

.1 Unit shall operate between 0^0C and 50^0C (32^0F and 120^0F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.

.2 Line voltage units shall be UL recognized and CSA approved.

.2 Power line filtering.

.1 Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:

.1 Dielectric strength of 1000 volts minimum

.2 Response time of 10 nanoseconds or less

.3 Transverse mode noise attenuation of 65 dB or greater

.4 Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

.3 Battery Backup with Surge Protection.

.1 Provide a battery backup unit with surge protection on the supply to the Supervisory Controller with a minimum capacity of 1000 Volt-amps.

Part 3 Execution

3.1 GENERAL WORKMANSHIP

.1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

.2 Install wiring in EMT conduit in exposed areas and drops in walls. Comply with all requirements of Electrical Division.

.3 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

.4 Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

.5 Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with National Electric Code (NFPA 70), CSA C22.2 and latest NEMA standards, FCC, and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

.6 All materials must be CSA and NEMA approved. Where this is not possible, arrange and pay for unconditional Electrical Safety Authority approval.

.7 Follow manufacturer recommendations for installation of all wiring

.8 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

.9 Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

.10 Free air cabling installed in non-combustible rated buildings shall be fire rated cable with a minimum rating of FT-6.

.11 Wiring located in combustible rated buildings above T-bar ceiling shall be run in free air using fire rated cable with a minimum rating of FT-6.

.12 Note: all free air cabling used in combustible rated buildings to interface to security or fire alarm systems shall be FT-6 rated.

.13 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

.14 Cables be installed in bundles resting in a cabling support system (J-hooks) where provided by the Electrical Division.

.15 Cable supports shall be attached to the wall or ceiling of the area they are running through. Cable supports shall not be attached to:

- .1 Electrical raceways,
- .2 Duct work,
- .3 Ceiling suspension systems,
- .4 Piping,
- .5 Wilson joists.

.6 All wire/cable terminations shall be made at screw type terminal strips. Wire nut terminations and butt splices shall not be acceptable. Wiring runs shall be continuous runs without splices.

.16 All BAS equipment and components shall be grounded to building ground facilities.

.17 BAS shall only be capable of controlling electric motors when the associated hand/off/auto (HOA) motor control switches are in the "auto" position. BAS control shall be wired into the auto circuit of the hand/off/auto motor control circuit only. Where hand/off/auto switches do not exist they shall be provided by the Controls Contractor.

.18 Life safety and equipment protection interlocks shall be wired to override equipment whenever it is in operation.

.19 Existing interlocks and override control should typically not be removed or overridden by the application of new BAS control without the specific instruction and/or approval of the Owner.

.20 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

.21 Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).

.22 Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

.23 Adhere to this specification’s Electrical Division requirements where raceway crosses building expansion joints.

.24 Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

.25 Size of raceway and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.

.26 All wiring in mechanical, electrical, or service rooms-or where subject to mechanical damage- shall be installed in raceway at levels below 3 m (loft).

.27 Include one pull string in each raceway 2.5 cm (1 in.) or larger.

.28 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

3.2 ETHERNET WIRING

.1 Cabling shall be installed as continuous links, including shielding. Field splices are strictly prohibited.

.2 Network installation shall strictly adhere to the manufacturer’s network installation instructions and procedures.

.3 Data cabling shall be run separately from power and signal wiring

.4 Network installation shall conform to standards for the LAN types and cabling types selected. Specific network rules inherent to the ANSI/AHRAE Standard 135, latest will be followed. Those include but are not limited to:

.1 The maximum length and cabling type of an MS/TP segment shall be in accordance with manufacturers specifications and shall comply with EIA-485.

.2 Each internetwork LAN must have a unique Network Number (1 - 65,545).

.3 The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard.

.5 Primary LAN Network wire and cable shall be run separately from all other wiring.

.6 Other LAN Network wire and cabling shall be installed separate from any wiring over thirty (30) volts.

.7 All communications shielding shall be grounded as per Networked System manufacturer's recommendations.

3.3 120 VOLT WIRING

.1 All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to NEC and the Electrical Division requirements.

.2 Power wiring for all enclosures and equipment, including branch circuit wiring from circuit breaker panels shall be the responsibility of the System Contractor unless specifically shown on the Plans or Specifications.

.3 The Building Controller panel shall be served from isolated ground receptacle via UPS by dedicated branch circuits.

.4 Power shall NOT be obtained by tapping into miscellaneous circuit that could inadvertently be switched off.

.5 Power for controls equipment shall be from a dedicated circuit. Where a controller is dedicated to controlling a single piece of equipment, power may be obtained directly from that equipment.

.6 All other enclosures, sensor and control devices shall be fed from separate circuits in the electrical distribution panels and shall not be served from the typical floor receptacle or lighting circuits.

3.4 LOW-VOLTAGE ELECTRICAL AND CONTROL WIRING

.1 All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.)

.2 Cabling shall be installed as continuous links, including shielding. Field splices are strictly prohibited.

.3 Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

.4 All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

.5 Maximum allowable voltage for control wiring shall be 120-volts.

3.5 POWER CONDITIONING

.1 Provide integral or supplementary power conditioning equipment for all BAS hardware so as to ensure that power line noise or electrical spikes, noise, bursts, sags or surges shall not damage equipment or software or cause erroneous computations.

3.6 IDENTIFICATION OF HARDWARE AND WIRING

.1 All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.

.2 The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

.3 Permanently label or code each point of field terminal strips to show the instrument or item served.

.4 Identify control panels with minimum 1 cm (1/2 in.) letters on laminated plastic nameplates.

.5 Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

.6 Identify room sensors relating to terminal box or valves with nameplates.

.7 Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

.8 Identifiers shall match as-built documents.

.9 Ethernet cabling shall be a separate color than the building data cabling and be labelled as BUILDING AUTOMATION SYSTEM at 20 foot intervals.

END OF SECTION

Part 1 General

1.1 Not Used.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURER

.1 Operator software shall be matched to the Building Automation System supplier.

2.2 BUILDING AUTOMATION SYSTEM SERVER AND OPERATOR WORKSTATION HARDWARE

.1 The owner shall provide the operator workstation. Software shall be compatible with 64 bit Windows operating systems.

.2 Install all software necessary to permit the operator to create, modify, delete, file and recall all graphics. The package shall encompass all graphics, control, control schematics and wiring details for all points and systems contained in the Input/output Point Summary. Provide a separate, valid license, complete with manuals, disks, and documentation for the graphics engineering software. Provide a separate valid license for of the software necessary to view the graphics with each Operator Workstation,

.3 Set up an icon on the desktop to take the Owner directly to the BAS system login page.

.4 Provide a copy of the software (or all software's if there are multiple) used to program and download sequences to controllers.

.5 Provide a backup of the all of the programs used in the system for storage by the Owner.

2.3 OPERATOR WORKSTATION SOFTWARE - GENERAL

.1 Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation.

.2 Operator workstation interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software.

.3 Interface software shall simultaneously communicate with and share data between any combination of dedicated, modem autodial, and Ethernet-connected building level networks. The software shall provide, as a minimum, the following functionality:

.1 Real-time graphical viewing and control of the BAS environment.

.2 Reporting of real time and historical information.

.3 Scheduling and override of building operations.

.4 Collection and analysis of historical data.

.5 Point database editing, storage, and downloading of controller databases. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.

.6 The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.

.7 Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system.

.8 Alarm reporting, routing, messaging, and acknowledgment.

.9 "Collapsible tree," dynamic system architecture diagram application:

.1 Showing the real-time status and definition details of all workstations and devices on an enterprise level network.

.2 Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level.

.3 Showing the status and definition details of all field-level application controllers.

.10 Definition and construction of dynamic colour graphic displays.

.11 Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.

.12 On-screen access to User Documentation, via online help or PDF-format electronic file.

.13 Automatic and manual database backup at the workstation for database changes initiated at DDC Controller operator interface terminals.

.1 Backups shall produce a configuration file that contains pertinent details regarding the specific backup. This log file shall be created each time a backup is run and be stored in the backup directory.

.2 Restore dialog box shall list detailed information to facilitate the restore of the correct database.

.3 Ability to restore selected components of a backup.

.4 Delete old backup directories automatically or individually from a detailed list.

.14 Provide automatic backup and restore of all DDC controller and HVAC Mechanical Equipment controller databases on the workstation hard disk.

.15 Display dynamic trend data graphical plot.

.1 Must be able to run multiple plots simultaneously.

.2 Each plot must be capable of supporting 10 pts/plot minimum.

.3 Must be able to plot both real-time and historical trend data.

.4 Must be able to plot real time data without prior configuration.

.16 Program editing.

.17 Transfer trend data to 3rd party spreadsheet software.

.18 Scheduling reports.

.19 Operator Activity Log.

.20 Open communications via BACnet Client & Server option.

.21 Tracking of supervised objects.

.22 A colour graphics application to build and edit graphics.

.23 Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):

.1 Dynamic colour graphics application.

.2 Alarm management application.

.3 Scheduling application.

.4 Dynamic trend graph data plotter application.

.5 Dynamic system architecture diagram application.

.6 Control Program and Point database editing applications.

.7 Reporting applications.

.8 Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.

.4 Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information

2.4 CLIENT SERVER CONNECTIVITY

.1 Client sessions must be allowed to run on the server and on other devices connected to the server via Intranet, Extranet, or Internet connections.

.2 Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the owner as required to support remote access features.

.3 The following client options must be supported:

.1 Installed Client.

.1 Software application installed from installation media on to the client machine.

.2 Installed client software must be configurable to allow it to run in a Closed Mode such that the BAS software can lock down the client machine and prevent users without permission from minimizing the application or running other Windows applications that might cover the BAS software interface.

.3 Communication between the server and Installed Clients must be monitored so that any break in communication between the server and an installed client results in notification at the Server and Installed Client machine

.4 Installed client machines communicate directly with the BAS server.

.2 Web Client.

.1 Software that runs in a browser on the client machine as a Full Trust client application.

.2 Connected to the BAS software server via Microsoft IIS Server.

.3 Windows App.

.1 Software application downloaded from the BAS server to run on the client machine like an installed application.

.2 Application must be automatically updated whenever new apps are available at the server.

.3 Connected to the BAS software server via Microsoft IIS Server.

.4 Each of the client options shall provide the same functionalities including operation and configuration capabilities.

2.5 CERTIFICATIONS AND APPROVALS

.1 BAS software shall have been tested against the following norms and standards:

.1 BACnet Revision 1.13, certified by BACnet Testing Laboratory as BACnet Advanced Workstation Software (BTL B-AWS).

.2 IT security compliant with the ISA-99/IEC 62443 Security Level: SL1.

.3 OPC DA V2.05a and V3.0 Server, certified by the OPC Foundation certification program.

.4 UL-listed to UL864 9th edition Standard for Control Units and Accessories (when installed on a UL-approved computer).

2.6 ACCESS RIGHTS AND USER PRIVELEGES

.1 Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows user account as a foundation.

.2 The workstation software shall also include an application to track the actions of each individual operator, such as alarm acknowledgement, point commanding, schedule overriding, database editing, and logon/logoff. The application shall list each of the actions in a tabular format and shall have sorting capabilities based on parameters such as ascending or descending time of the action, or name of the object on which the action was performed. The application shall also allow querying based on object name, operator, action, or time range.

2.7 WORKSTATION APPLICATION EDITORS

.1 Each PC system shall support editing of all system applications. Provide editors for each application at the workstation. The applications shall be downloaded and executed at one or more of the controller panels.

.1 Colour Graphics Application. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.

.2 Scheduling Application. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable from this master schedule. Schedules shall be easy to copy to other objects and/or dates.

.3 Custom Application Programming Application: Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.

2.8 DYNAMIC COLOUR GRAPHICS APPLICATION

.1 Must include graphic editing and modifying capabilities.

.2 Graphics shall be available with the same look and functionality whether they are displayed at an installed client workstation or via browser interface.

.3 User shall be able to add/delete/modify system graphics for floor plan displays and system schematics for each piece of mechanical equipment from the standard user interface without need for specialized tools.

.4 Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.

.5 A library of standard control application graphics and symbols must be included. A library of minimum 400 symbols will be provided consisting of common systems, including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams, piping and laboratory symbols.

.6 In the development of a graphic picture, the graphics software shall support all operator actions necessary to:

.1 Define the background;

.2 Establish colours;

.3 Locate, orient and size the symbols;

.4 Position and edit alphanumeric descriptors;

.5 Establish connecting lines;

.6 Establish sources of real time data and location of their readouts.

.7 The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.

.8 The Graphics application shall be capable of automatically assigning the appropriate symbol for an object (point) selected to be displayed on the graphic based on what the object represents (fan, duct sensor, damper, etc.) when the object is placed on a graphic. The user shall be able to override the assigned symbol if desired.

.9 User shall be able to add custom symbols to the symbol library.

.10 Software shall permit the importing of AutoCAD or scanned pictures for use in graphics.

.11 Must be able to command points directly off graphics application.

.12 Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks. At a minimum animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed. Animation shall also indicate the priority and alarm status of the point.

.13 Animation status indicators shall give you a quick visual indication of a point's value, priority, or status in the form of an icon.

.14 Software shall provide animation that depicts movement of mechanical equipment, or air or fluid flow.

.15 Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure or view recently opened graphics through a backward and forward paging.

.16 Graphics viewing shall include dynamic pan and zoom capabilities.

.17 Graphics viewing shall include the ability to switch between multiple layers with different information on each layer.

.18 Graphics shall include a decluttering capability that allows layers to be programmatically hidden and displayed based on zoom level.

.19 The software must provide the ability to create dashboard views consisting of gauges and charts that graphically display system and/or energy performance.

.20 Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls, etc.), Internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

.21 Colours shall be used to indicate status and change as the status of the equipment changes. The state colours shall be user definable.

.22 The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands.

2.9 REPORTS

.1 Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archivable on the hard disk for historical reporting. Provide the ability for the operator to obtain real-time logs of all objects by type or status (e.g., alarm, lockout, normal). Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications, including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer and shall be set to be printed either on operator command or at a specific time each day.

.2 Provide ability for the owner to readily customize these reports:

- .1 All Objects: All system (or subsystem) objects and their current values.
- .2 Alarm Summary: All current alarms (except those in alarm lockout).
- .3 Disabled Objects: All objects that are disabled.
- .4 Alarm Lockout Objects: All objects in alarm lockout (whether manual or automatic).
- .5 Alarm Lockout Objects in Alarm: All objects in alarm lockout that are currently in alarm.
- .6 Logs:
  - .1 Alarm History
  - .2 System Messages
  - .3 System Events
  - .4 Trends

.3 Custom Reports. Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.

.4 Override Reports. Provide a monthly report showing the daily total time in hours that each system has requested after-hours HVAC and lighting services. Provide an annual summary report that shows the override usage on a monthly basis.

.5 Reports shall be generated on demand or via pre-defined schedule, and directed to displays, printers, or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:

.1 A general listing of all or selected points in the network.

.2 A status report showing present value and alarm status.

.3 List of all points currently in alarm.

.4 List of all points currently in override status.

.5 List of all disabled points.

.6 List of all points currently locked out.

.7 List of user accounts and access levels.

.8 List all weekly schedules and events.

.9 List of holiday programming.

.10 List of control limits and dead bands.

.11 Custom reports from 3rd party software.

.12 System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points.

.13 List of programs.

.14 List of point definitions.

.15 List of logical point groups.

.16 List of alarm strategy definitions.

.17 List of DDC Control panels.

.18 Point totalization report.

.19 Point Trend data listings.

.20 Initial Values report.

.21 User activity report.

2.10 SCHEDULING AND OVERRIDE

.1 The software shall provide a calendar type format for simplification of time and date scheduling and overrides of building operations.

.2 The software shall support the definition of BACnet schedules that are defined at the workstation and are downloaded to Building Controller to ensure time equipment scheduling when PC is off-line, such that the operating software is not required to execute time scheduling. The software must provide the following capabilities for BACnet scheduling capabilities as a minimum:

.1 Fully support all BACnet Schedule, Calendar, and Command objects.

.2 Daily and Weekly schedules.

.3 Ability to combine multiple points into a logical Command Groups for ease of scheduling (e.g., all Building 1 lights).

.4 Ability to schedule for a minimum of up to ten (10) years in advance.

.3 The software shall support the definition of schedules that are configured and executed to run at the workstation, to support scheduling of workstation software activities and to support field systems that do not include internal scheduling mechanisms. The software must provide the following capabilities for BACnet scheduling capabilities as a minimum:

.1 Schedule predefined reports.

.2 Schedule Trend collections.

.3 Schedule automated system backups.

.4 Schedule commands to be sent to field panels.

.5 Daily and weekly schedules.

.6 Setting up and executing Holiday schedules.

.7 Ability to combine multiple points into a logical Command Groups for ease of scheduling (e.g., all Building 1 lights).

.8 Ability to schedule for a minimum of up to ten (10) years in advance.

.4 The software shall support the definition of Schedules Objects that are defined at the workstation and are downloaded to Building Controller to ensure time equipment scheduling when PC is off-line, such that the operating software is not required to execute time scheduling The software must provide the following capabilities for BACnet scheduling capabilities as a minimum:

.1 Equipment schedule Zones.

.2 Equipment schedule Events.

.3 Configuration of Daily, Weekly, Monthly schedules.

.4 Configuration of Replacement Days.

.5 The software shall provide the ability for users to override regular weekly schedules through menu selection, graphical mouse action or function key.

.6 The software shall provide a timeline view, showing the results of any number of combined selected workstation and field panel controller schedules for an overview of facility operation.

.7 Additionally, the scheduling application shall:

.1 Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report).

.2 Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report).

.3 Provide searching capabilities of schedules based on name – with wildcarding options.

2.11 COLLECTION AND ANALYSIS OF HISTORICAL DATA

.1 Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

.2 The software must support configuration of panels that have a trending level threshold, above which the data will be automatically uploaded to the BMS server to prevent overwriting the data in the field panel. The trending level will be user defined in % of available space (e.g., automatically upload when the trend buffer is at 75% of allocated space).

.3 The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and scheduling take the form a wizard, or online assist utility, in order to complete this process within a small amount of time for a large group of points.

.4 Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

.5 Provide additional functionality that allows the user to view real-time trend data on trend graphical plot displays. A minimum of fifteen points may be plotted, of either real-time or historical data. The dynamic graphs shall continuously update point values. At any time, the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of plot screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed. A minimum of 8 true graphs shall run simultaneously. Operator shall be able to command points directly on the trend plot by double clicking on the point. Operator shall be able to zoom in on a specific time range within a plot. Operator must be able to configure separate left and right axis for easier differentiation of point values and be able to display historical data for the same group of points at different times simultaneously for easy comparison of system behaviour over time. The dynamic trend plotting application shall support the following types of graphs, with option to graph in 3D: line graph, area graph, curve graph, area-curve graph, step graph, and scatter graph. Each graph may be customized by the user, for graph type, graph text, titles, line styles and weight, colours, and configurable x- and y-axes.

2.12 ALARM MANAGEMENT

.1 Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.

.2 Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time & date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.

.3 Only events for which the logged on user has privileges to view shall be displayed on each workstation.

.4 The software shall provide the ability to users to limit the list of events displayed at each workstation, no matter who is logged on (i.e. workstation will only show fire events).

.5 Each event shall have the ability to sound an audible notification based on the category of the event.

.6 Alarm Display shall have the ability to list & sort the alarms based on alarm status, point name, ascending or descending alarm time.

.7 Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.

.8 Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm, which can be viewed from the alarm display screen, graphic display screen, and anytime the point is being commanded to a new value or state.

.9 Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs.

.10 Software shall provide the option to configure detailed operating procedures that guide a user through predetermined standard operating procedures for handling critical events. Users shall be able to log completion of each operating step as it is performed.

.11 Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and BAS system management.

.12 Remote notification of messages

.1 Workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition. A point's alarm status will be configurable for remote notification whether the point is in a specific alarm priority, has returned to normal, failed, out of service, in trouble, alarm disabled by program or operator and alarm by command.

.2 There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices, which can receive messages from the system.

.3 On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.

.4 Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.

.5 System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.

.6 Message detail shall be configurable on a per user basis.

.7 During a mass influx of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.

.8 Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.

.9 Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

.10 Ability to configure Fire and Life Safety points for remote notification through the point editor application.

.13 Expanded Alarm Issue Management

.1 As optional functionality, configurable point-by-point, the system shall impose an ordered process for managing the lifecycle of an alarm. The process requires the operator to:

.1 Acknowledge the alarm.

.2 Assign the alarm issue to a contact (e.g., tradesperson or trained staff).

.3 Answer – an explanation of the diagnosis or solution to the alarm.

.4 Resolve – this happens when at least one Answer is provided and the point has returned to a stable Normal state.

.5 Clear – the operator may clear the alarm issue from the display.

.2 Each step in the lifecycle is automatically recorded for audit trail historical purposes.

.14 Provide alarm priority functionality to meet requirements of sequences of operation.

2.13 AUDIT TRAIL OF USER ACTIONS

.1 To protect against inadvertent changes damaging critical system functions, and to enable audit-trail tracking on selected database objects, optional functionality shall be provided to configure selected objects for increased supervision. The additional supervision functionality shall allow for designation of points, control programs, trend collection reports, panels on a building level network and user account objects for detailed tracking of user modifications and deletions. Display an icon, which indicates the level of supervision for an object within specified applications.

.1 The minimal setting for additional supervision shall warn the user that he is attempting to modify or delete a supervised object and will require the user to input a reason-for-change in order to proceed. The warning shall be customizable for each object.

.2 Additional supervision levels shall be optional to require the user to re-enter his user password, and/or require that a "supervisor" enter his user password, in order to proceed with the modification or deletion of the supervised object.

.3 Supervised objects shall be assigned a dedicated "revision number," and the revision number shall be incremented automatically by the system upon each user modification. This revision number may serve as a method for tracking changes to objects.

.4 Point in an alarm state can have annotations added which can be viewed from the alarm display screen, graphic display screen, and anytime the point is being commanded to a new value or state. For supervised objects, the point annotation will automatically populate the reason for change field.

.2 Audit Trail tracking of supervised objects shall record the following:

.1 The property of the object that was changed.

.2 The value of the property before the change.

.3 The value of the property after the change.

.4 Who made the change.

.5 The reason for change (entered by the operator).

.6 Who the change was authorized by (if configured for this level of supervision).

2.14 EXTERNAL DATA ACCESS

.1 The software shall provide the ability to expose configuration properties and real-time values through CSV files, OPC DA, OPC UA, or REST-based Web Services.

.2 The software shall provide the ability for external applications to change configuration and real-time values through OPC DA, OPC UA, or REST-based Web Services.

.3 The software shall provide the ability for external applications to access historical Trend data through CSV files or REST-based Web Services.

.4 External data access must be secured using the level of permissions configured for users and operator workstations.

.5 Web service interfaces must allow for exchanging data (object's values, events and trend series) between workstation and external applications such as facility management systems, enterprise applications, mobile applications or other value-added services.

.6 Documentation describing web services interfaces must be included to allow external developers to write applications that leverage the data exchange.

2.15 DATA SECURITY

.1 Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application, editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time period shall be user-adjustable. All system security data shall be stored in an encrypted format.

.2 The BAS software must allow that all communication paths between clients and the server are encrypted and protected against replay attacks as well as data manipulation.

.3 Any runtime data transfer between the system server and Web Server (IIS) must be allowed to be encrypted by Desigo CC.

.4 Communication between any Web Server (IIS) and the Web Clients must be allowed to be encrypted.

.5 Passwords must be handled with encrypted storage and transmission

.6 The software must support the use of public domain algorithms for cryptographic functions, including AES, DiffieHellmann, RSA, and SHA-2. No self-coded algorithms shall be allowed.

.7 All symmetrical encryption must use 256 bit AES or stronger.

.8 All asymmetrical encryption must use 2048 bit or stronger.

.9 The software must support the use of commercial certificates for securing client-server communications.

.10 The software must support the use of self-signed certificates to allow local deployments without the overhead of obtaining commercial certificates.

.11 The BAS software shall be compatible with the following Virus Scanners:

.1 Kaspersky.

.2 Avira.

.3 McAfee.

.4 Bitdefender.

.5 TrendMicro Office Scan.

2.16 SUBSYSTEM CONNECTIVITY

.1 The BAS application software must be capable of connecting simultaneously to multiple control systems and data sources.

.2 Interface software shall simultaneously communicate with and share data between multiple Ethernet-connected building level networks.

.3 The BAS application software must support the following standard protocols:

.1 BACnet IP (standard Revision 1.13).

.2 OPC (OLE for Process Control) OPC DA 2.05, 3.0.

.3 Modbus TCP.

.4 SNMP (Agent V1 and V2).

.4 Any break in system controller communication must result in a notification at the server.

2.17 BACnet INTEROPERABILITY

.1 The Operator Workstation Software shall be capable of BACnet IP communications.

.2 The Operator Workstation Software shall have demonstrated interoperability during at least one BTL Interoperability Workshop.

.3 The Operator Workstation Software shall have demonstrated compliance to BTL B-AWS device classification through BTL listing as specified in ANSI/ASHRAE 135 under revision 1.13 or higher.

.4 The BAS software shall meet the BACnet device profile of an Advanced Workstation Server (B-AWS) and Operator Workstation (B-OWS) and shall support all BACnet BIBBs required to deliver a full and operable system.

.5 The BAS Server and Workstations shall support the following Data Link Layers:

.1 BACnet IP Annex J.

.2 BACnet IP Annex J Foreign Device.

.3 ISO 8802-3, Ethernet (Clause 7).

.6 The BAS Server and Workstations shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:

.1 Calendar – Creatable, Deletable.

.2 Command – Creatable, Deletable.

.3 Event Enrollment – Creatable, Deletable.

.4 Notification Class – Creatable, Deletable.

.5 Schedule - Creatable, Deletable.

.7 The BAS Server and Workstations shall support transmitting and receiving segmented messages.

.8 The BAS Server and Workstation shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.

Part 3 Execution

3.1 GRAPHICS

.1 Provide linked graphic pictures as follows:

.1 Building Identification front plate with menu.

.2 Photo of front elevation of building.

.3 Floor Plan of each building level.

.4 Schematic for each system.

.5 Tables summarizing temperatures in each zone.

.6 Tables summarizing the monitored functions off all air handling units.

.7 Table summarizing weekly schedules.

.8 Tables summarizing fault detection results.

.9 Outside Lighting Schematic.

.10 Time of Day schedules.

.11 Up to five additional graphics as defined by the owner.

.12 Global Setpoints, summarizing items such as Min/Max Setpoints, Override Period, etc.

.13 Global Statistics, summarizing lowest temp, highest temp, number of heat pumps heating/cooling, number of zones occupied, number of zones in override, etc.

.14 The graphics shall be submitted to the Owner for preapproval before final implementation.

.2 Graphic Display Screens

.1 Individual schematics shall include, where applicable:

.1 Navigation buttons to each major system in the building which indicate current screen display by a change in button colour.

.2 Outdoor air temperature shall be displayed on every graphic screen.

.3 Access links to all global schedules or specific screens affecting entire building operation.

.4 Access buttons links to Set Time, Holiday Schedule, Alarms, Points on Manual, Conversion °C - °F, 24 Hour Clock, Operations Manual, Autocad Drawings, BAS Manual, and Work Orders

.5 Status of monitored and controlled on/off points;

.6 Current value of analog input;

.7 Identification for each point;

.8 Current value of the setpoint & DDC output for each control loop;

.9 Current state of each control loop (computer auto/computer manual);

.10 Schematic and systems identification;

.11 Point alarm lock-out status;

.12 Equipment symbolic information (pump, fan, etc);

.13 Alarm/normal indication

.14 All points pertinent to one system shall be on one screen.

.15 Symbols shall have the ability to change colour, depending on the status.

.16 Animations are to indicate point status. Animations are to include pumps, fans and boilers. The BMS contractor shall obtain from the owner the final numbering and name convention to be used for all spaces in the building for incorporation in the "As Built" drawings and manuals.

.2 System Architecture.

.1 Control panel layout and network architecture.

.2 Indicating BAS panels and panel type (model).

.3 Panel locations room number text on screen.

.4 Systems controlled by each panel.

.5 Links to points list accessible from each panel.

.3 Architecture Panel Layout (Locations on Floor Plans)

.1 Locations of each panel on each floor plan level.

.2 Panel types indicated by different icon.

.3 Controls transformers locations.

.4 Main network wiring and sub-network wiring layout.

.4 Floor Plans Graphics

.1 Room numbers accurate as per room signage.

.2 Mechanical rooms locations and signage tags.

.3 space temperatures for every temperature on each floor in appropriate room.

.4 space focus pick area for individual room control where applicable shall be yellow text.

.5 Air Handler symbols indicating areas of the floor plan serviced by each air handler by a corresponding colour.

.6 Status of Air Handler by colour change Red for off status, or text indication.

.7 Supply air temperature for each air handler.

.5 HVAC/AHU Unit Graphic

.1 Accurate representation of the HVAC design.

.2 All associated control points to be displayed.

.3 A calculated percentage of fresh air shall be indicated on the HVAC graphic.

.4 Operator offset adjustment of the supply air setpoint, adjustable directly from the graphic.

.5 HVAC physical location shall be indicated on the graphic.

.6 Weekly occupied time of day schedule for the associated HVAC shall be accessible directly from the graphic by selecting an icon.

.7 Trend logs shall be accessible directly from the graphic by selecting an icon.

.6 Exhaust Fans Graphic

.1 Exhaust fans control shall be editable directly from the graphic.

.2 Exhaust fan status shall be indicated in text and a change in the exhaust fan icon.

.3 Exhaust fan physical location shall be indicated on the graphic.

.4 Area of the building being exhausted shall be indicated on the graphic.

.7 Terminal Units/Misc. Items

.1 Accurate representation of equipment.

.2 All associated control points to be displayed.

.3 Space temperature.

.4 Mode of operation.

.5 Current setpoint.

.6 Trend logs shall be accessible directly from the graphic by selecting an icon.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is to be read in conjunction with the remainder of the Division 25 specifications.

Part 2 Products

2.1 ACCEPTABLE MANUFACTUERERS

.1 Controller shall be matched to the Building Automation System supplier.

2.2 GENERAL REQUIREMENTS

.1 Provide BACNet controllers. DDC controllers that are not BACnet compliant shall not be acceptable under this specification and are strictly prohibited.

.2 All BAS DDC Devices at all levels shall be fully custom-programmable in the field using the standard Operators Workstation Software. No configurable, canned program application specific controllers will be permitted unless specifically noted in this specification.

.3 All BAS controllers shall be tested, certified, clearly stamped and listed by the BACnet Testing Laboratories (BTL)

.4 The BACnet operating stack must be embedded directly in every Device at the board level, and in all operator interface software packages.

.5 No Gateways, Communication Bridges, Protocol Translators or any other device that translates any proprietary or other communication protocol to the BACnet communication protocol shall be permitted as a part of the BAS installation pursuant with this specification section. Gateways may only be used as required for communication to existing systems or systems installed pursuant with other specification sections.

.6 Program database, data acquisition, and all control sequence logic shall reside in each DDC Device. The Building Level Network shall not be dependent upon connection to a Server or Master Controller for performance of the Sequence of Operation. Each individual Device shall, to the greatest possible extent, perform its programmed sequence without reliance on the Building Level Network.

.7 All BAS DDC Devices shall be capable of updating firmware using software via internetwork without replacing any hardware, microprocessors or chips.

.8 All binary output points shall be protected from short cycling via output configuration and/or programming. This feature shall allow minimum on time and off-time to be configurable.

.9 Panels shall use only following signal types to interface with field data points:

.1 Binary Input (BI) also known as Digital Input (DI) contacts. Internal voltage source shall be dry contact or 0-5 V.D.C.

.2 Analogue Input (AI) is to be standard 4 - 20 ma transmitter, 0 – 5 VDC, 2-10 VDC or 0-10 VDC.

.3 Binary Output (BO) also known as Digital Output contacts rated at 24 V.D.C., 20 mA.

.4 Analogue Output (AO) to be standard 4 to 20 mA or 0-10 V.D.C. @ 20 mA maximum.

.10 Each output on major controllers shall have an ON, OFF, AUTO select with status indication lamp and internal voltage source.

.11 Controls shall be D.D.C. solid state type as noted elsewhere, and with exception of actuators, contain no moving parts.

.12 Building level controllers must have real time clocks. Time keeping methods that depend on the clock speed of the processor chip are not accurate enough and are not acceptable. One designated controller shall keep the time for the entire system.

.13 Control algorithms shall be available and resident in digital system controller to permit proportional, integral derivative, incremental, floating and two position control modes in any combination to meet requirements of application.

.14 Canned packages shall not be permitted in controllers. Controllers must be flexible enough to accommodate custom programs and additional points.

.15 Digital system controller shall be expandable by adding additional field interface units that operate through processor of digital controller to expand its control loop and energy management point capacity, without making any of the original equipment redundant.

.16 To maintain long term analog accuracy in controller sensing circuits, digital controller shall sense voltage being supplied to resistance sensing element and through firmware compensate for power supply.

.17 The non-volatile EPROM memory shall, as a minimum, support the operating system. Tape or disk media is not acceptable. All control languages, application functions and operating data or software shall reside in SuperCap or battery backed RAM. Data or control software (such as I/0 point characteristics, schedules, set points and alarm limits) must remain in RAM and, hence, modifiable on-line through an operators terminal connected to any panel on the system or from a remote location via modem without the use of specialized software not provided in this contract. Controllers using batteries that require periodic replacement shall not be used. Standard off the shelf communications software packages are acceptable but in no case shall a hardware key or any other protection method be permitted that restricts the Board from connection to the system from multiple remote locations to display system command language and graphics displays.

.18 All BMS components must be internally protected from loss of memory or operation due to power surges and brown outs. Controllers must be capable of operating without overheating or other damage at as little as 75% of nominal voltage, and as much as 125% of nominal voltage on the secondary side of the control transformers.

2.3 BUILDING CONTROLLERS

.1 The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.

.2 Provide all processors, power supplies, and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

.3 DDC controllers shall use the same programming language and tools. DDC controllers, which require different programming language or tools on a network, are not acceptable.

.4 Modular Controller

.1 This controller shall have the BTL listing and meet the BACnet device profile of a Building Controller (B-BC) and shall the BACNet BIBBs required to provide a complete and operable system:

.2 The Building Level Controller shall support the following Data Link Layers:

.1 BACnet IP Annex J.

.2 BACnet IP Annex J Foreign Device.

.3 MS/TP Master (Claus 9).

.3 The Building Level Controller shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:

.1 Calendar – Creatable, Deletable.

.2 Command – Creatable, Deletable.

.3 Event Enrollment – Creatable, Deletable.

.4 Notification Class – Creatable, Deletable.

.5 Schedule - Creatable, Deletable.

.4 The Building Level Controller shall support transmitting and receiving segmented messages.

.5 The Building Level Controller shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.

.6 The Building Level Controller shall have the capability to act as a BACnet router between MS/TP subnetworks and BACnet/IP.

.7 Computing power and memory minimum

.1 A 32 bit, stand alone, multi tasking, multi user, real-time 100MHz digital control microprocessor module.

.2 Inputs shall be 16-bit minimum analog-to-digital resolution.

.3 Outputs shall be 10-bit minimum digital-to-analog resolution.

.4 Memory module (24 Megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, password protected operator I/O, dial up communications.

.5 Real time clock and battery.

.6 Data collection/ Data Trend module sized for 10,000 data samples.

.7 Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.

.8 Onboard or Modular hardware and connections:

.1 Primary Network communication module, if needed for primary network communications.

.2 Secondary Network communication module, if needed for secondary network communications.

.3 RJ45 port 10/100Mbaud.

.4 RS485 ports for subnetworks and point expansion.

.5 Man to Machine Interface port (MMI).

.6 USB Port.

.9 Input and Output Points Hardware

.1 Input/output point modules as required including spare capacity.

.2 Input/output point modules shall have removable terminal blocks.

.3 Monitoring of the status of all hand off auto switches.

.4 Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.

.5 Local status indication for each digital input and output for constant, up to date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.

.6 Graduated intensity LEDs or analog indication of value for each analog output.

.10 Accessories:

.1 Appropriate NEMA rated metal enclosure.

.2 Power supplies as required for all associated modules, sensors, actuators, etc.

.5 Compact Controllers

.1 Compact Controllers shall be a 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.

.2 Each Compact Controller shall have sufficient memory to support its own operating system and databases, including:

.1 Control processes.

.2 Energy management applications.

.3 Alarm management applications including custom alarm messages for each level alarm for each point in the system.

.4 Historical/trend data for points specified.

.5 Maintenance support applications.

.6 Custom processes.

.7 Operator I/O.

.8 Network communications.

.3 Compact Controllers shall provide a data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

.4 Compact Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

.5 Accessories:

.1 Appropriate NEMA rated metal enclosure.

.2 Power supplies as required for all associated modules, sensors, actuators, etc.

.6 The operator shall have the ability to manually override automatic or centrally executed commands at the primary control panels via local, point discrete, on board hand/off/auto operator override switches. If on board switches are not available, provide separate control panels with HOA switches. Mount panel adjacent to primary control panel. Provide hand/off/auto switch for each digital output, including spares.

.7 Each Building Level Control Panel shall continuously perform self diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

.8 Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.

.9 Building Level control panels shall provide at least two data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.

.10 Building Level Controllers shall have the capability to serve as a gateway between Modus subnetworks and BACnet objects. Provide software, drives and programming.

.11 Immunity to power and noise:

.1 Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

.2 Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

.12 In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.

.1 Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

.2 Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local connection port, via telephone line dial-in or from a network workstation PC.

2.4 BUILDING LEVEL CONTROLLER LEVEL SOFTWARE

.1 General

.1 Provide a full capability user license to the owner for the operator to be able to see, modify, create, upload, download and save control programs to the DDC controllers.

.2 The software programs specified in this section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.

.3 The software application shall be accessible from a PC using the Windows environment but shall use all of its own services and data files so as to not be susceptible to Microsoft Windows operating systems based viruses.

.4 The Building Controller Software shall be capable of BACnet communications. The BACnet Building Controller (B-BC) shall have demonstrated interoperability during at least one BTL Interoperability Workshop and have demonstrated compliance to BTL through BTL listing.

.2 System Security

.1 User access shall be secured using individual security passwords and user names.

.2 Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.

.3 Building Controllers shall be able to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any Operator Interface or portable operator terminal) shall enable the operator to monitor, adjust and control only the points that the operator is authorized for. All other points shall not be displayed at the Operator Interface or portable terminal. Passwords and priorities for every point shall be fully programmable and adjustable.

.4 User Log On/Log Off attempts shall be recorded.

.5 The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.

.6 Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the DDC controller software.

.7 Passwords shall have the option to be configured to expire within a selected timeframe (1-365 days).

.8 Configuring the password expiration shall also enable the functionality to lock out a user account after three failed log-on attempts.

.3 User Defined Control Applications: The application software shall program DDC routines to meet the sequences of operations.

.1 The Building Controllers shall have the ability to perform the following pre tested control algorithms:

.1 Two position with differential control and time delays

.2 Floating control

.3 Proportional control

.4 Proportional plus integral control

.5 Proportional, integral, plus derivative control

.6 Automatic tuning of control loops

.7 Model-free adaptive control

.8 Start Stop Time Optimization

.2 Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

.3 Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.

.4 DDC Controllers shall have the ability to perform energy management routines for the purposes of optimizing energy consumption while maintaining occupant comfort. Routines shall include but are not limited to time of day scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides, start stop time optimization, automatic daylight savings time switch over, night setback control, enthalpy switch over, peak demand limiting, temperature-compensated duty cycling, heating/cooling interlock, supply temperature reset, priority load shedding, and power failure restart.

.1 Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions.

.1 The SSTO program shall operate in both the heating and cooling seasons.

.1 It shall be possible to apply the SSTO program to individual fan systems.

.2 The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.

.2 The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.

.2 Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.

.1 It shall be possible to individually command a point or group of points.

.2 For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and stop within that group.

.3 The operator shall be able to define the following information:

.1 Time, day

.2 Commands such as on, off, auto, occupied, unoccupied and so forth.

.3 Time delays between successive commands.

.4 There shall be provisions for manual overriding of each schedule by an appropriate operator.

.4 It shall be possible to schedule events up to one year in advance.

.1 Scheduling shall be calendar based.

.2 Holidays and exceptions shall allow for different schedules.

.3 Enthalpy switchover (economizer). The Energy Management Control Software (EMCS) will control the position of the air handler relief, return, and outside air dampers. If the outside air dry-bulb temperature falls below changeover set point the EMCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.

.4 Temperature-compensated duty cycling.

.1 The DCCP (Duty Cycle Control Program) shall periodically stop and start loads according to various patterns.

.2 The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.

.5 Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.

.6 Night setback control: The system shall provide the ability to automatically adjust set points for night control.

.7 The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.

.1 PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.

.2 PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.

.3 If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.

.4 Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.

.5 A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30-character, English language point names, structured for searching and logs.

.6 DDC Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task-orientated information from the user manual.

.4 Peer-to-peer access to other DDC controllers

.1 It shall be possible to use any actual or virtual point data or status, any system calculated data, a result from any process, or any user-defined constant in any controller in the system without dependence upon a central or intermediate processing device.

.2 Any process shall be able to issue commands to points in any and all other controllers in the system.

.3 Processes shall be able to generate operator messages and advisories to other operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of an advanced annunciation feature, such as:

.1 Generate a report

.2 Annunciate an alarm

.3 Issue a text message or email

.4 DDC and HVAC mechanical equipment controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device.

.5 The peer-to-peer network shall also allow any DDC and HVAC mechanical equipment controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

.5 Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC mechanical equipment controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC controllers ability to report alarms be affected by either operator or activity at a pc workstation, local i/o device, or communications with other panels on the network.

.1 All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

.2 Conditional alarming shall allow generation of alarms based upon user defined multiple criteria.

.3 An alarm “shelving” feature shall be provided to disable alarms during testing of systems.

.4 Binary Alarms shall be set to alarm based on the operator specified state. Provide the capability to automatically and manually disable alarming.

.5 Analog alarms shall have both high and low alarm limits. Provide the capability to automatically and manually disable alarming.

.6 The user shall be able to define the specific system reaction for each point. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

.7 Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hour’s destinations) or based on priority.

.8 In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

.9 Operator selected alarms shall be capable of initiating a trigger to an advanced annunciation, such as text, email, etc.

.10 An alarm history log shall report the start of the alarm condition, acknowledgement by a user and return of the alarm to normal condition.

.11 Remote Communication. The system shall have the ability to remotely communicate to the remote monitoring station.

.6 Provide a PID (proportional-integral-derivative) closed-loop control algorithm with direct or reverse action and anti-windup. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and weighting parameters shall be accessible from the operator workstation.

.7 Adaptive Loop Tuning

.1 Building Controllers shall also provide high resolution sampling capability for verification of DDC control loop performance. Documented evidence of tuned control loop performance shall be provided on a monthly, seasonal, quarterly, annual period.

.2 For Model-Free Adaptive Control loops, evidence of tuned control loop performance shall be provided via graphical plots or trended data logs. Graphical plots shall minimally include depictions of setpoint, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed-air temp).

.3 For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned control loop performance shall be provided via graphical plots or trended data logs for all loops.

.1 In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.

.2 Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

.8 Logic programming: Provide a software routine that can build ladder logic to control using many conditional statements.

.1 The logic programming syntax shall be able to combine ladder logic with other software features, such as combining status, scheduling, PDL and alarm conditions into one conditional decision.

.2 Logic programming shall be able to reference conditions in any other controller in the system.

.9 Staggered Start:

.1 This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user definable in an application and shall not require written scripts or ladder logic.

.2 Upon the resumption of power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.

.10 Totalization Features:

.1 Run-Time Totalization. Building Controllers shall automatically accumulate and store run-time hours for all digital input and output points. A high runtime alarm shall be assigned, if required, by the operator.

.2 Consumption totalization. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for all analog and digital pulse input type points.

.3 Event totalization. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for all points. The event totalization feature shall be able to store the records associated with events before reset.

.11 A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the i/o summary. The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and scheduling take the form a wizard, or online assist utility, in order to complete this process within a short amount of time for a large group of points. Ability to produce a summary of changes in a log file.

.12 Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC shall have a dedicated RAM-based buffer for trend data and shall be capable of storing data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

.1 Time-interval based trending shall have the capability of synchronizing the trend sampling of discrete points. This allows for the comparison of values of several different points at the same moment in time.

.2 Trended points shall have the option of sampling data values based on the condition of a "trigger" point (i.e., conditional trending). Options for sampling shall include always sampling as defined, only sampling when the trended point is in the alarm condition, or not sampling.

.13 System Coordination. Provide a standard application for the proper coordination of equipment. This application shall provide the operator with a method of grouping together equipment based on function and location. This group may then be used for scheduling and other applications.

2.5 ADVANCED APPLICATION CONTROLLERS

.1 The Advanced Application level control panel shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.

.2 The Advanced Application Controller Software shall be capable of BACnet communications. The BACnet Advanced Application Controller (B-AAC) shall have demonstrated compliance to BTL through BTL listing and shall substantially conform to BACnet Advanced Application Controller (B-AAC) device profile. Support all required BACNet BIBBS that are required to provide a complete and operable system.

.3 The Advanced Application Controller shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:

.1 Calendar – Creatable, Deletable.

.2 Command – Creatable, Deletable.

.3 Event Enrollment – Creatable, Deletable.

.4 Notification Class – Creatable, Deletable.

.5 Schedule - Creatable, Deletable.

.4 The Advanced Application Controller shall support transmitting and receiving segmented messages.

.5 Communication: The Advanced Application Controller shall support the communications protocols and methodologies indicated in Specification Section 25 05 02 – Network Architecture and Wiring.

.6 Serial Communication: Temporary use of portable devices shall not interrupt the BAS communication, nor the normal operation of permanently connected printers or terminals.

.1 Provide at least one EIA-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, and portable laptop operator's terminals.

.2 A USB port shall alternatively be available to support local HMI tools connection.

.7 Input/Outputs

.1 Inputs shall be 16-bit minimum digital resolution.

.2 Outputs shall be 10-bit minimum digital resolution.

.8 The following I/O port types shall be available on the controller

.1 Universal Input (software configurable):

.2 Digital Input choices:

.1 Pulse Accumulator.

.2 Contact Closure Sensing.

.3 Dry Contact/Potential Free inputs only.

.4 Digital Input (10 ms settling time).

.5 Counter inputs up to 20 Hz, minimum pulse duration 20 ms (open or closed).

.3 Analog Input Choices:

.1 0-10 Vdc.

.2 4-20 Ma.

.3 1K Ni RTD @ 32°F (Siemens, JCI, DIN Ni 1K).

.4 1K Pt RTD (375 or 385 alpha) @ 32°F.

.5 10K NTC Type 2 or Type 3 Thermistor.

.6 100K NTC Type 2 Thermistor.

.4 Universal Input or Output (software configurable):

.1 All of the above input types.

.2 Analog Output Types:

.1 0 to 10 Vdc @ 1 mA max

.5 Super Universal Input or Output (software configurable):

.1 All of the above input types.

.2 All of the above output types.

.3 Super digital output type:

.1 0 to 24 Vdc, 22 mA max. (for controlling pilot relay)

.4 Super Analog Output Choices:

.1 0 to 20 mA @ 650 Ω max.

.6 Provide software configurable I/O ports such that a programmer make a port either an input or an output.

.9 Each System Level Control Panel shall, at a minimum, be provided with:

.1 A 32 bit, multi tasking, real-time 100 MHz digital control microprocessor with plug-in, enclosed processors.

.2 Each Advanced Application Controller shall have sufficient memory, a minimum of 24 megabyte, to support its own operating system and databases, including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, and operator I/O.

.3 Real time clock and battery.

.4 Data collection/ Data Trend module sized for 10,000 data samples.

.5 Power supplies as required for all associated modules, sensors, actuators, etc.

.6 Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.

.7 Local status indication for each digital input and output for constant, up to date verification of all point conditions without the need for an operator I/O device.

.8 Each control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.

.9 Graduated intensity LEDs or analog indication of value for each analog output.

.10 Power loss. In the event of the loss of power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for the operating system software and firmware.

.1 Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

.2 Brownout protection and power recovery circuitry protect the controller board from power fluctuations.

.3 Battery backup shall be provided to support the real-time clock for 10 years

.4 The program and database information stored SDRAM memory shall be battery backed for a minimum of 30 days and up to 60 days. This eliminates the need for time consuming program and database re-entry in the event of an extended power failure.

.11 Database Restore: Each AAC controller shall automatically save the latest programmed database. The controller shall be able to automatically restore a lost or corrupt database without involvement from the operator.

.12 Each System Level Control Panel shall continuously perform self diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

.13 Each Control Panel shall support firmware upgrades without the need to replace hardware.

.14 System Level control panels shall provide at least two data communication ports for operation of operator I/O devices such as operator terminals, and additional memory. Control panels shall allow temporary use of portable operator interface devices without interrupting the normal communications.

.15 Immunity to noise: Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

2.6 ADVANCED APPLICATION CONTROLLER SOFTWARE

.1 General

.1 Provide a full capability user license to the owner for the operator to be able to see, modify, create, upload, download and save control programs to the DDC controllers.

.2 The software programs specified in this section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.

.3 The software application shall be accessible from a PC using the Windows environment but shall use all of its own services and data files so as to not be susceptible to Microsoft Windows operating systems based viruses.

.2 Advanced Application Controllers shall have the ability to perform energy management routines including but not limited to

.1 scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides

.2 automatic daylight savings time switch over

.3 night setback control

.4 economizer switch over using enthalpy, dry bulb or a combination

.5 peak demand limiting,

.6 temperature-compensated duty cycling

.7 heating/cooling interlock

.8 supply temperature reset

.9 priority load shedding

.10 power failure restart

.3 The software shall have a routine for automatic tuning of control loops

.4 System Security in the Field Panel

.1 User access shall be secured using individual security passwords and user names.

.2 Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.

.3 The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.

.4 Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the field panel.

.5 User Defined Control Applications:

.1 Controllers shall be fully-programmable. Controllers shall execute custom, job-specific sequences to automatically perform calculations and special control routines. Factory installed or pre-configured sequences shall only be allowed if they exactly match the sequence specified herein.

.2 Programs shall combine control logic, control loop algorithms, and energy management routines

.3 Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.

.4 Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task oriented information from the user manual

.2 Adaptive Loop Control:

.1 Each AAC controller shall come standard with an Adaptive Control Loop Algorithm

.1 Tuning parameter shall automatically adjust for non-linear applications

.2 Model-Free Adaptive (MFA) algorithm

.1 The algorithm shall not require modeling of the non-linear system in order to maintain control at all points of the non-linear load.

.2 The controlled variable, setpoint, and weighting parameters shall be user-selectable.

.3 Output shall be analog or shall stage a series of outputs.

.4 Adaptive Control shall take the place of Proportional, Proportional + Integral, and PID type algorithms for non-linear applications. Adaptive Control routines shall:

.1 Improve response time.

.2 Improve System efficiency.

.3 Improve Stability.

.4 Result in Consistent outputs.

.5 Reduce cycling and repositioning.

.6 Reduce wear and tear on actuators.

.5 Adaptive control shall auto-adjust to compensate for

.1 Mode changes.

.2 Load changes.

.3 Seasonal changes.

.4 Heating and cooling changeover.

.5 Heating or cooling capacity changes on the primary side.

.6 Flow changes on the primary or secondary side.

.7 Airflow changes across coil.

.8 Flow across a heat exchanger.

.6 Adaptive control shall auto-adjust to compensate for

.1 Non-linear coils and heat exchangers.

.2 Hot water and chilled water reset routines.

.3 Water flow reset routines.

.4 Duct Static reset routines.

.7 Auto-Tune PID loops are not acceptable substitutions.

.8 If Adaptive Loop Control is not available, then the BAS contractor shall provide re-tuning of the control loops for coils and heat exchangers for each of the following conditions:

.1 Low heating supply water, high heating supply water.

.2 Low load on steam coil, high load on steam coil.

.3 Chilled water coil, non dehumidification and condensing.

.4 Chilled water coil, low airflow, high airflow, economizer.

.5 Dual temperature systems tune for heating and cooling modes.

.6 Each of 4 seasons.

2.7 APPLICATION SPECIFIC CONTROLLERS (ASC)

.1 Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

.2 All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the floor, building or management level networks is not acceptable.

.3 Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

.1 Provide for control of each piece of terminal equipment where indicated.

.2 Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable.

.3 Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the minimum performance requirements of +/- .6 deg. C accuracy, operating in the range of +/- .6 C° (± 1F°) accuracy, operating in the range of 2 to 46°C (36°F to 115°F), adjustable between 2°C to 30°C (36°F to 86°F).

.4 Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. The temperature indicator shall be digital readout visible without removing the sensor cover.

.5 Each controller shall perform its primary control function independent of other DDC Controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during interruption is not acceptable. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications.

.6 Provide each terminal equipment controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPRM, EPROM and PROM, or 72-hour battery backup shall be provided. Controllers that require factory changes of all applications are not acceptable.

Part 3 Execution

3.1 CONTROLLER APPLICATIONS

.1 Building Level Controllers shall be used for the following types of systems. It is intended that each unique system be provided with its own point resident DDC Controller.

- .1 Heating plant systems.
- .2 Pumping systems.
- .3 VAV air handlers.
- .4 Air handlers over 15,000 cfm.
- .5 Systems with over 24 input/output points.

.2 Advanced Application Controllers shall be used for systems with custom sequences that meet all of the criteria below:

- .1 No primary pumping systems.
- .2 Secondary Pumping systems that are remote from Central Plants.
- .3 Air handlers up to 15,000 cfm.
- .4 Systems up to 20 input/output points.
- .5 BAS Network or Architecture or Sequences do not require the system to be on an IP network.
- .6 No systems that require integration to meters, VFDs or other smart equipment.
- .7 Integration to smart thermostats is allowed.
- .8 When application specific controllers are not allowed.
- .9 Rooftop systems.

.3 Application Specific Controllers are intended to be used for only the following systems:

- .1 Variable Air Volume (VAV) boxes
- .2 Constant Air Volume (CAV) boxes
- .3 Unit Conditioners
- **.4 Application Specific Controllers are not allowed. Provide Advanced controllers with custom programming capability for all systems.**

3.2 CONTROLLER INSTALLATION

.1 Install all DDC controllers in heated space. Keep all electronic equipment away from temperature extremes and wild fluctuations and shielded from electromagnetic interference.

.2 Proposed panel locations shall be approved by Engineer/Board. Panels containing controllers shall be installed only in heated areas not subject to extremes of temperature or rapid temperature variations.

.3 Label all wiring at termination point, reflect labelling in as-built shop drawings.

.4 Isolation shall be provided at all primary control panel terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587 1980.

.5 Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

.1 RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V.

.2 Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.

.3 Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power.

.4 Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).

.6 Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:

.1 IEEE Standard 587-1980.

.2 UL 864 Supply Line Transients.

.3 Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11).

.7 Install all panels in a metal enclosure. Use of controller plastic enclosures is not acceptable.

3.3 FUTURE EXPANSION

.1 Controllers shall perform all of the functions described in these specifications, including all of the options described even if the options are not required in the initial work.

.2 Controllers shall have an allowance of a minimum of 10% in spare points for each type of point.

.3 If a certain type of point is not associated with a specific panel, the required minimum spare points shall be two (2).

3.4 PANELS

.1 Local equipment cabinets shall be provided for each controller or group of controllers, of free standing or wall mounted type. Respective controllers, transducers, shall be mounted within cabinet. Relays, transformers and any other devices using a voltage above 24 VAC must be housed in a separate enclosure from the controllers. Transformers may be enclosed type, mounted outside of the enclosures. Panel instruments shall be designated as to type and function of black Lamicoid tags 6.4 mm white engraved, secured with drive screws. Cabinets shall be located where shown or as later directed and may be grouped per Mechanical Room.

.2 Control panels shall be fully enclosed cabinets with all steel constructions. Cabinets shall have hinged door with locking latch or bolt on cover plate. All cabinet locks shall be common keyed.

.3 Controller Panels

.1 Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.

.2 Controllers in areas where moisture is a concern shall be mounted in NEMA 12 enclosures.

.3 Controllers installed outdoors shall be mounted in NEMA 4X enclosures. Provide heaters where freezing temperatures are normally experienced.

.4 Provide power supplies for control voltage power.

.5 Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.

.6 Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.

.7 All power supplies for 24V low voltage wiring shall be class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run a separate, non-class 2 conduit to the device.

.8 Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator's workstations.

.9 All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.

.10 Provide a pocket to hold documentation.

.11 Panels shall be wall mounted or free standing and shall be as located on the mechanical drawings.

.12 All relays, transducers etc., shall be located within the control panels.

.13 Each DDC Controller enclosure shall have a standard duplex AC power receptacle located within the enclosure to provide power for test equipment, operation communication devices.

.14 Enclosures shall be large enough to accommodate the components without crowding, after allowing sufficient space for good wiring management. In all cases, the local field panel must have a minimum of 25% free mounting area within the enclosure

.15 If the DDC controllers come with plastic enclosures, the plastic enclosures must be themselves enclosed in a metal enclosure.

3.5 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 Not Used.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Any devices listed in this specification shall be branded by the BAS supplier or one of the following manufacturers:

- .1 Sensors, Relays Etc.
  - .1 Greystones
  - .2 Enercorp
  - .3 Johnson
  - .4 Siemens
  - .5 ACI
  - .6 Honeywell
  - .7 Setra
- .2 Thermostats
  - .1 Match BAS provider
- .3 Control Valves
  - .1 Siemens
  - .2 Belimo
  - .3 Johnson Controls
- .4 Actuators
  - .1 Siemens
  - .2 Belimo
  - .3 Johnson Controls
  - .4 Honeywell
  - .5 Schneider Electric

2.2 GENERAL REQUIREMENTS

.1 Actuation of control devices shall be electronic. Spring return fail-safe actuation shall be provided when loss of property and/or property damage is possible and where specified.

.2 All equipment, unless specified to contrary, shall be fully proportioning, modulating in operation.

.3 Space and duct sensors shall be electronic suitably located for specific application. Space sensing units shall be mounted 1500 mm from floor to centre for non-adjustable and 1200 mm from floor for adjustable unless otherwise noted or agreed to by the consultant.

.4 Sensors shall meet or exceed the specified standards.

.5 All sensors shall be capable of operating over the expected operating range and humidity.

.6 Detectors and electrical components within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code).

2.3 ELECTRONIC DAMPER AND VALVE ACTUATORS

.1 General

.1 Electric control shall be direct coupled actuators.

.2 Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.

.3 The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard 1/2" diameter shaft or damper blade.

.4 Actuators shall be designed for mounting directly to the shaft without the need for connecting linkages.

.5 All actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

.6 All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.

.7 All actuators having more than a 100 lb-in torque output shall accept a 1" diameter shaft directly, without the need for auxiliary adapters.

.8 All actuators shall be designed and manufactured using ISO900 registered procedures and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 l.

.9 Provide visual scale indicating percent of travel.

.10 Provide feedback signal on all control valves over 2 inches and all damper actuators where specified.

.11 Actuators shall be UL and CSA listed.

.2 Electronic Valve Actuators

.1 The valves shall be provided with an actuator by the same manufacturer, factory installed.

.2 All actuators shall have visual position indication.

.3 No external programming device shall be required.

.4 Actuator shall be electric motor driving, microprocessor signal controlled.

.5 Electric Control Rangeability: 40:1

.6 Control Signal 0 to 10 VDC or 0 to 20 mA signal. 2 to 10 VDC or 4 to 20 mA operating range.

.7 Power 24 VAC, 50-60 Hz

.8 Fail Safe: Valves actuators shall position the valve in a fail safe position when the power supply is disrupted or the signal goes to 0. Fail-safe according to the following guidelines unless otherwise stated in the sequence of operations

.1 Power fail safe shall be via spring loaded mechanical means

.2 Any AHU hot water exposed to ventilation air shall fail open

.3 AHU Chilled water coils exposed to ventilation air in possible freezing conditions shall be fail open

.4 Terminal unit valves shall fail-in-place

.9 Fail in place valves on primary equipment such as chilled water systems, hot water systems and condenser water systems shall have a means to manually open the valve when power is not available, such as a hand wheel or a geared crank with a clutch.

.10 The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).

.11 Actuator shall provide minimum torque required for proper valve close-off. The close-off differential pressure rating of the valve shall exceed the highest possible head pressure available at the pump plus 10% and still be rated for a Class IV leakage.

.12 The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.

.13 All automatic control valves installed in locations exposed to the elements shall be provided with weather resistant housings and heaters for climates that reach below freezing.

.3 Electronic Damper Actuators

.1 Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a "V" bolt and "V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.

.2 Damper operators shall be of the replaceable diaphragm piston type with external adjustable stops to limit the length of stroke in either direction. Operators shall be mounted on adjustable brackets. Operating arms shall have double yoke linkages and double set screws for fastening to damper shaft.

.3 Damper operators shall be selected to operate maximum damper loads of 2.6 m^2 (135 ft^2). Where damper sizes exceed this area rating, multiple damper operators shall be provided.

.4 Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.

.5 For power-failure/safety applications, a mechanical, spring return mechanism

2.4 DAMPER STATUS SWITCHES

.1 Damper status switches shall be a lever operated, activated by damper blade movement and mounted securely on damper frame.

.2 Damper switch shall have contact rating of 5 amperes at 120V AC and be CSA approved.

2.5 DIFFERENTIAL PRESSURE SENSORS

.1 Differential pressure sensors shall be provided for water differential pressure air and static pressure applications.

.1	Monitoring Range	To suit application
.2	Output Signal	4 to 20 mA
.3	Accuracy	+/- 1.0% full scale

.2 Select materials suitable for the measured variable, i.e. water and air, and to withstand a minimum of twice the normal pressure.

.3 The transmitter output shall be linear proportional signal over the full operating range.

2.6 FILTER BANK STATUS DIFFERENTIAL PRESSURE SWITCHES

.1 Provide switches with SPDT contacts rated at 9 amperes at 120 VAC and be CSA approved.

.2 Select the differential pressure range of the switch to suit the application.

.3 Provide switches with adjustable setpoint.

.4 Mounted switches with diaphragm in a vertical plane.

2.7 TEMPERATURE THERMOSTAT (DDC)

.1 Digital room sensors without LCD display, day / night override button, and setpoint slide adjustment to ±5°C adjustment and override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

.1	Temperature monitoring range	+20/120°F -13° to 49°C)
.2	Output signal	Changing resistance
.3	Accuracy at Calibration point	$\pm$0.5°F (+/- 0.3°C)
.4	Set Point and Display Range	55° to 95° F (13° to 35°C)

.2 Provide metal guards on thermostat in common areas and gymnasiums. Common area thermostats shall not have temperature adjustment.

.3 Sensor to be 10k wire, thermistor style

.4 Do not provide LCD display of space temperature.

.5 Sensor shall have integral CO2 sensor. Refer to CO2 sensor details for requirements.

2.8 LINE VOLTAGE ROOM THERMOSTATS

.1 Provide electric wall mounted 120 volt thermostats as indicated. Each thermostat shall be equipped with a thermometer and shall be tamperproof with locking covers.

.2 A metal guard and adapter plate shall be supplied for all thermostats mounted in storage areas.

2.9 AIR TEMPERATURE SENSORS

.1 Sensors shall be a minimum of 1.5m (5ft) in length per 1 square meter of duct cross section.

.2 All supply air sensors and mixed air sensors shall be 100 or 1000 OHM platinum, resistance temperature detector (RTD) type with a 7.5 m (25') averaging element. Each RTD may be provided with an industry standard, 4-20mA, transmitter mounted at the RTD as required.

.1	Temperature monitoring range	-7°C to 49°C (20°F to 120°F)
.2	Output signal	Changing resistance
.3	Accuracy at calibration point	± 0.3C (± 0.5F°)

.3 All return air sensors shall be RTD or thermistor type temperature detectors. The sensor probe shall have a minimum length of 450 mm (18"). Each RTD may be provided with an industry standard, 4-20mA, transmitter mounted at the RTD as required.

.1	Temperature and monitoring range	4°C to 66°C (40°F to 150°F).
.2	Output Signal	Changing Resistance
.3	Accuracy ant calibration point	0.3C (± 0.5F°)

.4 Outdoor air sensor shall be the PT-100 platinum 3 wire RTD type with a 4-20mA transmitter mounted at the sensor. The RTD shall be mounted in a weatherproof enclosure, the 4-20mA transmitter shall be mounted inside the building within an electrical box.

.1	Temperature and monitoring range	-18°C to 49°C (0°F to 120°F).
.2	Output Signal	Changing Resistance
.3	Accuracy at calibration point	± 0.3C (± 0.5F°) over a range of

.5 Sensors shall be provided with vented protective covers, mounted 1500 mm (60") from floor level.

2.10 ELECTRICAL DEVICES

.1 Relays

.1 Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

.2 Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

.2 Override timers.

.1 Override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer shall be suitable for flush mounting on control panel face and located on local control panels or where shown.

.3 Current transmitters.

.1 AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and +1 % full-scale accuracy at 500 ohm maximum burden.

.2 Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized.

.3 Unit shall be split-core type for clamp-on installation on existing wiring.

.4 Current transformers.

.1 AC current transformers shall be UL/CSA Recognized and completely encased (except for terminals) in approved plastic material.

.2 Transformers shall be available in various current ratios and shall be selected for ±1 % accuracy at 5 A full-scale output.

.3 Transformers shall be fixed-core or split-core type for installation on new or existing wiring, respectively.

.4 Status inputs for motors (pumps and fans) shall use inductive coils to monitor current draw from one phase of power.

.5 Current transformers shall be selected and configured for appropriate amperage range, and shall have 0 to 5 Volt output

.6 BMS shall use AI points to monitor current transformers.

.5 Voltage transmitters.

.1 AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.

.2 Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with ±1 % full-scale accuracy with 500 ohm maximum burden.

.3 Transmitters shall be UL/CSA Recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

.6 Voltage transformers.

.1 AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.

.2 Transformers shall be suitable for ambient temperatures of 4˚C to 55˚C (40˚F to 130˚F) and shall provide ±0.5% accuracy at 24 VAC and a 5 VA load.

.3 Windings (except for terminals) shall be completely enclosed with metal or plastic material.

.7 Power monitors.

.1 Power monitors shall be the three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers, and UL Listed split-core current transformers.

.2 They shall provide a selectable rate pulse output for kWh reading and a 4 to 20mA output for kW reading. They shall operate with 5 A current inputs with a maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

.8 Current switches.

.1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system. Switch shall be complete with LED and have four turn adjustment.

2.11 PHOTO SENSOR

.1 Weathertight.

.2 Operating Temperature –30 to +70 C.

.3 Resistance at 0 Lux 15 Kohms minimum.

.4 Resistance at 10 Lux 3 Kohms typical.

Part 3 Execution

3.1 NAMEPLATES

.1 Duct and pipe mounted sensors and panels shall be provided with minimum size 75 x 25 x 3.2 mm nameplates, clearly identifying the equipment and functions with letter and number designation. Nameplates shall be mechanically secured and listed in the Operating and Maintenance manual.

3.2 ACTUATORS

.1 Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.

.2 Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

.3 Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

.4 Provide all mounting hardware and linkages for actuator installation.

.5 The controls contractor shall provide wiring as follows:

.1 All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.

.2 All wiring between the central control system (ATC/BMS) and the valve actuator shall be wired by the controls contractor.

.3 All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls' contractor.

.4 All wiring shall comply with code requirements. Segregate high and low voltage wiring and circuits and segregate the FAS and controls (BMS) terminals.

3.3 CONTROL DAMPER INSTALLATION

.1 Damper style and construction shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.

.2 Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4". larger than damper dimensions and shall be square, straight, and level.

.3 Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8") of each other.

.4 Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

.5 Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

.6 Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.

.7 Provide a visible and accessible indication of damper position on the drive shaft end.

.8 Support ductwork in area of damper when required to prevent sagging due to damper weight.

.9 After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

3.4 INSTALLATION OF THERMOSTATS

.1 Install sensors in accordance with the manufacturer's recommendations.

.2 Mount sensors rigidly and adequately for the environment within which the sensor operates.

.3 Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

.4 All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

.5 Install thermostats at handicapped elevations 1200 mm above finish floor (AFF).

.6 Where not indicated on drawing, place where directed by consultant.

.7 Co-ordinate location with architectural and electrical items.

3.5 INSTALLATION OF SENSORS - GENERAL

.1 Install sensors in accordance with the manufacturer's recommendations.

.2 Mount sensors rigidly and adequately for the environment within which the sensor operates.

.3 All wires attached to sensors shall be air in EMT raceways.

.4 All din rail or screw mounted transmitters, shall be mounted in steel box of suitable size with removable cover and secured in place.

.5 The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.

3.6 AIR TEMPERATURE SENSORS

.1 Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

.2 Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (10 ft.) of sensing element for each $1m^2$ (1 ft of sensing element for each 1 ft^2) of coil area.

3.7 LIQUID TEMPERATURE SENSORS

.1 All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

3.8 OUTDOOR AIR TEMPERATURE SENSORS

.1 Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

3.9 LOW LIMIT THERMOSTATS

.1 Locate detectors after preheat coil or before cooling coil in air systems utilizing outside air.

3.10 DIFFERENTIAL PRESSURE SENSORS

.1 Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.

.2 Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.

.3 Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.

.4 All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.

.5 All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

3.11 FLOW SWITCH INSTALLATION

.1 Use correct paddle for pipe diameter.

.2 Adjust flow switch in accordance with manufacturer's instructions.

3.12 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is to be read in conjunction with 25 10 01 Building Automation Systems – General Requirements and the remaining Section 25 specifications.

1.2 BACNET INTEGRATION AND CONTROL POINTS

.1 The BAS contractor is responsible to provide a full and operable system that meets all required specifications and sequences.

.2 The BAS contractor shall provide hard wired control points, sensors and all other components of the system as required to either supplement available BACNet points, or in the absence of a BACNet card make the system completely operable.

.3 Sequences of operation may or may not be achievable through BACNet integration, as not all points required may be available from the unit manufacturer.

.4 Not all equipment in the project has been specified with BACNet cards. The BAS contractor is responsible to review the entirety of the mechanical specification to confirm which equipment is being specified with BACNet integration cards and which equipment will not be provided with BACNet integration.

.5 Quoting or pricing work as BACNet integration only is not acceptable.

Part 2 Products

Not Used.

Part 3 Execution

3.1 SYSTEM CONTROL STABILITY AND ACCURACY

.1 Control Stability and Accuracy shall maintain measured variable at set-point within tolerances listed below:

Control Stability and Accuracy		
Controlled Variable	Control Accuracy	Range of Medium Accuracy
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1°C (±2°F)	
Duct Temperature	±1.5°C (±3°F)	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-5- in. w.g.) differential

3.2 A2L REFRIGERANT CONTAINING EQUIPMENT

.1 A2L refrigerants are classified as mildly flammable. CSA B52-2023 has specific safety clauses related to the use of refrigerants with this classification within buildings.

.2 This contractor shall be responsible to ensure that the installation requirements of CSA B52-2023 are met.

.3 Throughout this specification various pieces of equipment have been specified with refrigerant leak detection systems. Field wiring of the alarm status of this system to various downstream system components is required under Annex P of the standard and is the responsibility of this contractor. These devices include the following:

.1 Open all zone dampers connected to the affected system.

.2 Disable electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves on the affected refrigeration systems

.4 De-energize any potential sources of ignition with the ductwork system of the affected system.

.5 Energize fans within the ductwork system.

.6 Activate any designated refrigeration leak ventilation systems.

3.3 VERIFICATION OF REFRIGERATION LEAK DETECTION SYSTEM OPERATION

.1 The commissioning process shall include the verification of the refrigeration leak detection system.

.2 All interlocks between leak detection systems installed and system components, as well as interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52. Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

3.4 NAMING OF POINTS AND CONTROLLERS

.1 Refer to section 25 05 02 Building Automation Systems – General Requirements

3.5 START-UP AFTER POWER FAILURE

.1 System shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started; along with the time delay between starts shall be user adjustable.

3.6 REQUIREMENTS TYPICAL TO ALL SEQUENCES

.1 BAS contractor is responsible to provide a full and complete system that is capable of meeting all sequences, alarms, trends etc. specified. A point not being listed on a points list does not absolve the contractor from providing it if it is necessary to meet the Sequence of Operation.

.2 All set points, reset curves etc. shall be adjustable by the operator.

.3 This building is designed to comply with the prescriptive approach of the OBC SB-10 and ASHRAE 90.1 All mandatory control functions listed in the latest edition of ASHRAE 90.1 shall be included in sequences. These functions include, but are not limited to:

.1 Zone thermostatic control, complete with dead bands between heating and cooling set points.

.2 Set-point overlap protection

.3 Off-Hour Controls consisting of:

.1 Automatic shut down

.2 Temperature set back

.4 Optimum start controls

.5 Zone Isolation or grouping of HVAC equipment that is not expected to operate on the same schedule. All equipment in a single zone shall be scheduled together unless it was designed to operate 24/7. Each zone shall be capable of being provided it's own schedule or being scheduled together. As per ASHRAE 90.1 a zone shall not span more than one floor or be greater than 25,000 square feet.

.6 Provide logic to identify zones that may be excessively driving reset logic and generate an alarm for system operator to review. Provide functionality to remove any zone from reset logic.

.7 Where a space has a door to the exterior without an automatic closer, provide a door switch that resets heating set point to 55°F and cooling set point to 90°F if the opening is left open for more than 5 minutes.

3.7 ALARMS

.1 Provide alarms, alarm hierarchy and alarm suppression as indicated in ASHRAE Guideline 36. Proivde an alarm system capable of providing the following:

.1 Time and date is listed on the alarm

.2 Alarm Level. User shall be able to set alarm level for each individual alarm. The 4 levels of alarm shall be as follows:

.1 Level 1: Life-safety message

.2 Level 2: Critical equipment message

.3 Level 3: Urgent Message

.4 Level 4: Normal Message

.3 Sort alarms by level in the user interface

.4 Provide alarm description

.5 Provide equipment tags of units in alarm.

.6 Provide possible cause of alarm, if detected by fault detection routines.

.7 User adjustable entry delay for alarms. The default time delays are as follows:

.1 Level 1: 1 second

.2 Level 2: 10 seconds

.3 Level 3: 1 minute

.4 Level 4: 5 minutes

.8 Alarms shall be configured as latching or nonlatching. A latching alarm requires acknowledgement from operators before return to normal, even if exit deadband has been met. A nonlatching alarm does not require acknowledgement. Default latching status is as follows:

.1 Level 1 alarms: Latching

.2 Level 2 alarm: latching

.3 Level 3 alarms: nonlatching

.4 Level 4 alarms: nonlatching

.9 Postexit suppression delay shall be provided to limit the number of alarms. Once an alarm has been triggered and reset it shall not be triggered again for a period of time. Default delay is as follows:

.1 Level 1 alarms: 0 minutes

.2 Level 2 alarm: 5 minutes

.3 Level 3 alarms: 24 hours

.4 Level 4 alarms: 7 days

.10 Hierarchical Alarm Suppression. Provide a mechanism by which alarms in downstream equipment in the hierarchy are not presented to the operator if the source of the error is likely due to an alarm elsewhere in the building. (i.e. do not alarm that a VAV box cannot maintain discharge air temperature if the boiler plant or main circulation pumps are in alarm). Failure to start, Level 1, and command/status mismatch alarms are not subject to this hierarchy.

3.8 FAULT DETECTION ROUTINES

.1 Provide automatic fault detection routines that will alert the operator to problems with sensors within the existing BAS system. There shall be a summary page provided which tabulates each Air Handling Unit with the list of following faults. Each fault limit shall be user adjustable by air handling unit:

.1 Duct Static Pressure Too Low with fan at full speed

.2 Mixed Air Temperature Too Low (not between RAT and OAT)

.3 Mixed Air Temperature Too High (not between RAT and OAT)

.4 Too Many Changes in OS (Set points have changed more than 10 times in last 60 minutes)

.5 SAT below MAT

.6 <u>OA airflow is not within acceptable range for damper command</u>

.7 SAT too low in full heating or too high in full cooling

.8 Temperature drop across coil with cooling inactive

.9 Temperature rise across coil with heating inactive

.10 OAT too high for free cooling but mechanical cooling disabled.

.11 SAT and MAT are not approximately equal in free cooling mode

.2 Full formulas and definitions of these fault conditions are included in ASHRAE Guideline 36, High-Performance Sequences of Operation for HVAC Systems.

.3 Provide indication of potential fault cause as per ASHRAE Guideline 36.

3.9 TRENDS

.1 Provide Trends as follows:

.1 For HVAC Units:

.1 Unit/Fan Command and Status

.2 Fan Speed

.3 Unit Discharge Air Setpoint or Control Valve position

.4 Heating/Cooling Status (if applicable)

.5 Unit Supply and Return Air Temperatures

.6 Unit Supply and Return air Humidity

.7 Return Air CO_2

.8 Paired Exhaust fan command and status (if applicable)

.2 For Heating and Cooling Plants

.1 Boiler/Cooling Plant Command and status

.2 Pump Command and status

.3 Pump speeds

.4 Supply and Return water temperatures

.3 Energy Monitoring (Gas, Electric, Water etc.)

.1 Useage

.4 Temperature Sensitive Spaces (Boiler Rooms, IT Rooms, Electrical Rooms)

.1 Space Temperature

.2 Heating/Cooling Equipment status

.5 Exhaust Fans

.1 At owner request

.6 Misc. Heating Elements

.1 At owner request

.7 VAV/VVT Boxes

.1 At owner request

3.10 SCHEDULES

.1 All equipment shall be assigned to logical zone groupings of equipment with each group having its own defined schedule.

.2 Provide a standard schedule complete with options for both holiday and exception schedules for each zone.

.3 User shall be able to assign multiple zones to the same schedule where appropriate.

3.11 ROOM TEMPERATURE SET POINTS

.1 Heating:

.1 Occupied: 21° C.

.2 Unoccupied: 16° C.

.2 Cooling:

.1 Occupied: 24° C.

.2 Unoccupied: 27° C.

.3 Occupied-Standby: Where lighting integration is provided, use BAS integration to determine occupancy of space. If unoccupied, set heating set point back 1°C and set cooling set point up 1°C after 5 minutes of unoccupied. If all spaces in an HVAC zone are unoccupied disable HVAC system fans.

.4 Occupied Standby: Provide and install Occupancy Sensors to provide occupancy of space. If unoccupied, set heating set point back 1°F and set cooling set point up 1°F after 5 minutes of unoccupied. If all spaces in an HVAC zone are unoccupied disable HVAC system fans.

3.12 OCCUPANCY SENSOR INTEGRATION

.1 Spaces shall be given a temporary unoccupied setback of 1°C from normal set back if the occupancy sensor picks up no occupants for 30 minutes during occupied hours.

3.13 VAV BOXES WITH REHEAT (SIMPLE VERSION)

.1 Description

The variable volume terminal consists of a damper and SCR electric reheat.

The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:

.1 Occupied

The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air damper in sequence with the reheat to maintain the room temperature at set point. Reheat should be used as trim heat, integrate unit's VVT logic to maximize heat provision via the gas burner. Damper position should never restrict airflow to less than 80% of design in heating mode.

.2 Unoccupied

The reheat control is off. Provide heat via the gas burner in the HVAC unit.

Should additional heat be required at night the controller may reset to the terminal unit Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

.3 Points List

Name	**AI**	**AO**	**DI**	**DO**
Damper Command		X		
Airflow Volume	X			
Discharge Air Temperature	X			
Temperature Control Valve Modulation		X		
Space Temperature	X			

3.14 ELECTRIC HEAT CONTROL

.1 A temperature sensor energizes the fan/heating contact to maintain setpoint. Fan status is monitored and alarms to BAS when it does not match command.

.2 The control system shall maintain the following temperatures:

.1 Occupied mode 18°C for vestibules/stairwells.

.2 Unoccupied mode: 13°C.

.3 Provide alarm if space temperature is below 10°C.

.4 Points List

Name	**AI**	**AO**	**DI**	**DO**
Space Temperature	X			
Heating Contact Command		**X**		
Fan Command (if forced flow)				X
Fan Status (if forced flow)	X			

3.15 OUTDOOR AIR HANLDING UNITS (VAV DX, GAS, DISCHARGE AIR RESET)

.1 General

.1 The variable volume air handling units consists of a mixed air section with outdoor air, exhaust air and return air dampers, filter, gas fired burner, packaged cooling, supply and return fans with variable frequency drives. The unit is DDC controlled using electric actuation. **A remote ERV is integrated into the sequences.**

.2 Sequences are to meet ASHRAE Standard 36, High Performance Sequences of Operation for HVAC Systems. The BAS Contractor is responsible for full integration of the sequences, along with any additional requirements listed below.

.3 Time delays shall be provided to prevent unit short cycling.

.4 Fan status shall be reported.

.5 Units shall have a staggered start delay programmed into them for start-up on power failure.

.2 Safeties and Limits

.1 Freeze Protection: Provide programming to ASHRAE Guideline 36 standard. There are three levels of freeze protection to be programmed into the software:

.1 If supply air temperature drops below 4.4°C (40°F) for 5 minutes, enable heating plant, override outdoor air damper position/ERV operation to minimum, and modulate the heat to maintain a supply air temperature of at least 6°C (42°F). Disable this function once the supply air temperature rises above 7°C (45°F) for 5 minutes.

.2 If supply air temperature drops below 3.3°C (38°F) for 5 minutes, fully close both the economizer/outdoor air damper for 1 hour and set an alarm at the OWS. After 1 hour the unit shall resume minimum outdor air ventilation and entre the previous stage of freeze protection.

.3 If supply air temperature drops below 3.3°C (38°F) for 15 minutes or below 1°C (34°F) for 5 minutes, shut down supply and return fans, close outdoor air damper, open both the chilled water valves and energize both pumping systems. Also ensure heating plant is enabled, and modulate the heating valve to maintain the higher of the supply air temperature or mixed air temperature at 27°C (80°F), and send an alarm to the OWS. The freeze protection shall remain in place until reset by a software switch at the OWS.

.4 Provide a hardwired freeze stat that must be manually reset as a final safety.

.3 System Start/Stop

.1 The unit fan may run in any mode except for unoccupied mode.

.2 The unit shall only run in setback mode if there is a perimeter zone without perimeter radiation, or after the perimeter radiation has failed to maintain set point for a minimum of 15 minutes.

.3 Provide an override switch at the OWS to enable the unit for 3 hours.

.4 Monitor units' refrigeration leak detection system. Upon signal from system:

.1 Disable any electric reheat or other sources of ignition in the ductwork system.

.2 Fully open zone dampers within the ductwork system/close bypasses.

.3 Energize all fans within the duct system/general exhaust fans in area affected.

.4 Control Strategy

.1 Provide a summation of total airflow from the VAV boxes on the graphic for the unit.

.2 Determination of AHU Mode of Operation

.1 AHU system modes are the same as the zone groups served by the system. When zone groups served by an air-handling system are in different modes, the following hierarchy applies:

.1 Occupied mode

.2 Cool down mode

.3 Setup mode

.4 Warm-up mode

.5 Setback mode

.6 Freeze Protection setback mode

.7 Unoccupied mode

.5 Static Pressure Control

.1 Static Pressure Reset. Provide static pressure reset using Trim and Respond Set-Point Logic to ASHRAE Standard 36, High-Performance Sequences of Operation. All parameters shall be adjustable by the operator at the OWS.

.2 BAS shall modulate the VFD of the supply and return fans to maintain the static pressure set point.

.3 The speed AO sent to the VFDs shall be configured such that 0% speed corresponds to 0 Hz, and 100% speed corresponds to maximum speed configured at the VFD. This does not necessarily correspond to 60 Hz.

.6 Supply Air Temperature Control

.1 The Supply Air temperature control loop is enabled at all times that the supply air fan is proven on and disabled and output set to deadband (no heating, outdoor air damper closed) otherwise.

.2 Supply Air Temperature Set Point. Supply Air Temperature is to be reset and controlled to ASHRAE Guideline 36, using Trim and Respond logic. Design variables are as follows:

.1 Minimum Cooling Supply Air Temperature: 12°C (55°F)

.2 Maximum Cooling Supply Air Temperature: 18°C (65°F)

.3 OAT Minimum: 16°C (60°F)

.4 OAT Maximum: 21°C (70°F)

.3 Supply air temperature in heating mode shall be kept as low as possible so that heat can be delivered by the VAV reheat coils.

.4 All Trim and Respond variables and set points shall be adjustable from the OWS.

.5 During occupied mode and setup mode, the SAT set point shall be reset from Minimum Cooling Supply Air Temperature when the OAT is at OAT maximum and above, proportionally up to a maximum temperature, T-max when the outdoor air temperature is at OAT minimum and below.

.6 T-max shall be reset using Trim and Respond Logic between the minimum cooling supply air temperature and the maximum cooling supply air temperature.

.7 See controls diagram from ASHRAE Guideline 36 below:

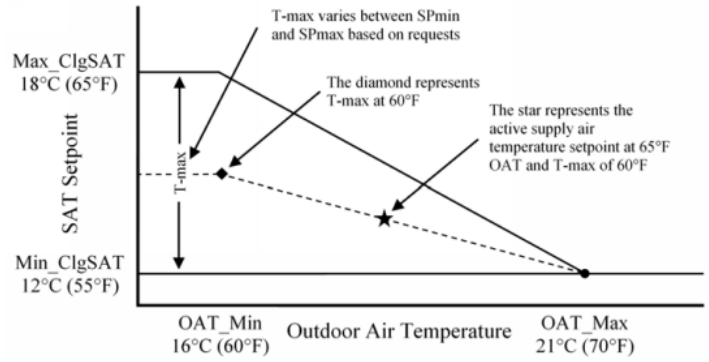


Figure 5.16.2.2 Example supply air temperature reset diagram.

.8 During the cooldown mode, the set point shall be the minimum cooling supply air temperature.

.9 During the warm-up and setback modes the set point shall be:

.1 35°C (95°F) for systems with zones without reheat.

.2 21°C (70°F) for systems with VAV reheat or perimeter heat in all zones.

.10 Provide logic to allow the VAV unit to act as the primary heat source and increase supply air temperature to 32°C (90°F) in case of central plant failure of branch piping shut down.

.11 The supply air temperature shall be controlled to set point shall be sent to the AHU.

.7 Minimum Outdoor Airflow Control

.1 ASHRAE Guideline 36 logic shall be modified to allow for CO_2 demand control ventilation based on a CO_2 reading in the return air duct.

.2 The ERV shall be enabled during all occupied hours and represents the minimum ventilation rate. When in minimum ventilation rate, the AHUs OA damper shall be fully closed.

.3 The ERV shall be set to free cooling mode when conditions are appropriate.

.4 Provide a minimum outdoor air control loop which is enabled whenever the AHU is in operation and in occupied mode. Set output to zero otherwise. Provide an IAQ signal to the unit for internal operation of the dampers, return fan etc.

.5 During occupied times:

.1 The outdoor air damper will remain closed until a preset value of 1000 ppm is reached. Beyond that value the damper shall modulate open until a minimum value of 800 ppm is reached.

.2 Reset the CO_2 setpoint up by 200 ppm with the mechanical cooling is in operation.

.6 The demand for economizer operation shall override the outdoor air damper position and exhaust/return fan control.

.7 Control loop mapping shall be as follows:

.8 Air Side Economizer

.1 The unit shall control the air side economizer operation.

.9 Return Fan and Building Pressure control

.1 Return fan shall operate whenever the associated supply fan is proven on, and shall be off otherwise.

.2 Return fan shall be controlled to maintain return fan discharge static pressure at set point.

.3 Exhaust dampers shall only be enabled when the associated supply and return fans are proven to be on, and the minimum outdoor air damper is open. The exhaust dampers shall be closed otherwise.

.4 The building static pressure shall be time averaged with a sliding 5-minute window to dampen fluctuations. The averaged value shall be that displayed and used for control.

.5 When exhaust dampers are enabled, a control loop shall modulate exhaust dampers in sequence with the return fan static pressure set point as indicated below to maintain the building pressure at a set point of 12 Pa (0.05 in. of water):

.1 From 0% to 50%, the building pressure control loop shall modulate the exhaust dampers from 0% to 100% open.

.2 From 51% to 100%, the building pressure control loop shall reset the return-fan discharge static pressure set point from its minimum to maximum. Static set points to be provided by the balancer.

.10 Alarms

.1 Maintenance interval alarm once fan has operated for 1500 hrs.

.2 Supply fan status/command mismatch (1 minute delay)

.3 Return fan status/command mismatch (1 minute delay)

.4 Freeze stat alarms as listed under Limits and Safeties section.

.5 Supply air temperature above 35°C (5 minute delay)

.6 Return air temperature is more than 5 degrees from space set point (5 minute delay)

.7 Unit is running and return air CO_2 levels are above 800 ppm (1 hour delay)

.8 Heat wheel or other alarm is received from unit controller (immediate)

.9 Unit not cooling when commanded, as indicated by SAT (5 minute delay)

.10 Unit not heating when commanded, as indicated by SAT (5 minute delay)

.11 High Building Pressure (more than 25 Pa (0.10 in. of water)

.12 Low Building Pressure (less than 0 Pa (0.0 in of water)

.11 Points List

.1 Where available, points may be integrated via BACNet. Any points not available via BACNet shall be provided by this contractor.

Name	**AI**	**AO**	**DI**	**DO**
Supply Fan Command				X
Supply Fan Speed Modulation		X		
Supply Fan Status	X			
Supply Fan Alarm			X	
Supply Duct Static Pressure	X			
Return Fan Command				X
Return Fan Speed Modulation		X		
Return Fan Status	X			
Return Fan Alarm			X	
Discharge Air Setpoint		X		
Heating Lockout				X
Gas Burner Status	X			
Cooling Lockout				
DX Cooling Status	X			
Supply Air Flow Volume	X			
Supply Air Temperature	X			
Supply Air Humidity	X			
Return Air Temperature	X			
Return Air CO_2	X			
Return Air Humidity	**X**			
Mixed Air Temperature	X			
Freeze Stat Status			X	
Unit Alarm			X	

3.16 EXHAUST FANS (GENERAL)

.1 Start/stop exhaust fans on time of day schedule.

.2 The DDC system uses a current switch to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.3 Points List

Name	AI	AO	DI	DO
Exhaust Fan Command				X
Exhaust Fan Status	X			

3.17 EXHAUST FANS (WASHROOM)

.1 Start/stop exhaust fans on time of day schedule.

.2 The DDC system uses a current switch to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.3 Points List

Name	AI	AO	DI	DO
Exhaust Fan Command				X
Exhaust Fan Status	X			

3.18 EXHAUST FANS (HEAT REJECTION)

.1 Start/stop exhaust fans based on space temperature.

.2 Space temperature shall be indicated on the BAS. Use of local reverse acting thermostats is not acceptable.

.3 Exhaust fan shall operate with motorized dampers on the exhaust ductwork, and on the make up air ductwork if motorized dampers are indicated on the plans. Confirm dampers are open prior to sending fan command.

.4 The DDC system uses a current switch to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.5 Points List

Name	AI	AO	DI	DO
Exhaust Fan Command				X
Exhaust Fan Status	X			
Space Temperature	X			
Motorized Damper Command				X
Motorized Damper Feedback			X	

3.19 ENERGY RECOVERY VENTILATORS

.1 General

.1 ERV shall come with internal controller to control wheel modulation speed, fan status, free cooling and defrost cycles.

.2 Safeties and Limits

.1 Unit shall be prevented from short cycling by the BAS.

.2 Monitor units' refrigeration leak detection system. Upon signal from system:

.1 Disable any electric reheat or other sources of ignition in the ductwork system.

.2 Fully open zone dampers within the ductwork system/close bypasses.

.3 Energize all fans within the duct system/general exhaust fans in area affected.

.3 Start/Stop

.1 The unit shall be started and stopped by a time of day schedule.

.4 Control Strategy

.1 The unit shall utilize internal controls.

.5 Alarms

.1 Provide indication at OWS if unit is in alarm.

.2 If fan status does not match command. (10 minute delay)

.6 Points List

.1 Where available, points may be integrated via BACNet. Any points not available via BACNet shall be provided by this contractor.

Name	AI	AO	DI	DO
Unit Command				X
Supply Fan Status	X			
Exhaust Fan Status	X			
Unit Alarm			X	
ERV Wheel Status	X			
ERV Wheel Entering Air Temp	X			
ERV Wheel Leaving Air Temp	X			

3.20 DOMESTIC WATER SYSTEM CONTROL (SIMPLE)

.1 Provide supply temperature indication with strap on sensor on domestic hot water pipe for two (2) domestic hot water systems.

.2 The recirculation pumps will be started/stopped on a time of day schedule.

.3 Recirculation pump status shall be monitored.

.4 Alarms shall be provided for the following:

.1 Recirc pump start/stop/status mismatch (5 minute delay).

.2 Domestic hot water supply temperature rises above 62 degrees C for kitchen loop.

.3 Domestic hot water supply temperature rises above 45 degrees C for main building loop.

.5 Points List

Name	AI	AO	DI	DO
Supply Water Temperature	X			
Recirc Pump Command				X
Recirc Pump Status	X			

3.21 SERVICE ROOM TEMPERATURE CONTROL

.1 Room Temperature Control.

The room temperature control consists of a temperature sensor, a forced flow unit heater fan motor, modulating control valve, and an exhaust air fan and a supply air fan.

The DDC will control using electric actuation.

The controller monitors the room temperature sensor.

On a call for cooling the unit heater control valve is closed and the fan motor is off, controller will start exhaust and supply fan motor to maintain room temperature setpoint.

On a call for heating the exhaust fan motor is off, controller will modulate unit heater control valve and the unit heater fan motor is on to maintain room temperature setpoint.

The DDC system uses current switches to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.2 Points List

Name	AI	AO	DI	DO
Space Temperature	X			
Exhaust Fan Command				X
Exhaust Fan Status	X			
Supply Fan Command				X
Supply Fan Status	X			

Unit Heater Fan Command				X
Unit Heater Fan Status	X			
Heating Valve Modulation		X		

3.22 OUTDOOR TEMPERATURE AND HUMIDITY

.1 Provide new sensor for outdoor air temperature

.2 Provide new sensor for outdoor humidity

.3 Points List

Name	**AI**	**AO**	**DI**	**DO**
Outdoor Air Temperature	X			
Outdoor Air Humidity	X			

3.23 EXTERIOR LIGHTING CONTROL

.1 The outdoor lighting consists of two lighting zones (parking lot poles and wall packs) and one astrological clock.

.2 The DDC will control using electric actuation Start/stop of each lighting zone on time of day schedule. Photocell will override program turning lights on should outdoor elements reach a low illumination during program stop period.

.3 The DDC system will monitor lighting zone operation and generates an alarm if status deviates from DDC start/stop control.

.4 Points List

Name	**AI**	**AO**	**DI**	**DO**
Zone Command (multiple)				X
Photocell			**X**	
Astrological Clock			**X**	

3.24 ELECTRICAL/GAS/WATER METER INTEGRATION

.1 Integrate electrical meters provided as part of switchboard into BAS to provide monitoring of instantaneous electrical load, as well as a variety of totalization and trending.

.2 Provide meters to monits gas and domestic water usage as indicated on drawings.

.3 Co-ordinate exact method of integration with electrical trade.

.4 Points List

.5

Name	AI	AO	DI	DO
Electrical Use	X			
Gas Use	X			
Water Use	X			

3.25 RECEPTACLE INTEGRATION

.1 The BAS shall enable/disable the receptacles identified on the electrical drawings based on a time of day schedule to meet the prescriptive requirements of ASHRAE 90.1 This contractor shall review the electrical drawings for locations and number of contacts.

.2 Points List

Name	AI	AO	DI	DO
Power Interruption				X

.1 Applies to parts and labour.

3.26 SECURITY SYSTEMS

.1 Integrate to building security panel to monitor system status (armed/disarmed/alarmed).

.2 Provide owner toggled option to disable each exterior lighting package 15 minutes after the system is armed.

3.27 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

SECTION 23 05 23.02
VALVES - CAST IRON

PART 1 GENERAL

1.1 RELATED REQUIREMENTS (NOT USED)

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B16.1-05, Cast Iron Pipe Flanges and Flanged Fittings

.2 ASTM International (ASTM):

.1 ASTM A49-01, Standard Specification for Heat-Treated Carbon Steel Joint Bars

.2 ASTM A126-04, Standard Specification for Grey Iron Castings for Valves, Flanges, and Pipe Fittings

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

.1 MSS SP-61-03, Pressure Testing of Steel Valves

.2 MSS SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends

.3 MSS SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends

.4 MSS SP-82-1992, Valve Pressure Testing Methods

.5 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10 valves, each size, minimum 1.

.3 Stem packing: one for every 10 valves, each size, minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

PART 2 PRODUCTS

2.1 MATERIAL

.1 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:

.1 Gate valves: MSS SP-70

.2 Globe valves: MSS SP-85

.3 Check valves: MSS SP-71

.3 Requirements common to valves, unless specified otherwise:

.1 Body, bonnet: cast iron to ASTM B209 Class B.

.2 Connections: flanged ends plain face with 2 mm raised face with serrated finish to ANSI B16.1

.3 Inspection and pressure testing: to MSS SP-82

.4 Bonnet gasket: non-asbestos.

.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.7 Gland packing: non-asbestos.

.8 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62

.9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62

.3 Seat rings: renewable bronze to ASTM B62, screwed into body

.4 Stem: bronze to ASTM B62

.5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem

.6 Seat: integral with body.

.7 Stem: wrought steel.

.8 Operator: handwheel or T handle service box wrench.

.2 NPS 10 - 24, non rising stem, inside crew, bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.

.2 Pressure ratings: Class 125.

.3 Disc: solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem

.4 Seat rings: renewable bronze to ASTM B62 screwed into body

.5 Stem: bronze to ASTM B62

.6 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.

.7 Stem: wrought steel.

.8 Operator: handwheel or T handle service box wrench.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:

.1 Approvals: UL and FM approved for fire service

.2 UL and FM Label: on valve yoke

.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC C-262 (B).

.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements

.5 Packing gland: bronze.

.6 Stem: manganese bronze. Diameter to ULC C-262 (B). Brass, ASTM B16.

.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B)

.8 Bosses for bypass valve, drain: on NPS 4 and over.

.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: EPDM coated cast iron with bronze disc rings.

.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.

.11 Pressure rating:

.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.

.2 NPS 14-1.2: 1.2 MPa CWP.

.12 Operator: handwheel.

2.4 GLOBE VALVES (NOT USED)

2.5 BYPASSES FOR GATE AND GLOBE VALVES (NOT USED)

2.6 VALVE OPERATORS (NOT USED)

2.7 CHECK VALVES (NOT USED)

2.8 SILENT CHECK VALVES (NOT USED)

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

SECTION 26 42 00
CATHODIC PROTECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS (NOT USED)

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.3 No. 4-1974 (R2004) Control of Electrochemical Corrosion of Underground Metallic Structures.

.2 National Association of Corrosion Engineers (NACE)

.1 NACE SP0169-2007, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheets for cathodic protection and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Indicate location of anodes, test positions, connecting cables, wire splicing details, installation procedures, power supply, hardware and accessories.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Provide complete cathodic protection system to OPSS 442, to NACE SP0169, CSA 22.3 No.4 and comprising galvanic or impressed current anodes with design life, of 30 years minimum.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install system including bonding of structure as indicated.

.2 Locate test stations in weatherproof housings as indicated.

.3 Make joints and connections by means of thermit welding.

.1 Bond pipelines to structure.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Division 26 Common Requirements for Electrical

26 00 11 Electrical Specification Index

Common Contract Requirements for Electrical

26 01 13 Electrical Supplemental Tender Form
26 01 15 Electrical Allowances – Division 1
26 01 16 Electrical Contract General Requirements
26 01 19 Commissioning of Electrical Systems
26 01 20 Integrated Testing of Fire Protection and Life Safety Systems
26 01 21 Electrical Occupancy Requirements

Common Work Results for Electrical

26 05 19 Wires and Cables
26 05 20 Splitters, Junction, and Pull Boxes
26 05 21 Outlet Boxes, Conduit Boxes, and Fittings
26 05 22 Wire and Box Connectors – 0 –1000 V
26 05 26 Grounding Secondary
26 05 33 Conduits, Conduit Fastenings, and Conduit Fittings
26 05 43 Installation of Cables in Trenches and Ducts
26 05 74 Short Circuit/Coordination Study Arc Flash Hazard Analysis
26 05 75 Auxiliary Systems
26 05 76 Electric Heating Systems

Low-Voltage Transformers

26 22 13 Dry Type Transformers

Switchboard and Panelboards

26 24 13 Service Entrance Board
26 24 16 Panelboards
26 24 17 Moulded Case Circuit Breakers

Low-Voltage Distribution Equipment

26 27 26 Wiring Devices

Low-Voltage Circuit Protective Devices

26 28 13 Fuses – Low Voltage
26 28 16 Disconnect Switches

Low-Voltage Controllers

26 29 13 Starters and Contactors

Lighting

26 51 13 Lighting Equipment
26 51 16 Digital Occupancy & Network Lighting Control Systems (Wired)

Division 28 Electronic Safety and Security

Fire Detection and Alarm

28 31 25 Fire Alarm System (Addressable)

END OF SECTION

Part 1 General

1.1 INSTRUCTIONS TO BIDDERS

.1 The Electrical Supplemental Tender Form must be submitted to the architect and consultant (admin@deiassociates.ca) within 2 hours after tender closing. Electrical contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.

.2 Should the Electrical Supplemental Form not be submitted then the contractor shall use Basis of Design manufacturers as listed.

.3 CONTRACTOR

I/We certify that I/We have the authority to bind the company.

COMPANY NAME	AUTHORIZED SIGNATURE
ADDRESS	PRINTED SIGNATURE
CITY	TITLE
TELEPHONE NUMBER	DATE

.4 SUB-CONTRACTORS

The Contractor shall state below the name of the Public Address, Security, Co-ordination Study, Computer Network, Life Safety Systems Commissioning Agent, Seismic Restraint Engineer Sub-contractor he intends to use, which shall not be changed without the consent of the Consultant.

Public Address	CASH ALLOWANCE
Security	CASH ALLOWANCE
Co-ordination Study	_____
Computer Network	CASH ALLOWANCE

.5 The Stipulated Bid Sum shall be for the basis of design manufacturer or supplier equipment only, unless otherwise indicated. Where a choice of this equipment is given, this Contractor shall indicate the supplier or manufacturer he intends to use. **Where no choice is indicated, the basis of design supplier or equipment shall be used.**

.6 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The Electrical Contractor shall not indicate equipment, materials or suppliers which are not listed. If this is done, the base bid supplier shall be used.

.7 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.8 Submit the following list of basis of design and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	**Equipment**	**Basis of Design**	**Acceptable Alternate Manufacturer**	**Indicate Manufacturer Or Supplier**
26 29 13.13	Starters and Contactors	Schneider Electric	Allen Bradley Siemens Eaton Klockner-Moeller	
26 22 13.13	Dry –Type Transformers	Hammond	Rex Acme Delta Bemag	
26 24 13	Service Entrance Board	Schneider Electric	Siemens Eaton ABB	
26 24 17	Molded Case Circuit Breakers	Schneider Electric	Siemens Eaton ABB	
26 28 16	Disconnect Switches	Schneider Electric	Siemens Eaton ABB	
26 24 16	Panelboards	Schneider Electric	Siemens Eaton ABB	
26 28 13	Fuses – Low Voltage	Mersen	GEC Littlefuse	

26 05 75	Classroom Control Panels	Swift Path	Control Hub Olympic Tool & Die DiPanel	
26 51 13	LED Interior	Cooper	Lithonia Signify	
26 51 13	LED Exterior	Cooper	Lithonia Signify	
26 51 13	Exit Lighting	Aimlite	Lumacell Stanpro	
26 51 13	Emergency Battery Units	Aimlite	Lumacell Stanpro	
26 51 13	Emergency Fixtures	Aimlite	Lumacell Stanpro	
26 51 16	Digital Occupancy and Network Lighting Control Systems (wired)	Acuity (nLight)	Cooper (Wavelinx CAT) Legrand (Wattstopper)	
26 43 13	Surge Protection Devices	Innosys	N/A	
26 05 76	Electric Heating Equipment	Ouellet	Westcan Stelpro	
28 31 25	Fire Alarm System (Addressable)	Edwards	Simplex Notifier Mircom	

.9 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Apprentice Electrician $_____/hr

Journeymen Electrician $_____/hr

1.2 ELECTRICAL TENDER PRICE (EXCLUDING HST)

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: $_____

_____

(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

END OF SECTION

Part 1 General

1.1 GENERAL INSTRUCTIONS

.1 Comply with the General Conditions, Supplementary Conditions, and all of Division 1.

.2 Allowances are indicated in Division 1 for this project. Refer to Division 1 to obtain allowance values.

1.2 CASH ALLOWANCE (HST EXCLUDED)

.1 Refer to current CCDC requirement and Division 1 for CASH ALLOWANCES.

.2 HST (Harmonized Sales Tax) is not included in cash allowance(s).

.3 Allowances are stated in Division 1 of this project specification. It is the responsibility of the Electrical Contractor to review all allowances. If no allowances are identified, the Electrical Contract Price shall include all costs associated for the full scope of work and materials related to Electrical Contract Documents prepared by the Consultant.

.4 Allowances shall be expended as the Owner directs through the Consultant. The Consultant will direct the Contractor(s) to **purchase** and perform work for which payment is made from an allowance.

.5 Unless otherwise noted, the stated allowances for equipment purchase include initial distributor mark-up for the material components. The installation of these allowance items, along with required power connections, device boxes, conduit, controls, cabling, cable terminations with testing, making operable, and warranty must be included in the electrical tender price. Therefore, the Contractor shall include any overhead and profit on the allowance value in their tendered price and not from within the allowance value.

.6 Where the actual cost of the Work under any cash allowance is less that the amount of the allowance, the Owner shall be credited for the unexpended portion of the cash allowance, but not for the Contractor's overhead and profit on such amount.

.7 Where the allowance is insufficient to cover the actual cost the difference in value will be addressed as a change order.

.8 The value of the work performed under a cash allowance is eligible to be included in progress payments.

1.3 EXPENDITURE OF CASH ALLOWANCES

.1 Owner, through Consultant, will provide Contractor with documentation required to permit pricing of a cash allowance item.

.2 Owner, through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.3 Owner, through Consultant, may request the Contractor to disclose originals of all bids, quotations, and other price related information received from potential Suppliers or Subcontractors.

.4 Owner, through Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain Owner's prior written approval in the form of a Change Order before entering into a subcontract, amending an existing subcontract, or performing own forces work included in a cash allowance. Upon issuance of the Change Order, the Contractor's responsibilities for a cash allowance item shall be the same as for other work of the Contract.

.5 Refer to CCDC 2 – 2020, GC4.1.4. Where the actual cost of the Work under any cash allowance exceeds the amount of the allowance, and unexpended amounts from other cash allowance shall be reallocated, at the Consultant's direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the Contract Price for overhead and profit.

.6 Only where the actual cost of the Work under **all** cash allowances exceeds the total amount of **all** cash allowances shall the Contractor be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the Contract Documents.

.7 Where the actual cost of all the Work under the cash allowances are less than the amount of the allowances, the Owner shall be credited for the unexpended portion of the cash allowances, but not for the Contractor's overhead and profit on such amount.

1.4 CASH ALLOWANCE CONTRACT REQUIREMENTS

.1 The Contractor accepts to provide all contract requirements for the products supplied in the allowances, this includes providing supervision to include the product into the contract, shop drawing submission, coordinating installation, accepting warranty, accepting instruction to the Owner, providing as-builts, including product literature in maintenance manuals, etc.

.2 All this work must be included in the Contractor's tender price.

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 BUY CANADIAN AND ONTARIO GOODS AND SERVICES

.1 The products being supplied on this project shall be in compliance with the Buy Canadian Policy (BCP) and Ontario's Procurement Restriction Policy (OPRP).

.2 Efforts have been made to include Ontario and Canadian made goods and manufacturers. In instances where goods and services have been specified that are not Ontario or Canadian made, if there are alternates that are Ontario and Canadian produced, meet the performance of the specified items, and that are available within the project construction schedule, they will be allowed to be supplied as part of this project upon review and approval by the consulting team.

.3 As the Project Owner is governed under, and considered to be a Broader Public Sector (BPS) entity, they are required by the 'Buy Ontario Procurement Directive' to exclude U.S. businesses from procurements; however, procuring from U.S. businesses is allowed if any of the following circumstances apply:

.1 A U.S. business is the only viable source for the good/service, and the procurement cannot be delayed.

.2 For procurements for services, the U.S. business commits to having at least 90 percent of the required staff to deliver the contracted services located in Canada.

.4 For any goods or services from the U.S. business, regardless of the value, approval must be obtained from the appropriate governing entity to procure. To understand the procedure, forms, and information required for approval of any goods or services from a U.S. business, visit https://www.ontario.ca/page/buy-ontario-procurement-directive.

.5 From "Buy Canadian Policy" the products must meet the appropriate appendix sections.

.6 The Ontario Procurement Restriction Policy applies to provincially funded projects and can be any of the on-line listed facilities.

.7 This Ontario policy applies to all public sector entities, which means government entities and all designated BPS organizations, unless otherwise specified. This includes:

Government Entities

.1 All ministries.

.2 All provincial agencies.

.3 Ontario Power Generation (OPG)

.4 Independent Electricity System Operator (IESO)

Broader Public Sector (BPS)

Designated BPS organizations that are subject to the BPS Procurement Directive including:

.1 Hospitals.

.2 School boards.

.3 Colleges and universities.

.4 Children's aid societies.

.5 Shared services and group purchasing organizations

.6 Publicly funded organizations that received public funds of $10M or more in previous fiscal year of the Government of Ontario.

.8 For more information on the Buy Canadian Policy and Ontario Procurement Restriction Policy refer to the online data.

.9 The BCP includes the following relevant definitions:

.1 "Canadian business" means a supplier, manufacturer, or distributor of any business structure that conducts its activities on a permanent basis in Canada. The business either:

.1 Has its headquarters or main office in any province or territory within Canada, or

.2 Has at least 250 full-time employees in any one province or territory within Canada at the time of the applicable procurement process.

.2 "Canadian-Made Good" means a good that meets any one of the following criteria:

.1 Is wholly manufactured or originating in Canada,

.2 At least 51% of the total direct costs of producing or manufacturing the good have been incurred in Canada, or

.3 Is labelled as "Made in Canada" or "Product of Canada".

.3 "Canadian Service" means a service wholly provided by individuals (natural persons) located in Canada.

.4 "Ontario Business" means a supplier, manufacturer or distributor of any business structure that conducts its activities on a permanent basis in Ontario. The business either:

.1 Has its headquarters or main office in Ontario, or

.2 Has at least 250 full-time employees in Ontario at the time of the applicable procurement process.

.5 "Ontario Service" means a service wholly provided by individuals (natural persons) located in Ontario.

.6 "Ontario-Made Good" means a good that meets any one of the following criteria:

.1 It is wholly manufactured or originating in Ontario, or

.2 At least 51% of the total direct costs of producing or manufacturing the good have been incurred in Ontario.

.10 Refer to front end specifications for scoring criteria and methodology.

1.2 GENERAL PROVISIONS

.1 This Section covers items common to Electrical Division 26, as well as Division 27 and Division 28.

.2 This section supplements requirements of Division 1.

.3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

1.3 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations, or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for electrical work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.4 TENDERS

.1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.

.2 Submit Supplemental Tender Form as noted.

.3 Submit tender based on specified described equipment or Alternates listed.

.4 State in Tender, names of all Subcontractors proposed for work under this Division.

1.5 LIABILITY INSURANCE

.1 This contractor must maintain and produce at the request of the consultant proof of proper insurance to fully protect the owner, the consultant and the contractor from any and all claims due to accidents, misfortunes, acts of God, etc.

1.6 ELECTRICAL SAFETY AUTHORITY

.1 The contractor is to determine general inspection fees with Electrical Safety Authority and include as part of tender.

.2 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be coordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action. Contractor will not be responsible for these review costs.

1.7 DRAWINGS

.1 Electrical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of conduits and ducts to accommodate structural conditions. Location of conduits and other equipment may be altered by the consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.2 As work progresses and before installing fixtures and other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fitments.

.3 Electrical drawings are diagrammatic. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Conceal wiring, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.

.4 Before commencing work, check and verify all sizes, locations, grades, elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.

.5 Locate all electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.6 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install services so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.7 Relocate equipment and/or material installed but not co-ordinated with work of other Sections as directed, without extra charge.

.8 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.8 INTERFERENCE AND CO-ORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are co-ordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant’s request submit copies of interference drawings to the consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, mechanical, and electrical systems for the consultant's review prior to fabrication.

.2 Detailed equipment room drawings clearly showing all distribution equipment.

.3 Detailed layout drawings clearly showing conduit/feeder runs 78mm diameter or larger, including hangers or tray.

.6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

1.9 QUALITY ASSURANCE

.1 The installations of the division must conform to the latest edition of the Electrical Safety Code as well as its supplemental bulletins and instructions. Provide materials and labour necessary to comply with rules, regulations, and ordinances.

.2 Complete underground systems in accordance with CSA C22.3 No. 7-94 except where specified otherwise.

.3 Abbreviations for electrical terms: to CSA Z85-1983.

.4 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify consultant in writing of such differences.

1.10 ALTERNATES AND SUBSTITUTIONS

.1 Throughout these sections are lists of "Alternate Equipment" manufacturers acceptable to consultant if their product meets characteristics of specified described equipment.

.2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs to suit Alternated used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" unit is proposed and does not fit space allotted nor equal specified product in consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

1.11 EXAMINATION

.1 Site Reviews

.1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Drawings

.1 Electrical Drawings show general arrangement of fixtures, power devices, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

.2 Consider Architectural, Mechanical, and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Electrical Drawings.

.3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories required to meet conditions.

.3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.12 SEQUENCING AND SCHEDULING

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to consultant. Should conditions arise where certain changes would be advisable, secure consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of electrical items, make proper provision to avoid interferences in a manner approved by consultant. Changes required in work specified in these sections caused by neglect to do so shall be made at no cost to owner.

.3 Arrange fixtures, conduit, ducts, and equipment to permit ready access to junction boxes, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish and install inserts and supports required by these sections unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by the electrical trade.

.5 Adjust locations of ducts, conduits, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each conduit and duct prior to installation.

.1 Make offsets, transitions, and changes in direction of ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.2 Supply and install pull boxes, etc., as required to affect these offsets, transitions, and changes in direction.

1.13 REQUEST FOR INFORMATION (RFI) PROCEDURES

.1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit and RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.

.2 All RFIs will be submitted with the following information:

.1 RFI number

.2 Name of project

.3 Date of initiation

.4 Date response required by (minimum two (2) weeks)

.5 Subject

.6 Submitter's name

.7 Drawing/specification reference

.8 Photograph of the issue (if applicable)

.9 Description of the issue

.10 Contractor's proposed resolution

1.14 DRAW BREAKDOWN

.1 This contractor MUST submit a breakdown of the tender price into classifications to the satisfaction of the consultant, with the aggregate of the breakdown totaling the total contract amount. **Each item must be broken out into material and labour costs.** Progress claims, when submitted are to be itemized against each item of the draw breakdown. This shall be done in table form showing contract amount, amount this draw, total to date, % complete and balance.

.2 Breakdown shall be as follows:

.1 Permits and fees
.2 Mobilization (maximum 1%)
.3 Switchboard
.4 Panelboards and miscellaneous distribution equipment
.5 Ductbank primary
.6 Ductbank secondary
.7 Secondary cables
.8 Feeder conduits
.9 Branch conduits
.10 Feeder cables
.11 Branch wiring
.12 Lighting fixtures (interior)
.13 Emergency lighting
.14 Exterior lighting
.15 Fire alarm system
.16 Classroom control panels
.17 Starters, contactors, and control devices
.18 Electric heating
.19 Wiring for mechanical equipment
.20 Cash allowances (itemized)
.21 Integrated Life Safety System Testing
.22 Commissioning (minimum 3%)
.23 Electrical contractor closeout requirements (minimum of 3% on the first $1,000,000.00, 1.5% on excess over $1,000,000.00.)

.3 The breakdown must be approved by the consultant prior to submission of the first draw.

.4 Breakdowns not complying to the above will not be approved.

.5 Breakdown must indicate total contract amount.

.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.15 SHOP DRAWINGS AND PRODUCT DATA

.1 General

.1 Furnish complete catalog data for manufactured items of equipment to be used in the work to consultant for review within 14 days after award of Contract.
.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.
.3 Provide a complete list of shop drawings to be submitted prior to first submission.

.4 Before submitting to the consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.5 If material or equipment is not as specified or submittal is not complete, it will be rejected by consultant.

.6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.7 **Submit all shop drawings for the project as a package. Partial submittals will not be accepted**.

.8 Catalog data or shop drawings for equipment, which are noted as being reviewed by consultant or his engineer shall not supersede Contract Documents.

.9 Review comments of consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. e.g. access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Manufacturer test data where requested.

.3 Manufacturer to certify as to current model production.

.4 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 If a shop drawing is returned "reviewed as noted" this contractor must provide written indication that the comments have been complied with.

.15 A partial list of shop drawings includes:

.1 Switchboards, panelboards, and transformers

.2 Fire alarm system

.3 Luminaires and drivers

.4 Emergency battery units, exit signs, and fixtures

.5 Electrical heaters

.6 Telecommunication system
.7 Classroom control panels
.8 Starters, contactors, and control devices
.9 Firestopping materials
.10 Surface raceways
.11 Hand dryers
.12 Wiring devices
.13 Cable management hangers
.14 Cable management system
.15 Lighting controls
.16 Disconnect switches and fuses
.17 Destratification fans and associated controls
.18 Roof cone
.19 Miscellaneous enclosures
.20 Co-ordination study and arc flash hazard analysis
.21 Integrated Life Safety System Testing Plan (ITP)

.2 Submissions shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants' project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (1) copy of the "reviewed" shop drawings in a binder as noted above.

.6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

1.16 CARE, OPERATION AND START-UP

.1 Instruct consultant and operating personnel in the operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.17 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.18 PERMITS, FEES, AND INSPECTION

.1 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be co-ordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action.

.2 The contractor is required to include in his tender all required inspection costs by the Electrical Safety Authority. Permit application is the responsibility of the contractor.

.3 Reproduce drawings and specifications required by Electrical Safety Authority at no cost.

.4 Notify consultant of changes required by Electrical Safety Authority prior to making changes.

.5 Furnish Certificates of Acceptance to consultant from Electrical Safety Authority and other authorities having jurisdiction upon completion of work.

.6 This contractor must furnish any certificates required to indicate that the work completed conforms with laws and regulations of authorities having jurisdiction.

1.19 ADDITIONAL INSTALLED EQUIPMENT

.1 The electrical contractor is to review all specification sections forming part of the electrical bid documents and include additional equipment or components, as well as all associated installation costs and testing costs as noted, in the electrical bid price.

1.20 MATERIALS AND EQUIPMENT

.1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Safety Authority.

.2 Factory assemble control panels and component assemblies.

1.21 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

.1 Supplier and installer responsibility is indicated in the Equipment Wiring Schedule on electrical drawings.

.2 Control wiring and conduit is specified in the Electrical specifications except for conduit, wiring and connections below 50 V, which are related to control systems specified in the Mechanical specifications.

1.22 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light grey.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, fastenings, and conduits etc. to prevent rusting.

1.23 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm (1/8") thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	9 mm x 50 mm (3/8" x 2")	1 line	3 mm (1/8") high letters
Size 2	12 mm x 70 mm (1/2" x 2 1/2")	1 line	5 mm (3/16") high letters
Size 3	12 mm x 70 mm (1/2" x 2 1/2")	2 lines	3 mm (1/8") high letters
Size 4	20 mm x 90 mm (3/4" x 3 1/2")	1 line	9 mm (3/8") high letters
Size 5	20 mm x 90 mm (3/4" x 3 1/2")	2 lines	5 mm (3/16") high letters
Size 6	25 mm x 100 mm (1" x 4")	1 line	12 mm (1/2") high letters
Size 7	25 mm x 100 mm (1" x 4")	2 lines	6 mm (1/4") high letters

.3 Wording on nameplates labels to be approved by consultant prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Nameplates for disconnects, starters and contactors must indicate equipment being controlled and voltage.

.8 Nameplates for transformers must indicate transformer label as indicated and capacity, primary, and secondary voltages.

1.24 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.25 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m (45') intervals.

.3 Colour bands must be 25 mm (1") wide.

	Prime
up to 208 V	yellow
209 to 600 V	white
Voice system	green
Data system	orange
Security	brown
Public address	black
Cable TV	blue
Fire alarm	red
Emergency voice	red
Emergency lighting	pink

.4 This contractor must paint all system junction boxes and covers in conformance with the above schedule.

1.26 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.27 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.28 MANUFACTURERS AND CSA LABELS

.1 All labels must be visible and legible after equipment is installed.

1.29 WARNING SIGNS

.1 To meet requirements of Electrical Safety Authority and consultant.

.2 Provide porcelain enamel signs, with a minimum size of 175 mm x 250 mm (7" x 10").

1.30 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm (6") horizontal clearance between boxes.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m (10'), and information is given before installation.

.3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

1.31 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1100 mm (43.3").

.2 Wall receptacles:

.1 General: 400 mm (16").

.2 Above top of continuous baseboard heater: 200 mm (8").

.3 Above top of counters or counter splash backs: 100 mm (4").

.4 In mechanical rooms: 1200 mm (48").

.3 Panelboards: as required by Code or 1400 mm (56").

.4 Voice/Data outlets: At height of adjacent outlet or at 400 mm (16").

.5 Fire alarm pull stations: 1200 mm (3'-11").

.6 Fire alarm visual and signal devices: 2250 mm (88 ½").

.7 Television outlets: 400 mm (16").

.8 Thermostat: 1200 mm (3'-11").

.9 Clocks: 2100 mm (84").

.10 Heaters: 200 mm (8" AFF) to bottom of heater.

.11 Emergency call switches and/or pushbuttons: 900 mm (36").

1.32 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.33 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm (2") beyond either side.

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.34 FIELD QUALITY CONTROL

.1 Conduct and pay for following tests:

.1 Power distribution system including phasing, voltage, grounding, and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system, communications, security.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 Insulation resistance testing.

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of consultant.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Submit test results for consultant's review.

1.35 EQUIPMENT NAMEPLATE DATA

.1 Refer to the Equipment Wiring Schedule, Distribution Diagram(s) and Panel Schedules for information regarding the designed electrical connections for all equipment to be connected to the electrical distribution system.

.2 Refer to the shop drawing submissions of all project divisions and coordinate with all trades and equipment manufacturers throughout the construction period for equipment connection requirements.

.3 This electrical trade shall be responsible to coordinate any discrepancies on equipment minimum circuit ampacity, maximum overcurrent protection, voltage and phase, between the equipment manufacturer published literature, the equipment shop drawing submission, the project design drawings equipment wiring schedule, and the nameplate data on the equipment. The contractors installing and connecting all equipment shall be responsible for the coordination of this data through the construction period.

.4 Equipment shall not be connected where the specified maximum overcurrent protection and minimum circuit ampacity values do not meet the requirements of the equipment nameplate data on site.

.5 Electrical distribution equipment shop drawings shall not be submitted prior to approval of equipment to be connected including, but not limited to, mechanical units, pumps, elevators, etc. Electrical distribution equipment shall not be released into production until all connected equipment requirements are confirmed and included in approved shop drawings.

.6 Where nameplate data of equipment on site varies from that data listed in the approved equipment shop drawings, the consultant shall be notified in writing, and the equipment shall not be connected until the equipment connection details are confirmed. The final installation must meet the nameplate data of the equipment on site.

.7 No subsequent allowance for time or money for changes to breakers, wiring and conduit, or equipment sizes will be considered for any consequence related to failure by the electrical trade to coordinate final equipment connection requirements with nameplate data and electrical distribution equipment shop drawings.

1.36 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as indicated on drawings or as determined from co-ordination study.

.2 Electrical connections to all equipment requiring connection to the electrical distribution system as part of this electrical tender have been specified according to the anticipated equipment manufacturer electrical requirements and the applicable sections of the OESC. This contractor must coordinate electrical connections to all equipment specified to be connected as part of this electrical tender.

.3 Prior to submitting electrical distribution shop drawings to the consultant, review all shop drawings for all equipment specified for connection to the electrical distribution system to verify that the product electrical connection requirements listed by the manufacturer conform to the equipment electrical connections specified on the electrical design drawings and specifications. Make necessary revisions to breaker ratings associated with the review of all product shop drawings and identify such changes as part of the electrical distribution equipment shop drawing submission.

.4 Prior to making final equipment connections, this electrical contractor shall examine equipment nameplates at the project site to confirm voltage and phase requirements, minimum circuit ampacity and maximum overcurrent protection values, and bring to the attention of the consultant in writing any connection requirements which may vary from the designed connections or approved electrical distribution shop drawings. No subsequent allowance for time or money for changes to breaker or wire and conduit sizes will be considered for any consequence related to failure to examine site conditions.

1.37 GUARANTEE AND WARRANTY

.1 At ready for takeover of this project this Contractor must provide a written guarantee indicating that any defects, not due to ordinary wear and tear or improper use which occur within the first year from the date of ready for takeover will be corrected at the contractor's expense.

.2 If the electrical sub-contractor's office is 50 kilometers (30 miles) or more from the project site, the sub-contractor is to provide a service/warranty work agreement for warranty period with a local electrical sub-contractor approved by consultant. Include copy of service/warranty agreement in warranty section of operation and maintenance manual.

.3 Warranty period shall start from date of ready for takeover completion.

.4 Refer to individual specification sections for information on any special manufacturer's equipment warranties.

1.38 SYSTEM START UP

.1 Provide consultant with written notice verifying all equipment operation and installation is complete prior to scheduled start-up period.

.2 Start up shall be in presence of the following: owner or representative, contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.

.3 Arrange with all parties and provide 72 hours notice for start up procedure.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 These tests are to demonstrate that the systems and equipment installed are operational as specified.

.6 The contractor must describe during the start up session the required maintenance for each piece of equipment according to the manufacturer.

.7 The contractor must provide all necessary tools (including a digital multimeter) to successfully complete the start up procedure.

1.39 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as specified in other Sections of this Division.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, consultant before final inspection.

.1 Submit one (1) copy of Operation and Maintenance Manual to consultant for review and approval. Submission of individual data will not be accepted unless so directed by consultant. Submission can be done electronically in PDF format or as a hard copy.

.1 Electronic submission/PDF file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.

.2 Hard copy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as 'Operation and Maintenance Manual' with project name and location. Dividers are to be used for binder organization.

.2 Make changes as required and re-submit as directed by consultant.

.3 Each manual must include (in "tabbed" sections) the following:

.1 Index

.2 List of General, Mechanical, Electrical Contractors and all associated sub-contractor names, addresses and contact numbers.

.3 List of suppliers and equipment wholesalers local to the project.

.4 Letter of contractor's warranty and guarantee for all parts, equipment and workmanship.

.5 List of manufacturers, spare parts list and source.

.6 Copy of typewritten schedules for all new and renovated panels.

.7 Copy of all substantial performance final certificates.

.8 Copy of electrical shop drawings which have been stamped and reviewed by consultant.

.9 Electrical As-built drawings including contractor company's as built stamp.

.10 Coordination study/Arc flash hazard study shop drawings

.11 Any special warranties on equipment required (i.e. LED lighting, digital lighting control, SPDs, power generation).

.12 Certificate of completion from all associated sub-contractors.

.13 Cable test results and floor plans containing address labels.

.14 System commissioning certificate and report.

.4 Final Submittals:

.1 Upon acceptance of Operation and Maintenance Manual by the consultant, provide the following:

.1 Provide two (2) copies of final Operation and Maintenance Manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one (1) USB stick is to be provided containing both the approved manual and as-built drawings.

1.40 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible electrical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include field and contract changes to electrical systems.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings submittal for review:

.1 Identify **each drawing** in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Company Name) (Signature of Contractor) (date).

.2 Submit copy to consultant for approval. When returned, make corrections (if any) as directed.

.3 As-built drawings final submittal:

.1 Once approved, submit completed, reproducible paper as-built drawings as well as a scanned PDF file copy on USB stick with Operation and Maintenance Manuals.

1.41 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Manufacturers or their representatives are to provide demonstrations and instructions.

.3 Use operation and maintenance manual, As-built drawings, audio visual aids, etc. as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, consultants may record these demonstrations on video tape for future reference.

1.42 READY FOR TAKEOVER

.1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.

.1 As-built Drawings
.2 Maintenance Manuals
.3 System Start up
.4 Instructions to Owners
.5 Public Address
.6 Security
.7 Coordination Study / Arc Flash Hazard (including photos of each breaker)
.8 Telecommunications Structured Cabling
.9 Lighting Control System

1.43 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.44 REVISION TO CONTRACT

.1 Provide the following for each item in a given change notice:

.1 Itemized list of material with associated costs.
.2 Labour rate and itemized list of labour for each item.
.3 Copy of manufacturers/suppliers invoice if requested.

1.45 EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: shall be installed by the electrical contractor.

.2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings if necessary.

.3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. This installation of this pad shall be the responsibility of the electrical contractor.

.4 This contractor shall be responsible for providing all anchor bolts and associated formed concrete bases for lighting standards as detailed.

1.46 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete, or fire rated assemblies and as indicated.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and conduit.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Through foundation walls PVC sleeves are acceptable.

.7 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Fill future-use sleeves with easily removable filler.

1.47 FIRESTOPPING

.1 Firestopping material and installation within annular space between conduits, ducts, and adjacent fire separation.

.2 Provide materials and systems capable of maintaining effective barrier against flame, smoke, and gases.

.3 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.4 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.

.5 Provide “firewrap” blanket around services penetrating firewalls. Extent of blanket must correspond to ULC recommendations. In general wrap individual conduits with approved firewrap materials on each side of firewall. Refer to architectural drawings for FT ratings. Provide 1 and/or 2 layers of firewrap with transverse and longitudinal seams overlapped and/or butted (second layer offset from first layer). Cut edges are to be sealed with aluminum foil tape. Provide 50 mm stainless steel banding at 200 mm intervals. Install firewrap to manufacturers’ recommendations for proper FT rating. Acceptable manufacturers are 3M Firemaster ductwrap or approved equal.

.6 The firestopping materials are not to shrink, slump or sag and be free of asbestos, halogens and volatile solvents.

.7 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.8 Firestop materials are to be capable of receiving finish materials in those areas, which are exposed and scheduled to receive finishes.

.9 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.10 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.11 Submit product literature and installation material on firestopping in shop drawing and product data manual.

.12 Acceptable manufacturers:

.1 Rectorseal Corporation (Metacaulk)

.2 Proset Systems

.3 3M

.4 Hilti

.5 STI Firestop

Note: Fire stop material must conform to requirements of local authorities having jurisdiction. Contractor to confirm prior to application and ensure material used is compatible with that used by other trades on site.

1.48 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Prime and touch up marred finished paintwork to match original.

.4 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.49 ACCESS DOORS

.1 Supply access doors to concealed electrical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 mm x 600 mm (24" x 24") for body entry and 300 mm x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180º, have rounded safety corners, concealed hinges, screwdriver latches, and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by consultant.

.2 Remaining areas: use prime coated steel.

.3 Fire rated areas: provide ULC listed access doors

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.3 Installation is specified in applicable sections.

.5 Acceptable materials:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.50 DELIVERY, STORAGE, AND HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury, but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

1.51 REPAIR, CUTTING, CORING AND RESTORATION

.1 Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.2 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.3 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.4 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.5 Slots, cores and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.52 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

1.53 CLEANING

.1 Clean interior and exterior of all electrical equipment provided including light fixture lenses.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

1.54 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.55 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

.2 Design drawings are diagrammatic and do not necessarily indicate all specific final connection requirements. For the purposes of bidding, electrical trade shall include but not be limited to provision of a junction box to connect equipment wiring tail, provision of suitable disconnecting means, and flexible connection directly to equipment.

1.56 ENCLOSURES

.1 This contractor must ensure that all electrical equipment mounted in sprinklered areas is provided with an enclosure in conformance with the Electrical Safety Code.

1.57 ELECTRICAL SYSTEMS COMMISSIONING

.1 This electrical contractor shall work with the building commissioning agent to perform commissioning of all electrical systems.

.2 Refer to specification section 26 01 19 Commissioning of Electrical Systems for information on required electrical contractor participation and typical commissioning agent duties

1.58 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 The Integrated Life Safety System Testing Coordinator (ITC) shall be hired by the electrical trade as indicated in specification section 26 01 20.

.2 This electrical contractor shall work with the project Integrated Life Safety System Testing Coordinator (ITC) and participate in all phases of the Integrated Life Safety Systems testing process as specified within CAN/ULC S1001-11 (2024 Rev2 updates) as well as the electrical and architectural specifications.

.3 During the ***Planning Phase*** of the Integrated Life Safety Systems Testing process this electrical contractor shall review the Integrated Testing Plan (ITP) and give written confirmation of this review and acknowledgement of affected systems under his responsibility as required by the electrical specifications per the shop drawing submittal process.

.4 Prior to the building Integrated Life Safety Systems Testing this electrical contractor shall startup/commission/verify the operation of all systems under the responsibility of this electrical trade. This electrical trade shall give written indication of completed systems and provide copies of all inspection reports, start-up reports, commissioning reports, verification reports, etc. when requested by the ITC during the ***Implementation Phase***.

.5 Upon completion of the building Integrated Life Safety Systems Testing this electrical contractor shall rectify all deficiencies related to all systems under his responsibility during the ***Testing Phase*** in due time for the ITC to verify and document for the project team.

1.59 EXISTING CONCRETE SLAB X-RAY/SCANNING

.1 This contractor shall retain the services of a qualified company to provide and X-ray and/or scan of the existing buried services in walls and/or floors prior to starting any work in the affected area.

.2 Failure to locate existing piping, conduit, rebar etc., shall not relieve this contractor of repair of same prior to installing his service.

.3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Conform to the general conditions.

.2 Conform to the Electrical Contract General Requirements Section 26 01 16.

.3 Provide labour and material to conduct the commissioning process as outlined in this specification section.

.4 The electrical contractor shall perform the closeout requirements specified in conjunction with the independent Commissioning Consultant (CC) retained by the owner.

Part 2 Products

2.1 PRODUCTS

.1 The electrical contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The electrical contractor shall advise the electrical consultants of instrumentation to be used and the dates the instruments were calibrated.

Part 3 Execution

3.1 COMMISSIONING PROCESS

.1 The commissioning process consists of:

- .1 Shop Drawings and Record Drawings
- .2 Installation inspection and equipment verification
- .3 Independent testing contractor
- .4 Testing of equipment and systems
- .5 Commissioning meetings
- .6 Operating and maintenance manuals
- .7 Operating training
- .8 Commissioning Agent testing
- .9 Systems Demonstration and turnover
- .10 Testing forms
- .11 Warranties

3.2 SHOP DRAWINGS AND RECORD DRAWINGS

.1 Conform to Section 26 01 16 requirements for shop drawings and record drawings.

3.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The electrical contractor shall co-ordinate with the electrical consultant who will conduct general review the electrical installation.

.2 The electrical contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

.1 Manufacturers name, address and telephone number

.2 Distributors name, address and telephone number

.3 Make, model number and serial number

.4 Voltage and current ratings

3.4 INDEPENDENT TESTING CONTRACTOR

.1 The Independent Testing Contractor (ITC) shall be hired by the contractor and shall issue reports to the electrical consultant.

.2 The ITC shall conduct, as detailed in the Section 26 01 16 load balancing measurements.

3.5 TESTING OF EQUIPMENT AND SYSTEMS

.1 The electrical contractor shall be responsible for all tests detailed in the Section 26 01 16 and those tests required by a manufacturer as part of their installation requirements.

.2 The electrical contractor shall schedule all tests, which shall be witnessed by the electrical consultant or the commissioning consultant. The contractor shall complete and sign the testing forms.

.3 The electrical contractor shall conduct tests on the following equipment as a minimum. Refer to the individual specification sections for test procedures.

.1 Co-ordination study

.2 Switchboard

.3 Distribution panels

.4 Power and lighting panels

.5 Surge protection devices

.6 Fire alarm

.7 Public address

.8 Cables

.9 Lighting controls

.4 When all testing has been completed and all mechanical and electrical systems are operational the contractor shall conduct system load balance measurements, infra red test and harmonics tests.

3.6 COMMISSIONING MEETINGS AND REPORTING

.1 The electrical contractor shall include the schedule for all tests in the construction schedule.

.2 The commissioning meetings shall occur during the regular construction meetings. The testing schedules and the results of all tests shall be reviewed.

.3 All testing forms and reports associated with the electrical systems shall be directed to the electrical consultant with copies to the architect, commissioning consultant and the owner.

.4 The forms and reports to be issued shall include:

.1 Shop drawings, issued and accepted

.2 Equipment verification forms

.3 Testing forms

.4 Reports resulting from tests

.5 Testing schedule

.6 Minutes of commissioning meetings

.7 Manufacturers Certificates

3.7 OPERATING AND MAINTENANCE MANUAL

.1 Conform to the Section 26 01 16 the requirements of the O&M manuals.

3.8 OPERATOR TRAINING

.1 Conform to Section 26 01 16 for requirements for instructions to the Building Owner for each system and equipment.

.2 The training shall be provided by qualified technicians or electricians and shall be conducted in a classroom and at the equipment or system.

.3 The training sessions shall be scheduled, co-ordinated and video taped by the commissioning consultant.

.4 Each training session shall be structured to cover:

.1 The operating and maintenance manual

.2 Operating procedures

.3 Maintenance procedures

.4 Trouble-shooting procedures

.5 Spare parts

.6 Submit a course outline to the electrical consultant before training commences. Provide course documentation for up to eight people.

.5 The training session shall be scheduled and co-ordinated by the commissioning consultant. The commissioning consultant shall video tape the sessions.

.6 Training shall be provided for the following systems:

Fire Alarm System	2 hours minimum
Public Address System	1 hour minimum
Electrical System	8 hours minimum
Lighting Control System	4 hours minimum

.7 The electrical contractor shall conduct a walk through of the installation. During the walk through the electrical contractor shall:

.1 Identify equipment.

.2 Identify electrical panels.

.3 Identify starters and disconnects.

.4 Review the electrical power distribution.

.5 Review the light power distribution.

.6 Review the switchgear.

.7 Review the general maintenance procedures.

.8 Review the lighting controls operation.

3.9 COMMISSIONING CONSULTANT

.1 A commissioning consultant (CC) will be retained by the owner. The commissioning consultant will report to the owner.

.2 The CC responsibilities shall include:

.1 Preparing the commissioning plan

.2 Co-ordinating with the contractor to schedule tests

.3 Preparing a test form manual

.4 Witnessing selected tests

.5 Receiving all test forms

.6 Co-ordinating the contractors training

.7 Chair the commissioning meetings

.3 The electrical contractor shall co-operate with the CC.

.4 The electrical contractor shall provide assistance to the CC and have personnel available during the performance testing procedure. Each electrical system shall be tested in the operational mode.

3.10 ELECTRICAL SYSTEM DEMONSTRATION AND TURNOVER

.1 The system demonstration and turnover to the owner shall occur when:

.1 The installation is complete.

.2 The acceptance test conducted by the electrical consultant has been completed successfully.

.3 Training has been completed.

.4 Equipment Operating and Maintenance Manuals have been accepted.

.5 System operating manuals have been accepted.

.6 Shop-drawings have been updated.

.7 As-built drawings have been completed.

.8 The commissioning process has been completed successfully and system operation accepted by the electrical consultant and commissioning consultant.

.2 The systems demonstration shall be conducted by the electrical contractor and manufacturers. The demonstration shall cover a physical demonstration of equipment installation and operation.

3.11 TESTING FORMS

.1 The electrical contractor and manufacturers shall fill out the forms listed in this section or provide other forms. The forms must be approved by the electrical consultant and the owner before they are used.

3.12 WARRANTIES

.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by the owner.

.2 The electrical contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to the Division 1 and Division 26 Sections for the requirements during the warranty period.

.1 Furnish complete catalog data for manufactured items of equipment to be used in the work to consultant for review within 14 days after award of Contract.

.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.

.3 Provide a complete list of shop drawings to be submitted prior to first submission.

3.13 COMMISSIONING PROCESS ALLOCATION

.1 The commissioning process shall be allocated a value equal to 5% of the contract. The electrical contractor may draw from this allocation as the commissioning process is completed.

.2 The electrical contractor shall submit all test and verification forms. The consultant will use these forms to calculate percentage complete.

.3 The electrical contractor may claim up to 3% of the contract from this allocation leading up to performance testing. The remaining 2% shall not be paid out until the performance testing, O & M manuals and training have been completed satisfactorily.

END OF SECTION

Part 1 General

1.1 REFERENCE PROJECT SPECIFICATIONS FOR WORK INCLUDED

.1 As required by the building code, where fire protection and life safety systems and systems with fire protection and life safety functions, are integrated with each other, the systems shall be tested as a whole as prescribed by the CAN/ULC Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems, to verify that they have been properly integrated (functional testing). Such testing and documentation shall be performed in accordance with CAN/ULC-1001 (latest revision).

.2 For reference, project specifications applicable to the life safety systems, fire protection systems, and systems with life safety functions include, but are not limited to, the following:

- .1 Section 14 20 06 – ELEVATORS
- .2 Section 20 05 11 – MECHANICAL WORK REQUIREMENTS and DIVISION 1
- .3 Section 21 02 51 – FIRE PROTECTION GENERAL REQUIREMENTS and DIVISION 1
- .4 Section 21 12 13 – FIRE SUPPRESSION STANDPIPE SYSTEM
- .5 Section 21 13 13 – WET PIPE FIRE SUPPRESSION
- .6 Section 21 13 16 – DRY-PIPE SPRINKLER SYSTEMS
- .7 Section 21 22 11 – CLEAN AGENT FIRE SUPPRESSION SYSTEM and DIVISION 1
- .8 Section 21 30 00 – FIRE PUMPS
- .9 Section 23 02 51 – HVAC GENERAL REQUIREMENTS and DIVISION 1
- .10 Section 23 33 17 – SMOKE CONTROL DAMPERS
- .11 Section 26 01 16 – ELECTRICAL GENERAL REQUIREMENTS and DIVISION 1
- .12 Section 26 32 15 – POWER GENERATION DIESEL
- .13 Section 26 32 16 – POWER GENERATION NATURAL GAS
- .14 Section 26 36 23 – AUTOMATIC TRANSFER SWITCH (ATS)
- .15 Section 26 51 13 – LIGHTING EQUIPMENT
- .16 Section 26 51 16 – DIGITAL OCCUPANCY & NETWORK LIGHTING CONTROL SYSTEMS
- .17 Section 28 31 25 – FIRE ALARM SYSTEM (ADDRESSABLE)
- .18 Applicable building systems in item 1.3.10 and as included in all project DIVISIONS.

1.2 REFERENCE CODES AND STANDARDS

.1 OBC-2024, Ontario Building Code Compendium

.2 CAN/ULC-1001 Integrated System Testing of Fire Protection and Life Safety Systems

.3 CAN/ULC-S524, Installation of Fire Alarm Systems

.4 CAN/ULC-S537, Verification of Fire Alarm Systems

.5 CAN/ULC-S573, Installation of Ancillary Devices Connected to Fire Alarm Systems

.6 CAN/ULC-S561, Installation and Service for Fire Signal Receiving Centres and Systems

.7 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies

.8 NFPA 13 – Fire Sprinkler Systems

.9 NFPA 14 – Standard for the Installation of Standpipe and Hose Systems

.10 NFPA 17A – Standard for Wet Chemical Extinguishing Systems

.11 NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection

.12 NFPA 92 – Standard for Smoke Control Systems

.13 NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

.14 NFPA 654 – Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids

.15 CSA-B44 – Safety Code for Elevators and Escalators

.16 CSA-282 – Emergency Power Supplies for Buildings

.17 UL-924 – Emergency Lighting Relays

1.3 OVERVIEW

.1 All work shall be performed in accordance with CAN/ULC-1001 Integrated System Testing of Life Safety and Fire Protection Systems, latest edition.

.2 The Building Code has adopted CAN/ULC-1001 as the standard to comply with Integrated System Testing of Life Safety and Fire Protection Systems. The scope of this project shall follow the strict guidelines laid out in CAN/ULC-1001 for Integrated Testing Planning, review, and implementation.

.3 The Integrated Testing Plan (ITP) will provide a full overview of all integration points of life safety and fire protection systems. The ITP will be submitted for review to the design professionals and Authority Having Jurisdiction (AHJ). Upon the successful completion of the ITP and all the respective systems, the Integrated Testing Coordinator (ITC) will provide a schedule to the design professionals, the AHJ, and all required participating members for the ITP to be conducted.

.4 The ITC will review all drawings, specifications, sequence of operations, and methodology prepared by the design professionals, complete with the contractor's shop drawings and manufacture requirements.

.5 The ITP shall be coordinated with all sub-contractors and suppliers as outlined in item 1.1.

.6 The ITC will conduct the ITP and will sign each integrated test form, complete with signatures from each participating member of the integrated systems.

.7 The ITC shall witness all integrations and not rely on the CAN/ULC-S537 Verification Inspection Report for fire protection system integration testing; however, the ITC may attend the verification to validate the testing.

.8 The ITC will provide all work and ITP including functional documentation, prescribed in CAN/ULC-1001. Such testing and documentation have been deemed to satisfy the requirements of OBC 2024 Sentence 3.2.9.

.9 The ITC will provide PDF and digital media copy of the buildings ITP and Integrated System Report (ITR) for the building owner's use, re-testing, and reproduction purpose.

.10 The systems applicable to the functional testing include, but are not limited to:

- .1 Fire Alarm System (including sequence of operations) and Monitoring
- .2 Elevators
- .3 Sprinkler Systems (wet, dry, window, garbage chute, standpipe)
- .4 Fire Pumps
- .5 Water Supplies (fire cistern)
- .6 Life Safety Generator and Automatic Transfer Switches
- .7 Kitchen Fire Suppression Systems
- .8 Fixed Fire Suppression Systems
- .9 Magnetic Door Holds
- .10 Electromagnetic Locks
- .11 Fire Curtain or Fire Shutter Release
- .12 Smoke and CO Alarms
- .13 Smoke Damper Assemblies
- .14 Nurse Call Systems
- .15 Emergency Lighting
- .16 HVAC Shutdown and ON/OFF/Auto Controls
- .17 Pressurization Fans and ON/OFF/Auto Controls
- .18 Smoke Exhaust System and ON/OFF/Auto Controls
- .19 CO System
- .20 A/V System Mute/Shutdown
- .21 Mass Notification System
- .22 Hazardous Protection Monitoring
- .23 HVLS Fan Shutdown
- .24 Freeze Protection (heat trace monitoring)
- .25 Dust Collector (spark arrest system)

Part 2 Not Used

Part 3 Execution

3.1 TESTING AND PLANNING

.1 The Integrated Testing Process must include following:

- .1 Planning phase by the testing coordinator.
- .2 Integrated testing plan review by the design professionals.
- .3 Integrated testing plan review by the AHJ.
- .4 Review of sequence of operations.
- .5 System documentation.
- .6 Integrated System Testing Plan consisting of:
  - .1 Project description.
  - .2 Project contacts including applicable project responsibilities.
  - .3 Overview and description of each integrated system.
  - .4 System integrations and functional objective of each integrated system.
  - .5 Integration matrix of all integrated system complete with integration type, normal mode and off-normal mode.
  - .6 Test protocols and procedures of each integrated system,
  - .7 Notifications.
  - .8 Personnel safety.
  - .9 Phased occupancies.
  - .10 Pre-testing documentation checklist.
  - .11 Pre-testing documentation acknowledgement forms.
  - .12 Testing forms.
  - .13 Ongoing integrated system testing forms.
  - .14 Integrated system testing completion form.
  - .15 Integrated testing notes.

3.2 RESPONSIBILITIES

.1 General Contractor:

- .1 Coordinate with the ITC for schedule and witness testing.
- .2 Coordinate all responsible sub-contractors.
- .3 Confirm all respective systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.
- .4 Provide reports for respective systems such as, but not limited to; TSSA elevator inspection reports, start-up reports, commissioning reports, verification reports.
- .5 Participate in the ITP and provide function testing of equipment within the architectural, mechanical, electrical, and fire protection contract packages.
- .6 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.
- .7 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.2 Mechanical Contractor:

.1 The Mechanical Contractor shall confirm all mechanical systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Provide system reports such as, but not limited to; air balancing reports, TSSA inspection reports, start-up reports, commissioning reports, verification reports. The Mechanical Contractor shall further provide written confirmation that all mechanical systems are installed and operating as intended by the contract documents and sequence of operations.

.3 Participate in the ITP and provide function testing of equipment within the mechanical contract package.

.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.3 Fire Protection Contractor:

.1 The Fire Protection Contractor shall confirm all fire protection systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Provide system reports such as, but not limited to; NFPA 13 letter, NFPA 20, letter, above ground sprinkler piping letter, below ground sprinkler letter, system designer letter, start-up reports, commissioning reports, verification reports. The Fire Protection Contractor shall further provide written confirmation that all fire protection systems are installed and operating as intended by the contract documents and sequence of operations.

.3 Participate in the ITP and provide function testing of equipment within the fire protection contract package.

.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.4 Electrical Contractor:

.1 Electrical Contractor to employ the services of the ITC firm as a sub-contractor and include in bid price. Refer to item 3.6.

.2 The electrical contractor shall confirm all electrical systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.3 Provide system reports such as, but not limited to; ESA Inspection Certificate, Fire Alarm Verification, TSSA Inspection, Generator Start-up report, commissioning reports, and verification reports. The Electrical Contractor shall further provide written confirmation that all electrical systems are installed and operating as intended by the contract documents and sequence of operations.

.4 Participate in the ITP and provide function testing of equipment within the electrical contract package.

.5 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.6 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.5 Equipment Manufacturers:

.1 Where required, shall confirm all respective systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Participate in the ITP and provide function testing of equipment within the respective contract package.

.6 Design Professionals:

.1 The design professional shall include, but not be limited to, the project Architect, Electrical and Mechanical Consultants, Fire Protection Engineer, Elevator Consultant, etc.

.2 Shall review the ITP, and upon review, accept the ITP as the agreed ITP for implementation.

.3 The design professionals are responsible for design. Upon an unsuccessful test, the failure will be documented and provided to the respective design professionals for review and action.

3.3 NOTIFICATION OF TESTING PLANNING PROCESS

.1 The ITC shall work with the General Contractor, Owner, sub-contractors, design professionals, and the AHJ to provide a schedule for the implementation of the ITP.

.2 The ITC shall obtain contact names, contact details, and system responsibilities for all project design professionals.

.3 The ITC shall provide notification to the integrated testing participants seven (7) days prior to the date and time for the implementing of the ITP.

.4 Prior to testing, the ITC shall obtain written acknowledgement for acceptance and understanding of the ITP by all project design professionals and contractors per 1001 Section 5 and Appendix B. Include ITP Review & Acceptance acknowledgement sheet in the ITR. **Refer to Figure 1.**

.5 Prior to testing, the ITC shall obtain written acknowledgement for acceptance testing of site readiness from all project design professionals and contractors per 1001 Section 5 and Appendix B. Failure to obtain acknowledgement prior to implementation of integrated testing may invalidate the results and could result in delays by the design professionals issuing conformance. Include ITP Acceptance Testing acknowledgement sheet in the ITR. **Refer to Figure 2 and Figure 3.**

.6 In the event of building occupants, the ITC shall provide at a minimum, forty-eight (48) hour notice of the implementation of the integrated testing. Notification shall be provided via written notices posted at each building entrance.

.7 Partial occupancies shall employ this process for each individual occupancy and shall clearly identify the extent of to which the partial occupancy applies when obtaining written confirmations.

.8 Figures 1 through 3 of this specification section are indicated as informative and are for information only regarding the intent for required written acknowledgement gathering by the ITC. All designers and trades listed may not apply to all projects. The ITC shall be responsible for determining all required designers and contractors for the project based on the contact information from the ITP.

3.4 TESTING IMPLEMENTATION PROCESS

.1 Implementation of the integrated test shall follow all job site and personnel safety requirements set out in the contract and General Contractors requirements.

.2 The ITC shall define:

.1 Personnel safety protocols

.2 Special hazards

.3 Team communications

.4 Occupant notification of emergencies

.3 The integrated system test shall follow the methodology and process outlined in CAN/ULC-1001 as the requirement for this project.

.1 Provide the final ITP to the Consultant fourteen (14) days prior to scheduled implementation and test.

.4 The respective contractors and manufactures are responsible to start-up and function test their respective systems, for observation and witnessing by the ITC. The ITC will record the results, and the respective contractor and manufacture will restore the system to a normal condition. Upon successful testing the contractor and manufacture will initial the respective integrated testing from adjacent to their respective test.

.5 Upon a failure of a test, the ITC will document the failure and continue with the testing of other integrations. The respective contractor and manufacture will document the failure, notify they design professional, and correct the failure under the direction of the design professional.

.1 The ITC will re-test the unsuccessful integration after the correction has been documented and verified.

.6 Upon a failure of a device (such as a smoke detector), the contractor may immediately replace the device, and the ITC may continue to test the integration. The device failure maybe documented but shall not result in a failed integrated test.

.7 The ITC shall include in quote costs associated with site testing of all integrated devices. ITPs and testing procedures which include only for a sampling of devices will not be accepted. ITPs and testing procedures which rely solely on inspection reports, start-up reports, commissioning reports, or verification reports, etc. will not be accepted.

.8 Partial occupancies shall employ this process for each individual occupancy and shall clearly identify the extent to which the partial occupancy applies when obtaining written confirmations.

.9 Upon successfully completing the ITP, the ITC shall provide the ITR to the design professionals and building owner.

3.5 QUALITY CONTROL

.1 The ITC must meet the following criteria to be considered acceptable for this project:

.1 Firms regular engaged with contractors in function testing, fire alarm verification, sprinkler system testing, annual inspections and maintenance of fire and life safety systems.

.2 Firms knowledgeable and experience of the respective Codes and Standards of the particular project, including but not limited to; Building Codes, Fire Codes, ULC Standards, CSA Standards, and NFPA Standards.

.3 Firms must be a member in good standing of the Canadian Fire Alarm Association (CFAA).

.4 Vendors must be a 3rd party and independent from the fire protection and life safety system installation company present on the project in accordance with ULC Certification Bulletin 2020-08.

.5 Firms must maintain operations in the province of Ontario for at least five years.

.6 Vendors must be a ULC Listed Integrated Systems Testing Service Provider and posses a ULC Integrated Fire Protection and Life Safety Certification. The ULC Certificate must be valid from the date of project award until the completed Integrated Testing Report. The ULC certification level shall be that which is applicable to the building life safety systems level of complexity for the project.

.1 Submit the ULC Certificate upon project award to the Consultant's office complete with Applicant ID Number.

3.6 QUALIFIED INTEGRATED TESTING COORDINATOR

.1 Bidders may choose from the experienced ULC Listed ITC Firms listed below or local branches of these companies noted in the vicinity of this project and are acceptable as a sub-contractor to the Electrical Contractor:

.1 Lonergan Engineering Inc.

.1 235 Industrial Parkway S, Unit 3A, Aurora, ON L4G 3V5

.2 Great Lakes Fire Consulting & Engineering Group

.1 Windsor, ON

.2 Other experienced and ULC Listed ITC Firms must submit in writing, to the Consultant's office, confirmation of the items listed in the Quality Control criteria above, prior to tender close to be considered as an acceptable testing coordinator.

END OF SECTION

Figure 1 – Example Pre-Test ITP Acknowledgement (Typical Design Professionals): Informative

INTEGRATED SYSTEMS WRITTEN ACKNOWLEDGEMENT REVIEW AND ACCEPTANCE OF INTEGRATED TEST PLAN (EXAMPLE)			
Per Item 5.2.8 and Section B9.1 of CAN/ULC S1001 (latest version), the respective design professionals shall indicate written confirmation to the Testing Coordinator acceptance of the Integrated systems Test Plan according to the intent of the project design documents.			
List of Design Professionals		Company/Representative	Design Responsibility
Architect	Company Name:		
	Designer Name:		
	Signature		
Electrical Engineer	Company Name:		
	Designer Name:		
	Signature		
Mechanical Engineer	Company Name:		
	Designer Name:		
	Signature		
Fire Protection Engineer (sprinkler)	Company Name:		
	Designer Name:		
	Signature		
(typical responsible consultant on project)	Company Name:		
	Designer Name:		
	Signature		

Figure 2 – Example Pre-Test Trade Site Ready Acknowledgement (Typical Project Trades): Informative

PRE-TESTING INTEGRATED SYSTEMS WRITTEN ACKNOWLEDGEMENT (EXAMPLE)			
Per Item 5.3.1.(B) and Section B8.1 of CAN/ULC S1001 (latest version), the respective installing contractors shall indicate written confirmation to the Testing Coordinator that their respective life safety systems have been installed in accordance with the design are ready for integrated testing as outlined within the Integrated Systems Testing Plan.			
List of Installing Trades		Company/Representative	System Responsibilities
General Contractor	Company Name:		
	Name:		
	Signature		
Electrical Contractor	Company Name:		
	Name:		
	Signature		
Mechanical Contractor	Company Name:		
	Name:		
	Signature		
Sprinkler Contractor	Company Name:		
	Name:		
	Signature		
Elevator Contractor	Company Name:		
	Name:		
	Signature		
(typical responsible trade on project)	Company Name:		
	Name:		
	Signature		

Figure 3 – Example Pre-Test Designer Site Ready Acknowledgement (Typical Design Professionals): Informative

PRE-TESTING INTEGRATED SYSTEMS WRITTEN ACKNOWLEDGEMENT (EXAMPLE)			
Per Item 5.3.1.(A) and Section B8.1 of CAN/ULC S1001 (latest version), the respective design professionals shall indicate written confirmation to the Testing Coordinator that the site is ready for integrated systems testing per the descriptions and integrations outlined within the Integrated Systems Testing Plan.			
List of Design Professionals		Company/Representative	Design Responsibility
Architect	Company Name:		
	Designer Name:		
	Signature		
Electrical Engineer	Company Name:		
	Designer Name:		
	Signature		
Mechanical Engineer	Company Name:		
	Designer Name:		
	Signature		
Fire Protection Engineer (sprinkler)	Company Name:		
	Designer Name:		
	Signature		
(typical responsible consultant on project)	Company Name:		
	Designer Name:		
	Signature		

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Electrical Division 26, as well as Division 27 and Division 28.

.2 This section supplements requirements of Division 1.

1.2 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant's satisfaction prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter).

.1 Electrical Safety Authority – Final Inspection Certificate of Acceptance

.2 Emergency and Exit Lighting Test Letter.

.3 Fire Alarm System Verification Report (including Field technician worksheets) and ULC Monitoring Certificates

.4 Integrated Life Safety System Testing Final Report

.5 Smoke and CO Detector Alarm Test Letter

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No.131-M89(R1994), Type TECK 90 Cable.

.3 CAN/ULC S319 (latest edition), Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables.

.4 CSA C22.2 No. 123 (latest edition), Metal Sheathed Cables.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger.

.2 Minimum size: 12 AWG.

.3 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material 90°C (194ºF) rated T90 for indoor above grade installations and RW90 for below grade installations.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No.131.

.2 Conductors:

- .1 Grounding conductor: Copper.
- .2 Circuit conductors: Copper, size as indicated.

.3 Inner jacket: Polyvinyl chloride material.

.4 Armour: Aluminum.

.5 Overall covering: Polyvinyl chloride material.

.6 Fastenings:

- .1 One hole steel zinc straps to secure surface cables 50 mm (2") and smaller. Two-hole steel straps for cables larger than 50 mm (2").
- .2 Channel type supports for two or more cables at 1500 mm (60") centres.
- .3 Threaded rods: 6 mm (1/4") diameter to support suspended channels.

.7 Connectors must be suitable for:

- .1 Installed environment and approved for use with TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper minimum size as indicated above.

.2 Type: AC90 (minimum size 12 AWG).

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors must be suitable for installed environment and approved for use with armoured cable.

2.4 VFD RATED CABLES

.1 Where noted, provide VFD rated cable connection to mechanical loads.

.2 Type: TECK90 Armoured VFD.

.3 Conductors: Armored, shielded, 100% ground, copper minimum size to match ampacity of feeder to load as indicated but not less than the minimum circuit ampacity of the load.

.4 Insulation: XLPE 90C rated for 1000V or 2000V.

.5 Connectors and cable glands must be suitable and approved for use with the type of cable.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring from source to load through raceways as specified.

.2 Provide separate neutral conductors for all lighting circuits and circuits originating from surge protected panels. Size raceways accordingly.

3.2 INSTALLATION OF TECK CABLE 0 - 1000 V

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

3.3 INSTALLATION OF FIRE RATED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with manufacturer’s recommended installation instructions.

.3 Cables are to be installed as a single continuous run to maintain fire rating integrity.

.4 Support cables horizontally or vertically every 1219 mm (48") intervals and on each side of a bend.

.5 Provide thermoplastic barrier at all mounting locations as per manufacturer’s installation instructions.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

.3 These cables are to be installed in concealed locations only. These concealed locations are considered to be stud walls and “drops” to stud walls, lighting fixtures, and ceiling mounted devices.

.4 These “drops” shall not be permitted to exceed 2.4 m (8'-0"). To limit these “drops” to lengths noted above provide additional branch wiring in conduit.

3.5 INSTALLATION OF VFD RATED CABLES

.1 Install VFD rated wiring from VFD starter to load.

.2 Provide 1000V insulation rated cable for 208V loads.

.3 Provide 2000V insulation rated cable for 600V loads.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 MATERIALS

.1 Splitters must conform to CSA C22.2 No. 76 (latest edition).

.2 Junction and pull boxes must conform to CSA C22.2 No. 40 (latest edition)

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm (1") minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Install junction and pull boxes so as not to exceed 30 m (100') of conduit run between pull boxes and in conformance with the Electrical Safety Code.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with General Electrical Requirements Section.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Outlet boxes, conduit boxes, and fittings must conform to CSA C22.2 No. 18 (latest edition).

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm (4") square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 mm x 50 mm x 64 mm (3" x 2" x 2½") or as indicated. 102 mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required. Iberville 1104 Series.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit **in utility rooms**, minimum size 102 mm x 57 mm x 38 mm (4" x 2¼" x 1½"). Iberville 1110 Series.

.3 102 mm (4") square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm (4") square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle **in areas (other than utility rooms) where surface conduit is used.**

2.6 FITTINGS- GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm (1- 1/4") and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm (1/4") of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No.65-1956(R1965) Wire Connectors.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as indicated.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable, mineral insulated cable, and flexible conduit, as required.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 Not Applicable.

Part 2 Products

2.1 MATERIALS

.1 Grounding equipment must conform to CSA C22.2 No 41 (latest edition).

2.2 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe and electrically conductive metal gas piping.

.2 Rod electrodes: copper clad steel 19 mm (3/4") diameter by 3 m (10') long.

.3 Plate electrodes: galvanized steel, surface area 0.2 m^2, minimum 1.6 mm thick.

.4 Insulated grounding conductors: green with insulation type that matches specified phase conductors. Gauge shall be in conformance with the latest edition of the Electrical Safety Code to suit required installation conditions.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. **Where EMT is used, run ground wire in conduit.**

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process inspectable wrought copper compression connectors to ANSI/IEEE 837.

.5 Make bonding connection to gas piping from electrical service ground at each location it enters a building, including multiple entries.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Ground pad mounted transformers as detailed on the drawings.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter. This shall apply to the installation or replacement of building water service.

.2 Install water meter shunt.

.3 Make ground connections to continuously conductive metal gas piping system. This shall apply to installation or replacement of gas appliances, as well as installation or modification of a building gas piping system.

.4 Corrugated metal tubing shall not be used as a bonding means for the gas piping system.

.5 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.6 Install rod or plate electrodes and make grounding connections.

.7 Bond separate, multiple electrodes together.

.8 Use #2/0 copper conductors for connections to electrodes. Size in conformance with the Electrical Safety Code.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Electrical Service equipment, electrically conductive underground water pipe, electrically conductive metal gas piping, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, and outdoor lighting.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, computer network systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, computer network systems as indicated.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No.18-92, Outlet Boxes, Conduit Boxes, and Fittings.
- .2 CSA C22.2 No.45-M1981(R1992), Rigid Metal Conduit.
- .3 CSA C22.2 No.56-1977(R1977), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No.83-M1985(R1992), Electrical Metallic Tubing.
- .5 CSA C22.2 No.211.2-M1984(R1992), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No.227.1, Nema TC-13, Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No.45, aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT) with couplings: to CSA C22.2 No.83.

.4 Rigid PVC conduit: to CSA C22.2 No.211.2.

.5 Flexible metal conduit: to CSA C22.2 No.56, aluminum and liquid-tight flexible metal.

.6 Flexible PVC conduit: to CAN/CSA C22.2 No.227.1 and Nema TC-13, Electrical nonmetallic tubing (ENT).

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 53 mm (2") and smaller. Two hole steel straps for conduits larger than 53 mm (2").

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m (5'-0") oc.

.4 Threaded rods, 6 mm (1/4") diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 EMT fittings shall be set screw style (zinc alloy).

.2 Flexible metal conduit fittings shall be screw-in type.

.3 Liquid type flexible metal conduit fittings shall be sealtite type.

.4 PVC fittings shall be PVC type complete with PVC adaptors at all boxes.

.5 Rigid conduit and mineral insulated conduit fittings shall be threaded type.

.6 Coating: same as conduit.

.7 Factory "ells" where 90° bends are required for 27 mm (1") and larger conduits.

.8 Where bushings are noted to be provided they must be “screwed” type fastened to a conduit connector. Push-fit or glued in place bushings will NOT be accepted.

2.4 FISH CORD

.1 Nylon twine.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical/ electrical service rooms and in unfinished areas.

.3 Where devices are to be installed on existing walls in finished area, which cannot be “fished”, install feeds in a surface metal raceway equal to Wiremold V700 series. Coordinate surface installations with Consultant prior to rough-in, unless otherwise noted.

.4 Use electrical metallic tubing (EMT) for all branch circuits unless specified otherwise.

.5 Electrical nonmetallic tubing (ENT) may be used only for branch circuits in non-combustible buildings, in framed wall construction for residential suites, within block walls, and in precast or cast in place walls and floors. **Use of ENT for direct burial, plenum ceilings, or outdoor environments will not be accepted.**

.6 Use rigid aluminum threaded conduit where specified and up to 2.1 m (7'-0") above finish floor where exposed to mechanical injury.

.7 Use rigid PVC conduit underground and in kitchen areas.

.8 Use flexible metal conduit for connection to motors in dry areas, connection to recessed fixtures without a prewired outlet box, connection to surface or recessed fixtures, work in movable metal partitions.

.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations and for connections to kitchen equipment.

.10 Conduits terminating at electrical equipment in sprinklered areas are to be provided rain-tight insulated compression style connectors.

.11 **Minimum conduit size for branch circuits shall be 21 mm (3/4").** Single drops from ceiling mounted junction boxes down to a light switch or duplex receptacle may be reduced to 16 mm (½").

.12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.13 Mechanically bend steel conduit over 27 mm (1") diameter.

.14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.15 Install fish cord in empty conduits.

.16 Run 2- 27 mm (1") spare conduits up to accessible ceiling space from each flush panel. Terminate these conduits in 152 mm x 152 mm x 102 mm (6" x 6" x 4") junction boxes in ceiling space.

.17 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.18 Dry conduits out before installing wire.

.19 Do not install, store, or handle ENT in cold temperatures below -20°C(-4°F). Do not store ENT outside.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m (5') clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines with minimum of 25 mm (1") at crossovers.

.7 Do not fasten surface conduit to roof deck. Provide standoffs or supports as manufactured by Caddy or use unistrut trapeze fastened to structure.

3.3 CONCEALED CONDUITS

.1 Do not install horizontal runs in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 27 mm (1") concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 27 mm (1") and larger 300 mm (12") below slab (measured from top of slab to bottom of conduit) and encased in 78 mm (3") sand envelope.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 Conform to the General Provisions of Division 1 and Electrical General Requirements Section.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 MATERIALS

.1 Rigid PVC ducts must conform to CSA C22.2 No. 211.0, 211.1 and 211.2 (latest edition).

.2 Ducts and/or cables must be excavated, bedded, reinforced, encased and backfilled as per details on the drawings.

2.2 DUCT

.1 Ducts indicated for encasement in concrete must be type DB-2. Ipex “Super Duct” or approved equal.

.2 Ducts indicated for direct burial must be type SCEPTER. Ipex “Scepter” rigid PVC duct or approved equal.

2.3 DUCT FITTINGS

.1 Fittings required to provide a complete continuous ductbank installation shall include but not be limited to, couplings, bell end fitting, caps, adapters, base and intermediate spacers.

.2 Small or large angle couplings will be required where noted on the drawings.

.3 Expansion joints are to be provided when running ducts in concrete across expansion joints and where exposed on roofs or exterior of buildings.

Part 3 Execution

3.1 BASIC INSTALLATION

.1 Excavate trench along route as indicated and at a depth to suit cables and/or ducts as detailed.

.2 If required, trench is to be pumped to maintain excavation free of water.

.3 Import granular fill and place in bottom of trench. Compact to provide a firm level base.

.4 Quantity and arrangement of ducts must be provided according to drawing details.

.5 When ducts terminate at buildings or precast bases provide bell end fittings.

.6 When ducts enter buildings below grade they shall be sealed inside and out at the building foundation and service entrance equipment with a suitable duct sealing compound to prevent the entrance of moisture or gases.

.7 When terminating a ductbank for future extension terminate each duct with a coupling. If ducts are encased in concrete set coupling flush with end of concrete.

.8 Attach ducts to spacers using non-metallic materials.

.9 Provide concrete as detailed. Pour concrete down sides of ductbank to ensure spaces around and under ducts are filled first.

.10 Concrete must obtain 50% of its specified strength prior to backfilling.

.11 Backfilling must be imported granular 'A' material.

.12 Backfill must be placed as 150 mm (6") compacted lifts.

.13 Excess excavated material must be removed from site by this contractor.

.14 Ensure ducts indicated to be installed along a curb line are installed at least 600 mm (24") from that curb line.

3.2 DIRECT BURIAL OF DUCTS

.1 After sand bed specified is in place, lay ducts maintaining 75 mm (3") clearance from each side of trench to nearest duct. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset ducts 150 mm (6") for each 60 m (200') run, maintaining minimum duct separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Duct separation:

.1 Provide separation of ducts in conformance with the details in the Electrical Safety Code.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.4 FIELD QUALITY CONTROL

.1 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.2 Check phase rotation and identify each phase conductor of each feeder.

.3 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 mega ohms.

.4 Pre-acceptance tests.

.1 After installing cable but before terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.5 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

.6 Remove and replace entire length of cable if cable fails to meet any of test criteria.

.7 The Consultant requires a minimum of 48 hours notice to inspect at his discretion the following; ductbank excavation, bedding and duct placement, pouring and/or placement of ductbank encasement.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The studies must be submitted to the Consultant prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Consultant may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

.2 The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system, **as well as mechanical unit equipment.** Normal system connections and those, which result in maximum fault conditions, shall be adequately covered in the study.

.3 The firm should be currently involved in high- and low-voltage power system evaluation. The study must be performed, stamped and signed by a registered professional engineer in the Province of Ontario. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Consultant for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.

.4 The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

1.2 DATA COLLECTION FOR THE STUDY

.1 The Contractor shall provide the required data for preparation of the studies. The Consultant performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.

.2 The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.

.3 Data collected for the study, including correspondence with local utility, shall be included with study report.

Part 2 Products

2.1 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY

.1 The short-circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

.2 In the short-circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor fault contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.

.3 In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

.4 Include on the curve sheets power company relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. In addition, include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current to which the device is exposed.

.5 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

.6 Include complete fault calculations as specified herein based on contract documents.

.7 Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit the study to Consultant for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.

.8 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

.9 Include fault contribution of all motors in the study. Notify the Consultant in writing of circuit protective devices not properly rated for fault conditions.

.10 When emergency generator is provided, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Contractor shall obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

.11 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

.12 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.

.13 Evaluate proper rating of applicable mechanical unit equipment based on available fault at unit connection. Mechanical unit equipment in study shall include packaged assemblies identified as, but not limited to, AHUs, MUAs, DOAS, Chillers, and Cooling Towers.

2.2 ARC FLASH HAZARD ANALYSIS

.1 The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D and CSA Z462-(latest edition).

.2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

.3 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

.4 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

.5 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.

.6 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

.7 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

.8 Arc Flash computation shall include both line and load side of main breaker calculations, where necessary.

.9 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-latest edition section B.1.2.

.10 Arc Flash computation shall include arc flash current magnitude at each circuit breaker 1200A or higher (ARMS capable) to allow the Arc Flash Reduction Maintenance System pickups to be set based on multiples of the per unit secondary arc current monitored by the trip unit.

2.3 STUDY REPORT

.1 The results of the power system study shall be summarized in a final report. Submit report in accordance with Electrical General Requirements Section as a shop drawing.

.2 The report shall include the following sections:

.1 Descriptions, purpose, basis, and scope of the study.

.2 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.

.3 Tabulations of mechanical unit equipment ratings as identified on equipment shop drawings versus calculated short-circuit, and commentary regarding same. Short-circuit calculations for mechanical equipment shall be based on unit MCA with conductor sizes as identified on electrical design drawings and not based on equipment MOCP.

.4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

.5 Fault current calculations including a definition of terms and guide for interpretation of computer printout.

.6 Incident energy and flash protection boundary calculations

.1 Arcing fault magnitude

.2 Device clearing time

.3 Duration of arc

.4 Arc flash boundary

.5 Working distance

.6 Incident energy

.7 Hazard Risk Category

.8 Recommendations for arc flash energy reduction

.9 Recommendations for Personal Protection Equipment (PPE) level.

Part 3 Execution

3.1 POWER COMPANY APPROVAL

.1 Copies of the final report must be submitted to the power company for their review and approval. Approved copies of the report shall be submitted to the Consultant.

3.2 FIELD SETTINGS

.1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.

.2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

.3 At the completion of the project, configure settings and install equipment labels. On company letterhead, the contractor is to prepare a certification letter indicating at minimum:

.1 project
.2 date
.3 device designation
.4 certification of correct settings
.5 certification of correct device labels
.6 certification of arc flash hazard equipment labels
.7 digital image of each breaker indicating final settings and placement of labels

3.3 ARC FLASH WARNING LABELS

.1 The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:

.1 Location designation
.2 Nominal voltage
.3 Flash protection boundary
.4 Hazard risk category
.5 Incident energy
.6 Working distance
.7 Personal Protection Equipment (PPE) level
.8 Engineering report number, revision number and issue date.

.3 Labels shall be machine printed, with no field markings.

.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

.1 For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.

.2 For each motor control center, one arc flash label shall be provided.

.3 For each low voltage switchboard, one arc flash label shall be provided.

.4 For each switchgear, one flash label shall be provided.

.5 For medium voltage switches one arc flash label shall be provided

.5 Labels shall be field installed by the firm providing the Arc Flashing Hazard Analysis.

3.4 SERIES RATING LABELS

.1 Provide lamacoid labels where recommended by study. **Labels for series rating with panelboards or equipment shall be indicated on feeder breaker as "SERIES RATING BREAKER" and at the panelboard or equipment as "SERIES RATING EQUIPMENT". Refer to section 26 24 16.**

3.5 ACCEPTABLE TESTING FIRMS

.1 MVA Engineering (519) 668-4698

.2 GT Woods (905) 272-1696

.3 Brosz & Associates (905) 472-6660

.4 K-Tek Electro-services Ltd. (905) 640-0660 ext. 228

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings for each system in Conformance with The Electrical General Requirements Section.

1.2 PRODUCT/MAINTENANCE DATA

.1 Submit product/maintenance data for each system for inclusion in maintenance manual conforming to The General Electrical Requirements Section.

1.3 SCOPE

.1 The scope of this Section will include the following systems.

- .1 Hand dryers.
- .2 Cable management hangers.
- .3 Cable management system.
- .4 Auxiliary systems rough-in.
- .5 Security and access control rough-in.
- .6 Telecommunication network system rough-in.
- .7 Destratification fans and controls.
- .8 Classroom control panels.
- .9 Public address system rough-in.

Part 2 Products

2.1 HAND DRYERS

.1 Hand dryers where noted on the drawings are to be supplied and installed by this Division with the following features:

- .1 Surface mounting.
- .2 Fixed nozzle.
- .3 White finish with automatic activation.
  Final finish selection by owner/architect.
- .4 Rating of 1200 W at 120 V.
- .5 World Dryer Cat. #K-974A2
  - .1 World Dryer Cat. #XA5-2-974.

2.2 CABLE MANAGEMENT HANGERS

.1 Hangers where noted are to be complete with the following features:

.1 Approximately 150 mm (6") high by 80 mm (3¼") protrusion.

.2 Constructed from 5 mm (3/16") x 20 mm (3/4") flat steel bar and formed to resemble the letter “G”.

.3 Seven 6 mm (1/4") diameter mounting holes are to be provided around the hanger perimeter.

.4 Matte black finish.

.5 Suitable for wall or suspended mounting.

.6 Acceptable Manufacturers:

.1 EMF Cat. #H-533-S

.7 Manufacturer Contact:

Electron Metal Fabricators Inc.
2160 Dagenais Boulevard West
Laval, Quebec
H7L 5X9
Phone: 450-625-8064 or 1-800-267-8064
Fax: 450-625-8004

.8 Acceptable Alternate:

Wiremold Cat. #GH030406
Mono System Cat. # The Hook H-433
Cablofil Cat. #CSGH-3-4-6
Eaton Cat. #B-Line

.2 As an alternate to the hanger system detailed the contractor may

a) Use as an equal one run of 50 mm (2") x 150 mm (6") wire mesh cable management system equal to Cablofil Cat. #CF 54/150 EZ complete with Cat. #FAS L 150 universal wall bracket where noted to be wall mounted and Cat. # FAS C 200 where noted to be hung. The hangers are to be installed at intervals as recommended by the manufacturer but no greater than 2.4 m (8'-0") on centre.

2.3 CABLE MANAGEMENT SYSTEM

.1 The system where noted shall be a continuous, rigid, welded steel wire mesh cable management system with the following features:

.1 Permits continuous ventilation of cable and maximum dissipation of heat.

.2 Continuous safety edge T-welded wire lip.

.3 Welded at all intersections.

.4 Straight sections 4" x 12" (100 mm x 300 mm) in configurations noted on the drawings.

.5 Constructed of carbon steel wire, ASTM A 510, grade 1008. Wire welded, bent, and surface treated after manufacture.

.6 Post fabrication finish of electro-plated zinc galvanizing: ASTM B 633, Type III, SC-1.

.7 Fittings: Field fabricated in accordance with manufacturer's instructions from straight sections.

.2 The support system shall be Cablofil FAS CH hanger.

.3 The necessary hardware, including splice connectors and support components furnished by manufacturer.

.4 The product shall be Cablofil Cat. #CF105/300EZ complete with Cat. #FAS P300 CH at intervals as recommended by the manufacturer.

.5 The manufacturer shall be:

.1 Cablofil Inc.
Local representation by:
Cablofil
533 Galway Drive
Burlington, Ontario
L7L 2S6
Ph: 905-681-5380
Fax: 905-681-2206

.6 Approved equals:

.1 Eaton B-Line FT4x12x10 complete with 12 CTR HGR
Intralec Electrical Products Ltd.
1200 Cardiff Blvd.
Mississauga, Ontario
L5S 1P6
Phone: 905-670-0970

2.4 AUXILIARY SYSTEMS ROUGH-IN

.1 Outlets where noted shall be single gang boxes unless specified otherwise.

.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

.3 Coordinate final outlet locations, quantities, etc. with respective system vendor and owner's representative.

2.5 SECURITY AND ACCESS CONTROL ROUGH-IN

.1 Provide conduit from device and outlet locations to cable management systems as noted on drawings.

.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

.3 Provide grounding of equipment as noted on drawings.

.4 Security and access control systems installation shall be by Owner's approved vendor as part of separate tender.

2.6 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN

.1 Outlets where noted shall be single gang flush mounted in wall or surface raceways.

.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

.3 Provide a #6 insulated green ground conductor from main service ground to voice equipment backboard located on drawings.

.4 Telecommunication Network installation shall be by Owner's approved vendor as part of separate tender.

2.7 DESTRATIFICATION FANS AND CONTROLS

.1 General purpose fans in the gym to be provided with the following features:

.1 Metal construction.

.2 Baked white enamel.

.3 1400 mm (56") diameter blade combination.

.4 Minimum 400 mm (16") suspension with ball aligner and canopy.

.5 Suitable for 120V/1/60Hz operation.

.6 Provided with wire cage when installed in general purpose rooms.

.7 Manufacturer:

.1 Banvil Cat. #FP56R (FG60C where noted).

.2 Single fan variable speed controller shall be Banvil Cat. #100P c/w colour and coverplate to suit this specification.

.3 Multiple fan variable speed controller shall be Banvil Cat. [#105F (up to 4 fans), 150F (up to 8 fans), or 200F (up to 12 fans)] c/w colour and coverplate to suit this specification.

.4 Approved equal:

.1 Pleasantaire

.5 Decorative fans as indicated are to be provided with the following features:

.1 Metal construction.

.2 Blade, downrod and motor finish as directed by Architect.

.3 Down-blowing single direction.

.4 1300 (52") diameter blade combination.

.5 Minimum 400 mm (16") suspension with ball aligner and canopy.

.6 Suitable for 120V/1/60 Hz operation.

.7 Manufacturer: Big Ass Fans Cat. #K3127-A2-XX-XX-XX-03-C complete with multi-button wall mounted controller.

2.8 CLASSROOM CONTROL PANELS

.1 Provide surface mounted Classroom Hub Control Panels as detailed on the drawings.

.2 Modular control panels shall be constructed of structurally sound 6063 T5 alloy satin anodized aluminum frame .08mm thick with high pressure plastic laminate faced panels of lightweight particle core and 0.5mm thick plastic laminate backing sheet. Plastic laminate colour as selected by the Architect from Arborite or Formica, furniture finish, from manufacturer's standard colour range. Complete assembly to meet flame spread ratings in areas used.

.3 Units to be complete with backboxes fabricated from heavy gauge satin coat steel with suitable barriers and continuous knockouts. Satin anodized faceplates shall be pre-punched to accept detailed components.

.4 All panels shall be vandal resistant and removable with special tools for service access.

.5 Fabricate units in accordance with reviewed shop drawings with extruded aluminum frames and solid plastic laminated face panels.

.6 Panels to be removable from aluminum frames with rounded profile edging.

.7 Front panels to have colour finish as selected by the Architect.

.8 Panels to have all openings, mounting hardware, etc. for services as required for installation of mechanical and electrical services.

.9 PANELS MUST BE COMPLETE WITH RECESSED OPENING FOR TELEPHONE HANDSET. REFER TO CONTROL PANEL DETAIL ON DESIGN DRAWINGS.

.10 Units to be full height from 200 mm off floor to underside of ceiling panels. Standard unit dimensions are 16" in width, 4" deep.

.11 Units shall be required to accommodate the successful public address vendor's digital messaging board.

.1 Telecor Cat. #E2444-LD-MA

.2 Carehawk Cat. #CLKMSL10-SPK

.12 Acceptable Manufacturer (basis of design):

.1 Swift Path Solutions.

.13 Acceptable Alternates (no other alternates accepted):

.1 Control Hub Solutions Inc.

.2 Olympic Tool & Die Inc.

.3 DiPanel Inc.

2.9 PUBLIC ADDRESS SYSTEM ROUGH-IN

.1 Provide conduit from device and outlet locations to cable management systems as noted on drawings.

.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

.3 Provide grounding of equipment as noted on drawings.

.4 Public address system installation shall be by Owner's approved vendor as part of separate tender.

Part 3 Execution

3.1 HAND DRYERS

.1 Install and connect hand dryers in conformance with manufacturer's recommendations.

.2 Hand dryers are to be mounted at a height to suit age of expected users. Unless otherwise noted confirm height with manufacturer, owner, Architect, and/or consultant prior to rough-in.

.3 Once installed this contractor is to caulk the joint between dryer and wall surface with a bead of clear silicone.

3.2 CABLE MANAGEMENT HANGERS

.1 Install hangers as per details in configuration noted.

.2 Prior to installation co-ordinate location with other services within the ceiling space.

.3 Co-ordinate with noted sub-contractors to install cables noted to be utilizing these hangers. Cables are to be installed such that the maximum sag between hangers does not exceed 25 mm (1"). This electrical contractor is to coordinate.

.4 Attaching cable to any T-bar support rods is not acceptable.

3.3 CABLE MANAGEMENT SYSTEM

.1 Install cable management system at locations indicated on the drawings and in accordance with manufacturer's instructions.

.2 Support system every 2.4 m (8'-0") unless system is used within a telecommunication room. In that situation support every 1.5 m (5'-0").

.3 Cut wires in accordance with manufacturer's instructions.

.4 Cut wires with side action bolt cutters to ensure integrity of galvanic protective layer. Cut using side action bolt cutters (Cablofil Cat. #Coupfil).

.5 Cut each wire with 1 clean cut to eliminate grinding or touch-up.

.6 Install cable management system using hardware, splice connectors, support components, and accessories furnished by manufacturer.

.7 Suspend from structure or intermediate unistrut channel spanning across the corridor where access to structure is not available due to the concentration of mechanical ductwork and/or piping.

.8 Ground cable tray with continuous ground per O.E.S.C. and manufacturer instructions. Test to ensure minimum 5 ohms resistance.

.9 Locate cable management system minimum 9" from EMI sources including but not limited to fluorescent lights, transformers, motors, and power cables.

3.4 AUXILIARY SYSTEMS ROUGH-IN

.1 Provide backboard for each system use as noted complete with ground buss connection as specified.

.2 Outlets are to be installed complete with minimum 21 mm (3/4") conduit to accessible ceiling space or as otherwise detailed.

.3 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits when noted.

.4 Provide insulated bushings on all conduits terminated in ceiling space.

.5 Ensure specified zone or riser conduits are installed back to equipment backboard.

3.5 SECURITY AND ACCESS CONTROL ROUGH-IN

.1 Outlets are to be provided for devices with conduit as detailed on drawings.

.2 Conduits terminated into ceiling spaces must be within 1m of cable management of tray.

3.6 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN

.1 Install incoming service ducts and terminate as noted.

.2 Provide backboard as noted complete with ground connection to main service ground.

.3 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits (if applicable).

.4 Ensure specified zone conduits are installed back to service backboard.

.5 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest zone conduit (if applicable).

.6 Provide insulated bushings on all conduits terminated in ceiling space.

.7 A 25mm (1") conduit is to be installed from elevator machine room to voice service backboard.

3.7 DESTRATIFICATION FANS AND CONTROLS

.1 Ensure fans and controls are installed in conformance with manufacturer recommendations.

.2 Where noted install wireguards to be level. Fasten wireguards to structure NOT roof deck. Provide intermediate unistrut supports to suit.

.3 Demonstrate fan operation at the time of final inspection.

.4 Contractor is to remove manufacturer’s label prior to installation.

3.8 CLASSROOM CONTROL PANELS

.1 Electrical trade to supply and install units in accordance with manufacturers’ recommendations and reviewed shop drawings complete with all frames, cut outs, face panels, etc., to provide a complete installation.

.2 It is the electrical trade's responsibility to coordinate complete installation of all mechanical, electrical and miscellaneous services in all control panels. Components within control panels will vary from room to room.

3.9 PUBLIC ADDRESS SYSTEM ROUGH-IN

.1 Conduits terminated into ceiling spaces must be within 1m (10') of cable management tray.

.2 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest cable management tray.

.3 Provide insulated bushings on all conduits terminated in ceiling space.

.4 Electrical contractor shall obtain speaker back boxes from School Board vender for installation into ceiling tiles, block walls, etc.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Heaters must conform to CSA 22.2 No.46 (latest edition).

1.2 PRODUCT DATA

.1 Submit product data in accordance with the Electrical General Requirements Section.

.2 Product data to include:

- .1 Suspension of heating element.
- .2 Physical size.
- .3 Thermostat control if integral.
- .4 Finish.
- .5 kW rating, voltage, phase.
- .6 Cabinet thickness.
- .7 Cabinet surface temperature.
- .8 Mounting methods.
- .9 Auxiliary controls.
- .10 Replacement data for motor element, thermostat, and switch.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for all heating system components for incorporation into manual as specified in the Electrical General Requirements Section.

Part 2 Products

2.1 BASEBOARD CONVECTORS

.1 Heaters shall be standard wattage density with connection box at one end. Element through-type fitted with aluminum convector vanes and resistor wire enclosed in mineral insulation in copper coated steel sheath.

.2 Element locked to cabinet and supported at additional points throughout length to allow for linear expansion with non-metallic supports.

.3 Cabinets shall be bottom inlet/outlet front panel 1.6 mm (3/32") thick, finished in baked enamel, (colour to suit architect). Integral air diffusion reflector with wireway at bottom.

.4 Blank cabinet sections where specified shall be complete with wireway in all sections including splice plates, to match heater cabinets in all respects for continuous baseboard effect as indicated.

.5 Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified.

2.2 UNIT HEATERS

.1 Unit heater shall be horizontal discharge complete with adjustable louvers finished to match cabinet.

.2 Fan type unit heaters must be provided with built-in high-heat limit protection.

.3 Fan motor must be permanently lubricated ball bearing type with resilient mount. Built-in fan motor thermal overload protection.

.4 Hangers shall be as indicated on drawings.

.5 Elements shall be mineral insulated copper coated steel sheath with aluminum brazed fins.

.6 Cabinet shall be steel fitted with brackets for rod or wall mounting. Phosphatized and finished with baked enamel finish to suit architect.

.7 Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified. Integral magnetic contactors (if specified) are to be provided to suit load.

.8 For the purposes of bidding, electrical trade shall include but not be limited to provision of a junction box to connect equipment wiring tail, provision of suitable disconnecting means, and flexible connection directly to equipment.

2.3 CABINET CONVECTOR HEATERS

.1 Wall mounted cabinet shall be front inlet/front outlet 1.6 mm (3/32") thick front steel panel. Phosphatized and finished with baked enamel. Finish colour to suit architect. Pre-drilled back for securing to wall.

.2 Elements shall be mineral insulated with copper sheath and pressed-on fins, secured and free-floating for expansion.

.3 Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified.

2.4 FORCED AIR WALL HEATERS

.1 Forced air wall heaters, wall or ceiling mounted as noted complete with T-bar mounting frame. Heater shall be commercial type as follows:

.1 Enclosure:

.1 Steel: 18 gauge.

.2 Knockouts for 19 mm (3/4") diameter conduit left, right, bottom and rear.

.3 Grill and frame finished to suit architect.

.2 Elements and Fan:

.1 Mineral insulated.

.2 Motor: totally enclosed, shaded pole, impedance protected motor.

.2 Controls:

.1 Built-in tamperproof controls. 'On-Off-Fan Only' selector switch and temperature control knob.

2.5 THERMOSTATS

.1 Line voltage thermostats in finished areas as indicated shall be complete with the following features:

.1 Full load rating of maximum 18 A at 208 V

.2 Temperature range: 10ºC to 27ºC (50ºF to 80.6ºF)

.3 Temperature range shall be marked on face of thermostat in 5 degree increments.

2.6 APPROVED MANUFACTURERS

.1 Approved manufacturers shall be:

.1 Ouellet

.2 Stelpro

.3 Westcan

Part 3 Execution

3.1 INSTALLATION

.1 Install baseboard convector heaters, blank sections, and controls. When wireway is used, remove knock-outs and insert insulating bushing between each unit. Install grounding wire to maintain ground integrity between heating, blank, and auxiliary sections.

.2 Suspend unit heaters from ceiling or mount on wall as indicated. Provide local disconnecting means.

.3 Install cabinet convectors as indicated.

.4 Install force flow heaters as indicated.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.

.2 Ensure that heaters and controls operate correctly.

.3 On fan powered units:

.1 Test cut-out protection when air movement is obstructed.

.2 Test fan delay switch to assure dissipation of heat after element shut down.

.3 Test unit cut-off when fan motor overload protection has operated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Dry type transformers must conform to CSA C22.2 No.47 and C9 (latest edition).

.2 **Dry type transformers must conform to CSA C802 (latest edition).**

.3 Dry type transformers must be in accordance with Ontario Green Energy Act 2018 (NRCan 2018) DOE 2016.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 TRANSFORMERS

.1 Transformers to be of one manufacturer throughout project.

.2 Ratings and characteristics shall be as indicated on riser diagrams.

.3 Aluminum winding.

.4 Transformers are to be ventilated dry type style with 4-2½% taps (2 F.C.B.N. and 2 F.C.A.N.)

.5 Maximum permissible sound levels shall be as follows:

Transformer Rating (KVA)	Sound Level (dBA)
≤50	45
51 to 150	50
151 to 300	55
301 to 500	60

.6 All transformers with a K factor of 4 or above must be electro-static shielded.

.7 Transformers with a K-factor of 4 or above must include a secondary neutral bus that is sized at twice the rated secondary phase current.

.8 Transformer enclosure shall be EEMAC/NEMA 3R ventilated complete with removable front panel.

.9 Provide vibration isolators equal to Korfund R series, Mason ND-B, or approved equal. “Colour” of vibration isolators shall be based on weight of transformers.

Transformer Weight (lbs)	Approximate Rating	Colour (Korfund)
540	15 – 75 kVA	Blue (RD2)
680	112.5 kVA	Black (RD2)
960	150 kVA	Red (RD2)
1,520	300 kVA	Green (RD2)
2,200	500 kVA	Gray (RD3)

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Label must indicate:

.1 transformer “tag” as per riser diagram

.2 primary and secondary voltage and phase.

2.3 ACCEPTABLE MANUFACTURERS:

.1 Acceptable manufacturers are as follows:

.1 Hammond

.2 Rex

.3 Delta

.4 Acme

.5 Bemag

Part 3 Execution

3.1 INSTALLATION

.1 Primary and secondary feeders are to be connected using flexible conduit.

.2 Transformers with a rating up to and including 75 KVA are permitted to be wall mounted provided mounting method is a suitably sized angle iron frame secured to structure (i.e. masonry wall, steel columns, etc. NOT metal siding).

.3 The above rating of transformers may also be suspended from **structure only** on a unistrut trapeze as detailed.

.4 Transformers above 75 KVA must be floor mounted.

.5 Floor mounted transformers are to be mounted/secured to a concrete pad suitably sized to suit the transformer. This pad is the responsibility of this contractor and must be provided in conformance with the standard of Division 1 specifications for poured in place concrete.

.6 All transformers must be mounted on vibration isolators selected based on transformer weight.

.7 Ensure adequate clearance around transformer for ventilation as per the Electrical Safety Code.

.8 Loosen isolation pad bolts until no compression is visible.

.9 Install transformers in level upright position.

.10 Remove shipping supports only after transformer is installed and just before putting into service.

.11 Make primary and secondary connections in accordance with wiring diagram.

.12 Energize transformers after installation is complete.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Electrical General Requirements Section.

.2 Indicate on shop drawings.

- .1 Floor anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned positions and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for service entrance board for incorporation into manual specified in the Electrical General Requirements Section.

.2 Submit 5 copies of maintenance data for complete assembly including components.

1.3 MAINTENANCE MATERIALS

.1 Include:

- .1 One can of touch-up paint.

1.4 SOURCE QUALITY CONTROL

.1 Consultant to witness final factory tests if requested.

.2 Notify Consultant in writing 5 days in advance that service entrance board is ready for testing.

.3 Submit 5 copies of certified test results.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service entrance board must conform to CSA C222 No. 31 (latest edition).

.2 Rating: 600V, 3 phase, 4 wire, mains rating as per plan, short circuit current (kA rms symmetrical) as noted on distribution riser.

.3 Cubicles: wall-mounted/free standing, dead front, size as indicated, hinged access panels with captive knurled thumbscrews (front access only), EEMAC2 rating (sprinkler hood).

.4 Main section to contain:

Breakers as noted complete with kA interrupting capacity to match mains.

Barriered section for supply authority metering components.

Digital metering unit as specified.

NOTE: Refer to Moulded Case Circuit Breakers section for specifications regarding the required breakers.

.5 Distribution section to contain breakers as noted complete with kA interrupting capacity to match mains.

NOTE: Refer to Moulded Case Circuit Breakers section for specifications regarding the required breakers.

.6 Bus bars and main connections: aluminum.

.7 Bus bars from load terminals of main device through metering section to distribution section.

.8 Bus bars are to have identified colour coded phases.

2.2 GROUNDING

.1 Aluminum ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for grounding cable. Contractor to size lug.

2.3 POWER SUPPLY AUTHORITY METERING

.1 Separate compartment and rigid metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by power supply authority:

.1 3 current transformers.

2.4 FINISHES

.1 Apply finishes in accordance with the Electrical General Requirements Section.

.1 Service entrance board exterior: grey.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Nameplates:

.1 Black plate, white letters, and size 7.

.2 Complete board labeled: 347/600V.

.3 Main disconnect labeled: Main Breaker

.4 Branch disconnects labeled: as indicated.

2.6 ACCEPTABLE PRODUCTS

.1 Maximum 1200A (up to 65kA bracing and interrupting rating)

- .1 Eaton Cat# CMP Series
- .2 Siemens Cat# SMP
- .3 Schneider Electric Cat# MDS
- .4 ABB Cat# ReliaGear SB CompaXT

.2 Digital Metering Units

- .1 Eaton Cat# IQ 260 (MOD BUS) or Power Xpert 2000 Series (BACnet)
- .2 Siemens Cat# PAC 4200
- .3 Schneider Electric Cat# PM-5563RD
- .4 ABB Cat# RGM 6010

.3 Digital metering units shall be complete with MOD BUS (BACnet) communication module for interface of monitored parameters to BAS. Coordinate output with BAS contractor.

.4 Manufacturer is to include for representative to visit the site to fully commission the meter.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance board and fasten to wall/housekeeping pad.

.2 Connect main secondary service to line terminals of main device.

.3 Connect load terminals of distribution devices to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run grounding conductors from ground bus to building ground to suit the Electrical Safety Code.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

.7 Co-ordinate with local supply authority and board manufacturer for shipment and installation of metering components at board manufacture’s fabrication plant.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panel boards must conform to CSA C22.2 No. 29 (latest edition).

.2 Panelboards: product of one manufacturer.

.3 Install circuit breakers in panelboards before shipment.

.4 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand. **Series rating is acceptable – submit information with shop drawings. Provide lamicoid label on feeder breaker. Lamicoid label to state "Series Rating Breaker." Lamicoid label to be size 2.**

.5 Bus and breakers must be rated for [_____] A (symmetrical) interrupting capacity or as indicated.

.6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.7 Panelboard mains, number of circuits, and number and size of branch circuit breakers as indicated.

.8 Two keys for each panelboard and key panelboards alike.

.9 Aluminum bus with neutral of same ampere rating as mains.

.10 Mains must be suitable for bolt-on breakers. Provide main (if applicable) and branch breakers as bolt-on style.

.11 Trim with concealed front bolts and hinges.

.12 Trim and door finish must be baked grey enamel.

.13 All panels regardless of voltage and amperage must be provided with a lockable door.

.14 Branch circuit panelboards (250 AMP or smaller) must be one of the following:

- .1 Eaton Cat # POW-R-LINE-C PRL-1 or PRL-2
- .2 Schneider Electric Cat # NQ Series for up to 240V or NF Series for up to 600V
- .3 Siemens Cat #Sentron P1 Series
- .4 ABB Cat# ReliaGear RE/RS/RW/RD Lighting Panelboard Series

.15 Power distribution circuit breaker panelboards (400 AMP or larger) must be one of the following:

.1 Eaton CAT# POW-R-Line-C PRL-3A or PRL-4A

.2 Schneider Electric CAT# I-Line Series (Bolt-On)

.3 Siemens

.1 CAT# P2 Series (up to 600A mains and maximum 100A-3P branch breakers)

.2 CAT# S5 Series (up to 1200A mains with branch breakers above 100A-3P)

.4 ABB Cat# ReliaGear neXT

2.2 BREAKERS

.1 Breakers: to Moulded Case Circuit Breakers Section.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker (as specified) must be separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for fire alarm, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Nameplate for each panelboard size 4 engraved description as indicated. In finished areas install label on inside of panel, and in service areas install label on exterior of panel.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved “name of load” as indicated.

.4 Complete circuit directory with typewritten legend showing location of each circuit. **Include a copy of the directories in the maintenance manuals.**

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard. Plywood shall be 21mm (3/4”) fire rated or painted with intumescent fire block paint having a minimum of 1h rating, unless noted otherwise.

.3 Mount panelboards to height specified in Electrical General Requirements Section or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus.

.6 Install series rating lamicoids adjacent to all breakers utilized to achieve series ratings.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded case circuit breakers must conform to CSA C22.1 No.5.1-M91 (latest edition.)

.2 Bolt-on moulded case circuit breaker quick-make, quick-break type, for manual and automatic operation.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Unless otherwise indicated moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.5 Moulded case circuit breakers 250 Amps and above are to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection (if indicated or applicable by the Electrical Safety Code versus the breaker amperage). Unless otherwise specified, complete system selective co-ordination shall be provided by the individually adjustable time/current curve shaping elements as following:

.1 Breakers shall have fixed rating plug determining breaker continuous current rating.

.2 All breakers shall have adjustable long delay pickup and time, L.

.3 All breakers shall have individual adjustments for short delay pickup and time, S; including I2t settings in time adjustment.

.4 Breakers shall have adjustable instantaneous pickup, I; that if required by co-ordination study can be turned off, (I).

.5 If required by Electrical Safety Code breakers shall have individually adjustable ground fault current pick-up and time, G; including I2t settings in time adjustment.

.6 Unless otherwise specified, for the low voltage systems provide an electronic trip unit as specified above for the following moulded case circuit breakers:

.1 Mains or ties in main switchboard: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at the point of installation.

.2 Transformer feeder for the units 225kVA and above: LSI or LS trip unit with fixed instantaneous over-ride, where instantaneous trip setting or instantaneous over-ride allows for transformer inrush of 12xFLA at 0.1s and exceeds maximum value of fault at the transformer secondary.

.3 Feeders exceeding 250A trip setting: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at downstream panelboard.

.4 Branch circuits or feeders for MCCs with fusible combination starters: LSI trip unit where instantaneous trip setting allows for maximum size downstream fuse total clearing time.

2.2 BREAKERS 1200A AND HIGHER

.1 Circuit breakers rated 1200A or higher must be equipped with Arc Flash Reduction Maintenance System (ARMS) in conformance with OESC 2024 2-306(3) to provide reduced arc fault clearing time.

.2 Unless otherwise indicated ARMS mode shall be enabled via integrated breaker mounted switch and indicating light.

.3 Arc Flash Reduction Maintenance System pickup settings shall be based on the project Arc Flash Hazard Reduction study.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated complete with all necessary mounting hardware and filler panels if necessary.

.2 Provie lamicoid labels for series rating breakers. Lamicoid label to state “Series Rating Breaker.” Lamicoid to be size 2.

.3 Provie lamicoid labels for ARMS capable breakers. Lamicoid label to state “Arc Flash Reduction Maintenance System Breaker.” Lamicoid to be size 2.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 SWITCHES

.1 Line Voltage Wall Switches

.1 AC switches must conform to CSA C22.2 No. 111 (latest edition).

.2 AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine molding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Toggle style (Rocker style) (architect to select colour).

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 AC Switches of one manufacturer throughout project.

.5 Provide 2 keys per keyed switch.

.6 Occupancy sensor switches shall be dual technology style (PIR and Ultrasonic) where noted on the drawings.

.7 Acceptable Materials:

.1 Single Pole : Hubbell Cat #HBL1201

.2 Three Way: Hubbell Cat. #HBL1203

.3 Four Way: Hubbell Cat. #HBL1204

.4 Illuminated: Hubbell Cat. #HBL1221IL (light on with load off)

.5 Motor Rated: Hubbell Cat. #HBL1221PL

.6 Single Relay Occupancy Sensor includes:

.1 Legrand Cat. #DW-100

.2 Greengate Cat. #ONW-D-1001

.3 Sensorswitch Cat. #WSXA Series

.7 Dual Relay Occupancy Sensor includes:

.1 Legrand Cat. #DW-200

.2 Greengate Cat. #ONW/VNW-D-1001-DMV-N

.3 Sensorswitch Cat. #WSXA Series

.8 Acceptable toggle switch alternate manufacturers include:

.1 Pass & Seymour

.2 Leviton.

.2 Line Voltage 0-10V Dimming Switches

.1 0-10V Dimmers are to be provided complete with the following features:

.1 Rating of 15A or 20A, 120V or 347V.

.2 0-10V dimming leads

.3 Capable of operation with four switch locations.

.4 DIP switches or local programming through switch buttons to change mode of operation.

.5 Integral on/off switch.

.6 Devices must mount in single gang box or multi-ganged where noted.

.7 Device and faceplate colour must match other wiring devices.

.8 Integral dual technology occupancy sensors (PIR and Ultrasonic).

.2 Acceptable Materials:

.1 0-10V Occupancy Wall Sensor Switch (Decora): Legrand Cat. #DW-311

.2 0-10V Dimming Switch: Leviton Cat. #ZS057 Series

.3 Acceptable alternative manufacturer's include:

.1 Legrand

.2 Leviton

.3 Lutron

.4 Sensor Switch

.5 Greengate

.3 Digital Interval Timer Switches

.1 Where noted supply and install a digital pre-set countdown time switch with the following features:

.1 minimum 1/6 HP rated contacts, mounted in recess single gang outlet box.

.2 Six (6) pre-set time selection buttons with options up to 1 hour.

.3 Unit shall be complete with activation indicator lights.

.4 Unit shall have integral On/Off button.

.5 White finish unless noted otherwise. (final finish selection by Architect).

.2 Acceptable Materials:

.1 Legrand Cat. #RT-50

.3 Acceptable alternative manufacturer's include:

.1 Leviton

.2 Lutron

.3 Hubbell

2.2 RECEPTACLES

.1 Receptacles, plugs, and other similar wiring devices must conform to CSA 22.2 No 42 (latest edition).

.2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features (20A where noted):

- .1 Urea molded housing (Colour by architect).
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials:

- .1 Standard Devices
  - .1 Standard duplex receptacle: Hubbell Cat # HBL5252CN
  - .2 Tamper resistant receptacle: Hubbell Cat # BR15TR
  - .3 Tamper resistant T-slot receptacle: Hubbell Cat. #BR20TR
  - .4 Automatically Controlled Receptacles (Green): Hubbell Cat. # BR15C1GNTR (Green)
- .2 Above 20A
  - .1 Dryer receptacle: Hubbell Cat # HBL9430A
  - .2 Range receptacle: Hubbell Cat # HBL9450A
- .3 Decora Style Devices
  - .1 Ground fault protected T-slot receptacles: Hubbell Cat. # GF20L A
- .4 Tamper resistant
  - .1 Tamper resistant ground fault protected receptacle: Hubbell Cat. #GFTR15
  - .2 Tamper resistant ground fault protected T-slot receptacle: Hubbell Cat. #GFTR20

.6 Acceptable alternate manufacturers include:

- .1 Pass & Seymour
- .2 Leviton

2.3 COVER PLATES

.1 Cover plates from one manufacturer throughout project.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, brushed, 1 mm (1/32") thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof cover plates complete with gaskets and “heavy-duty in use” covers in conformance with the Electrical Safety Authority. Provide product equal to Intermatic Cat. #WP5100C.

.6 Where noted on plans for exterior weatherproof GFCI receptacles at grade, provide extra-duty single gang horizontal die cast receptacle covers. NEMA 3R rated complete with lockable hasp and reinforced hinge. Suitable for use with 12-gauge cord sets. Intermatic Cat. # WP1010HMXD or equal.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Electrical General Requirements Section or as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Electrical General Requirements Section or as indicated.

.3 Where split receptacle has one portion switched mount vertically and switch upper portion.

.3 Occupancy sensors:

.1 Occupancy sensors shall be set to 5 minutes “delay to off” unless otherwise noted.

.4 Occupancy sensors and dimmers:

.1 Switches with occupancy sensors and dimmers shall be programmed as follows:

.1 5 minutes “delay to off” unless otherwise noted.

.2 “Auto on” to 50% dimming level.

.5 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.6 Dimmer:

.1 Dimming Switches

.1 Mount devices at height as specified in Electrical General Requirements Section.

.2 Install in upright position as per manufacturer's installation instructions.

.3 Provide class II 0-10V control wiring from 0-10V dimming switch to each fixture driver in 21mmC.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.248.12/94, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

.2 CSA C22.2 No. 106-M92 (latest edition).

1.2 MAINTENANCE MATERIAL

.1 Three spare fuses of each type and size installed.

1.3 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Store fuses in original containers in moisture free location.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.

.2 Fuses specified below must conform to CSA C22.2 No. 106 (latest edition). Fuses conforming to standard C22.2 No. 106-1953 will be rejected.

.3 Fuses must provide a fully co-ordinated system for both overload and fault conditions.

2.2 FUSE TYPES

.1 Class J fuses (formerly HRCI- J).

.1 Time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Fast acting as noted.

2.3 ACCEPTABLE PRODUCTS

.1 Motor Protection:

1-600 A: Mersen Type AJT

.2 Other acceptable manufacturers:

.1 GEC

.2 Little Fuse

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Enclosed manual air break switches must conform to CSA C22.1 No.4 (latest edition).

.2 Fuseholder assemblies must conform to CSA C22.2 No.39 (latest edition).

.3 Fusible, and/or non-fusible, horsepower rated disconnect switches, size as indicated.

.4 Provision for padlocking in off switch position by three locks.

.5 Mechanically interlocked door to prevent opening when handle in ON position.

.6 Fuses: size as indicated, to Fuses - Low Voltage Section.

.7 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.

.8 Quick-make, quick-break action.

.9 ON-OFF switch position indication on switch enclosure cover.

.10 Disconnects feeding elevator controllers must be equipped with two auxiliary contacts approved by the elevator supplier.

.11 Service entrance rated with fault bracing, fusing and barrier as required.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Indicate name of load controlled on size 4 nameplate.

2.3 ACCEPTABLE MANUFACTURERS

Manufacturer	General Purpose	Weather Proof
Eaton	IHD Series	3HD Series
Schneider Electric	Type A Series	Type R Series
Siemens	ID Series	NFR/FR Series
ABB	TG Series	TH Series

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

.2 Connect auxiliary contacts to elevator controller using conduit, wire and route approved by the elevator supplier.

.3 Disconnect switches mounted on mechanical rooftop equipment shall be installed minimum 750 mm (30") above finished roof to be protected against damage and weather (snow build up).

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Electrical General Requirements Section.

.2 Indicate:

- .1 Mounting method and dimensions.
- .2 Starter/contactor size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

1.2 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Electrical General Requirements Section.

.2 Include operation and maintenance data for each type and style of starter/contactor.

1.3 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Electrical General Requirements Section.

.2 Provide listed spare parts for each different size and type of starter:

- .1 1 operating coil.
- .2 3 fuses.
- .3 10% indicating lamp bulbs used.

Part 2 Products

2.1 MATERIALS

.1 Starters: must conform to CSAC22.2 No. 14 (latest edition) and EEMAC E14-1.

.2 Control transformers must conform to CSAC22.2 No. 66 (latest edition).

.3 Auto-transformers must conform to CSAC22.2 No 47 (latest edition).

.4 Contactors must conform to CSA C22.2 No. 14 (latest edition).

.5 Half size starters will not be accepted. NEMA and IEC rated starters are acceptable.

2.2 MANUAL MOTOR STARTERS

.1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One or Three overload heaters, manual reset, trip indicating handle.

.3 Toggle switch: standard duty labeled “on”/“off”.

.4 Indicating light: standard duty type and red colour.

.5 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Pushbuttons Selector switches standard duty labeled as indicated.

.2 Indicating lights: standard duty type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 1 red pilot light for “stop” or “off” and 1 green light for “start” or “on”.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and secondary voltage to suit remote control device, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 CONTACTORS

.1 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled.

.2 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.3 Mount in CSA Enclosure 1 unless otherwise indicated.

.4 Include following options in cover:

.1 Red indicating lamp.

.2 Hand - Off - Auto selector switch.

.5 Control transformer: mounted in contactor enclosure.

.6 Contactors must be definite purpose.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Electrical General Requirements Section.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Manual starter designation label: black plate, white letters, size 1, engraved as indicated.

.3 Magnetic starter designation label: black plate, white letters, size 2, engraved as indicated.

.4 Contactor designation label:

black plate, white letters, size 4, indicating name of load controlled.

2.8 ACCEPTABLE MANUFACTURERS

.1 The acceptable manufacturers are as follows:

.1 Allen Bradley

.2 Eaton

.3 Siemens

.4 Group Schneider

.5 Klockner Moeller

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41- 1991, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM F1137- 88 (1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.3 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.4 IESNA LM-79-08, IES Electrical Method for the Electrical and Photometric Measurements of Solid State Lighting Products.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Electrical General Requirements Section for all light fixtures supplied under this contract.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Consultant.

.3 Photometric data to include: VCP Table spacing criterion.

1.3 SCOPE

.1 This contractor is responsible to supply and install all lighting fixtures as scheduled and/or indicated including lamp and those accessories required for a complete lighting system. This contractor must coordinate lighting installations with all other Divisions of this project.

.2 All fixtures must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.

1.4 GUARANTEE

.1 Guarantees for materials replacement shall be as follows from date of ready for takeover.

.1 LED lamps: 3 months

.2 LED fixtures, and driver: 5 years.

.2 The labour required to replace these ballasts, lamps or drivers must be included in the above guarantee, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

Part 2 Products

2.1 FIXTURE CONSTRUCTION

.1 Fixtures must be constructed of 20 gauge (minimum) cold rolled steel. All metal edges require smooth finish.

.2 Light leaks must be prevented by providing gasketting, stops, and barriers.

.3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.

.4 All fixtures operating on 347 Volts must be provided with an integral disconnecting means.

2.2 FIXTURE LENS

.1 Unless otherwise noted fixture lenses shall be as follows:

.1 Lens thickness: 3.2 mm (1/8")

.2 Material: injection moulded clear prismatic virgin acrylic

.3 Frame: hinged, latched, steel.

2.3 LED FIXTURES

.1 Fixture LEDs must be tested in conformance with IESNA LM80 standard.

.2 LEDs must be selected using a binning algorithm to ensure colour and lumen output of a given fixture are consistent, as well as meet or surpass ANSI C78.377 specification for the rated lifetime of the fixture. Colour accuracy between products must be within a 2-step MacAdam ellipse.

.3 Luminaires must be tested to IESNA LM79 by an independent approved laboratory.

.4 Luminaires must be tested prior to shipping.

.5 Luminaires must be ULC certified and approved for use in Canada.

.6 Fixtures must maintain a minimum of 90% of their initial light output for 60,000 hours. Submit test results upon request.

.7 Lumen values indicated for fixtures in the project documents are to be considered as “absolute” or “delivered” values.

.8 Other than for specialty fixtures, and unless otherwise indicated, the maximum driver current is to be 750 mA.

2.4 STANDARD EXIT LIGHTING UNITS

.1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).

.2 Housing: extruded aluminum housing, white finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: 2W LED.

.5 Operation: 25 year.

.6 Units are to be provided with three (3) pictogram legends indicating “left from here”, “straight from here”, and “right from here”.

.7 Face plate to remain captive for relamping.

2.5 SELF-POWERED COMBINATION EXIT/EMERGENCY LIGHTING UNITS

.1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).

.2 Housing: Extruded aluminum housing. White Finish.

.3 Face and back plates: Extruded aluminum.

.4 Lamps 2W LED (EXIT).

.5 Operation: 25 year life.

.6 Units are to be provided with three (3) pictogram legends indicating “left from here”, “straight from here”, and “right from here”.

.7 Face plate to remain captive for relamping.

.8 Supply voltage: As noted on drawings.

.9 Output voltage: 12 V DC.

.10 Battery: Sealed maintenance free 10 year life.

Note: Battery must be capable of supplying the wattage indicated for a minimum of 30 minutes.

.11 Charger: Solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.

.12 Solid state transfer circuit.

.13 Signal lights: “AC Power On” condition and “charging” condition.

.14 Lamp heads: Integral on unit, 345º horizontal and 180º vertical adjustment. Lamp type: minimum 4 watt LED.

.15 Mounting: Suitable for universal mounting directly on junction box and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.16 Cabinet: finish: White.

.17 Auxiliary equipment:

.1 Test switch.

2.6 EMERGENCY LIGHTING UNITS

.1 Emergency lighting units must conform to CSA C22.2 No 141 (latest edition).

.2 Supply voltage: As noted on drawings.

.3 Output voltage: 12 V DC.

.4 Battery: Sealed, maintenance free, 10 year life.

Note: Battery units must be capable of supplying the wattage indicated for a minimum of 30 minutes.

.5 Charger: Solid state, multi rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.6 Solid state transfer circuit.

.7 Low voltage disconnect: Solid state, modular, operates at 80% battery output voltage.

.8 Signal lights: “AC Power ON” condition and “charging” condition.

.9 Lamp heads: Integral on unit, 345º horizontal and 180º vertical adjustment. Lamp type: minimum 4 watt LED.

.10 Cabinet suitable for direct of shelf mounting to wall and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.11 Auxiliary equipment:

.1 Test switch.

.2 Ac input and DC output terminal blocks inside cabinet.

.3 Shelf.

.4 Cord and plug connection for AC. **(Not applicable on 347 V units)**.

2.7 REMOTE EMERGENCY LIGHTING FIXTURES

.1 Remote emergency lighting fixtures must conform to CSA C22.2 No141 (latest edition).

.2 Fixtures shall be small “micro” size or recessed style as indicated in the Light Fixture Schedule.

.3 Fixtures must be adjustable type heads with canopy.

.4 Fixtures are to be provided with protective lexan cube when specified in the Light Fixture Schedule.

.5 Unless otherwise indicated surface mounted fixtures in washrooms, locker rooms, changerooms, and gymnasiums must be provided with wire guard.

2.8 ACCEPTABLE LIGHTING MANUFACTURERS

.1 Refer to the light fixture schedule as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated. Luminaires are not to be supported from the roof deck. Provide additional unistrut support channel and/or support from structure. Co-ordinate with consultant on site.

.2 Ball align hangers must be provided for rod suspended fixtures.

.3 Fixtures surface mounted to suspended ceilings must be secured through ceiling assembly to cross member supports. These supports are to be steel channels or angles independently secured **to structure** using # 12 “jack” chain. Each chain must be secured so no fixture weight is added to the ceiling assembly.

.4 Plaster frames/flange kits must be provided by this Division for fixtures recessed in plaster and/or drywall ceilings.

.5 Where specified, fixtures to be chain hung shall be hung using “jack” chain with a capacity to suit the fixture weight. Branch circuit wiring feeding these fixtures shall be AC90 cable “ty-wrapped” at 900 mm (36") intervals along length of drop. Final appearance must be neat and professional.

.6 Install exit lighting units with illuminated faces and chevrons/arrows indicating path(s) of exit as indicated. Unless otherwise noted install exit fixtures at 2400 mm (8'-0") above finished floor.

.7 Install emergency lighting units and associated remote mounted fixtures as indicated.

.8 Direct “heads” on units and remote mounted fixtures to illuminate path(s) of exit.

.9 Install emergency lighting units and remote fixtures at 300 mm (12") below finished ceiling, unless indicated otherwise.

.10 Provide a 15 A 120 V duplex receptacle (connected to circuit indicated) adjacent to unit. **Not applicable on 347 V units. This receptacle connection is to be no lower than 8'-0" (2400 mm) AFF.**

.11 Special installation: Secure fixtures to structure to conform to the Electrical Safety Code using “jack chain” NOT ceiling suspension wire. Where coreslab is used, suspension point must be independent of the one used for suspension of the ceiling assembly. As an alternate to jack chain the contractor may use a pre-manufactured aircraft cable suspension and fastening system as manufactured by Gripple (Gripple Cat. #HF02-10F2). Provide minimum 2 per fixture.

.12 All battery units are to be provided with a visible lamicoid label indicating the unit number as per drawings.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

.2 Connect exit fixtures to exit lighting circuits and unit equipment (if applicable).

.3 Connect unit equipment to circuits as indicated.

.4 All wiring of remote emergency fixtures shall be minimum #10 T90 for each circuit and run in conduit. Wiring must be sized in conformance with manufacturer’s recommendations for distances required.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 DELIVERIES

.1 Fixtures are to be completely assembled at the manufacturer’s plant and delivered to the project site in original unitized containers. Ensure that a dry, protected and secure space is available for proper storage before scheduling delivery of fixtures.

3.5 TESTING/CERTIFICATION

.1 At the completion of the project and in the presence of the consultant, test all exit and emergency fixtures. On company letterhead, the contractor is to prepare a chart indicating:

.1 Project

.2 Date

.3 Equipment type

.4 Certification of correct connection

.5 Certification of correct operation

.6 Duration of test in minutes (minimum 30)

.7 Actual period of testing (time of day)

3.6 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 This electrical contractor shall participate in integrated testing of this life safety system in conformance with Electrical General Requirements. Include all associated costs in tender.

3.7 ADDITIONAL INSTALLED EXIT SIGNS

.1 The electrical contractor is to include in their bid the cost to add four (4) additional standard exit lighting units to be installed and tested in locations as directed by the consultant. Note: This installation and test will be occurring after the initial testing/certification testing is complete.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes a networked lighting control system comprised of the following components:

- .1 Wired Networked Devices
  - .1 Wall Stations
  - .2 Occupancy and Photocell Sensors
  - .3 Wall Switch Sensors
  - .4 Embedded Sensors
  - .5 Power Packs and Secondary Packs
  - .6 Bluetooth® Low Energy Programming Device

.2 The networked lighting control system shall meet all the characteristics and performance requirements specified herein.

.3 The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

.4 All equipment must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.

.5 Reference section 26 51 13 for Lighting information.

.6 Reference section 26 27 26 Wiring Devices for wall mounted sensor switches.

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 01 16.

.2 Submit composite wiring diagrams and control schedule for each room control circuit type as proposed to be installed. Include load type, sequence of operation, sensor parameters, time delays, sensitivities and daylighting set points.

.3 Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.3 QUALITY ASSURANCE

.1 Product Qualifications

- .1 System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
- .2 System luminaires and controls shall be certified by the manufacturer to have been designed, manufactured, and tested for interoperability.

.2 Installation and Startup Qualifications

.1 System startup shall be performed by qualified personnel approved or certified by the manufacturer.

.3 Service and Support Requirements

.1 Phone Support: Toll-free technical support shall be available. The manufacturer shall provide an online tool to schedule a technical support appointment. Manufacturer shall provide 24/7 emergency support.

.2 Remote Support: The manufacturer shall offer remote support capability and the ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects. Cellular connectivity to a networked lighting control systems shall be optionally available to provide remote support within the continental United States.

.3 Onsite Support: The manufacturer shall offer onsite support that is billable.

1.4 WARRANTY

.1 The manufacturer shall provide a minimum five (5) year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.

.2 The hardware warranty shall cover repair or replacement of any defective products within the warranty period.

Part 2 Equipment

2.1 MANUFACTURERS

.1 Basis of design product: nLight Controls system. Acceptable equals are subject to compliance and prior approval with specified requirements of this section, as one of the following:

.2 Cooper Controls (Wavelinx CAT wired).

2.2 SYSTEM PERFORMANCE REQUIREMENTS

.1 System Architecture

.1 System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.

.2 Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

.3 System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).

.4 Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

.5 Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”

.1 Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.

.6 Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.

.7 Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time-based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.

.8 The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.

.9 All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

.10 System shall be capable of reporting lighting system events and performance data to management software for display and analysis.

.2 Wired Networked Control Zone Characteristics

.1 Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.

.2 Devices in an area shall be connected via a “daisy-chain” topology. “Hub-and-spoke” topology, requiring all individual networked devices to be connected back to a central component, shall not be permitted, so as to reduce the total amount of network cable required for each control zone.

.3 System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware to reduce the opportunity for improper wiring and communication errors during system installation.

.4 Following proper installation and provision of power, all networked devices connected with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).

.1 The “out of box” default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

.5 Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.

.6 All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

.7 Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:

.1 Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.

.2 UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power. Integrated testing shall be performed on these emergency Relay Packs.

.8 Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.

.9 Wired networked Wall stations shall provide the follow Scene Control Capabilities:

.1 Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.

.2 Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.

.1 Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours.

.2 Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

.3 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” preset scene and profile scene control.

.3 Supported Sequence of Operations

.1 Control Zones

.1 Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.

.2 Networked luminaires and intelligent lighting control devices shall include the ability to track occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.

.2 Wall Station Capabilities

.1 Wall stations shall be provided to support the following capabilities:

.1 On/Off of a local control zone.

.2 Continuous dimming control of light level of a local control zone.

.2 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support “multi-way” switching and/or dimming control.

.3 Occupancy Sensing Capabilities

.1 Occupancy sensors shall be configurable to control a local zone.

.2 Multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.

.3 System shall support the following types of occupancy sensing sequence of operations:

.1 On/Off Occupancy Sensing

.2 Partial-On Occupancy Sensing

.3 Partial-Off Occupancy Sensing

.4 On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:

.1 Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.

.2 Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.

.3 To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.

.4 Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities.*

.5 The use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

.5 To accommodate diverse types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.

.4 Photocell Sensing Capabilities (Automatic Daylight Sensing)

.1 Photocell sensing devices shall be configurable to control a local zone.

.2 The system shall support the following type of photocell-based control:

.1 Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

.5 Schedule Capabilities

.1 System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.

.2 System shall support blink warning and timed extension capabilities.

.1 The system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule.

.2 Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional period of time.

.1 Timed override/extension duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.

.6 System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.3 SYSTEM CABLING REQUIREMENTS

.1 Provision of all conduit and cabling for all Lighting Control Systems shall be by this electrical contractor.

.2 Controls devices are to be installed, cabled, and connected by this electrical contractor.

.3 Electrical design drawing lighting control schematics are generic and meant to show intent of controls approach. Contact lighting control system manufacturer rep for lighting control system schematics, wiring diagrams, controls risers, sensor layouts, etc. and installation instructions prior to bid.

.4 All devices have RJ-45 female ports. Making network control cables on site is required.

.5 Cabling for system shall be Category 5e as per manufacturer’s recommendations.

.1 Cable shall be 4 pair, 24 AWG solid bare annealed copper conductors, ANSI/TIA/EIA-568-B.2 and ISO/IEC 11801 category 5e compliant.

.2 The jacket shall be printed with TRU-Mark™ 1000’ to 0’ marking system, CMP (FT-6) rated with outer sheath colour for each level in the system to be according to advisement by school board representative

.3 Shall be suitable for use indoor, riser or plenum, and horizontal applications.

2.4 WIRED NETWORKED DEVICES

.1 Wired Networked Wall Switches, Dimmers, Scene Controllers

.1 Product Series: nPODM, nPODM xS, nPODM xL, nPODMA, nPODMA xS, nPODMA xL.

.2 Devices shall recess into single-gang switch box and fit a standard GFI opening.

.3 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.4 All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.5 Devices with mechanical pushbuttons shall provide tactile and LED user feedback.

.6 Devices with mechanical pushbuttons shall be made available with custom button labeling.

.7 Wall switches & dimmers shall support the following device options:

.1 Number of control zones: 1, 2 or 4

.2 Control Types Supported:

.1 On/Off

.2 On/Off/Dimming

.3 On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types

.3 Colors: Ivory, White, Light Almond, Gray, Black, Red

.8 Scene controllers shall support the following device options:

.1 Number of scenes: 1, 2 or 4

.2 Control Types Supported:

.1 On/Off

.2 On/Off/Dimming

.3 Preset Level Scene Type

.4 On/Off/Dimming/Preset Level for Correlated Color Temperature

.5 Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

.6 Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

.3 Colours: Ivory, White, Light Almond, Gray, Black, Red.

.2 Wired Networked Occupancy and Photosensors

.1 Product Series: nCM, nCMB, nRM, nWV, nHW

.2 Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

.3 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

.4 For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.

.5 Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

.6 All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

.7 System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.

.8 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.9 All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.10 Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.

.11 Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).

.12 Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.

.13 Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.

.14 Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

.15 Photosensor and dimming sensor's set-point and dead band shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered and/or modified.

.16 Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

.17 A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an "offset" from the primary zone.

.3 Wired Networked Wall Switch Sensors

.1 Product Series: nWSX LV, nWSXA LV

.2 Devices shall recess into single-gang switch box and fit a standard GFI opening.

.3 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.4 All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.5 Devices with mechanical push-buttons shall provide tactile user feedback.

.6 Wall switch sensors shall support the following device options:

.1 User Input Control Types Supported: On/Off or On/Off/Dimming

.2 Occupancy Sensing Technology: PIR only or Dual Tech acoustic

.3 Daylight Sensing Option: Inhibit Photosensor

.4 Colours: Ivory, White, Light Almond, Gray, Black, Red

.4 Wired Networked Embedded Sensors

.1 Product Series: nES

.2 Network system shall have embedded sensors consisting of occupancy sensors and/or dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.

.3 Occupancy sensor detection pattern shall be suitable for 7.5' to 20' mounting heights.

.4 Embedded sensors shall support the following device options:

.1 Occupancy Sensing technology: PIR only or Dual Tech acoustic

.2 Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor

.5 Wired Networked Relay Packs and Relay Packs

.1 Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P-LVR, nSHADE, nAR40, nEPS-60, nPS-80

.2 Relay Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.

.3 Relay Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.

.4 Secondary Relay Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.

.5 Power Supplies shall provide system power only, but are not required to switch line voltage circuit.

.6 Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).

.7 Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.

.8 Relay Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.

.9 Relay Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

.10 When required by local code, Relay Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

.11 Relay/Secondary Relay Packs shall be available with the following options:

.1 Relay Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.

.2 Secondary Relay Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.

.3 Relay and Secondary Relay Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.

.4 Secondary Relay Pack capable of full 16-Amp switching of all normal power lighting load types.

.5 Secondary Relay Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).

.6 Secondary Relay Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.

.7 Secondary Relay Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.

.8 Secondary Relay Pack capable of louver/damper motor control for skylights.

.9 Secondary Relay Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.

.10 Secondary Relay Pack capable of switching 1 Amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).

.11 Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

Part 3 Execution

3.1 INSTALLATION REQUIREMENTS

.1 Installation Procedures and Verification

.1 The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.

.2 The successful bidder shall install and connect the lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.

.3 The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:

.1 Wire Map (continuity, pin termination, shorts and open connections, etc.)

.2 Length

.3 Insertion Loss

.2 Coordination with Owner's IT Network Infrastructure

.1 The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.

.1 The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.

.2 The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

.3 Documentation and Deliverables

.1 The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.

.1 As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.

.2 As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.

.1 CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:

.1 Title block

.2 Text - Inclusive of room names and numbers, fixture tags and drawings notes

.3 Fixture wiring and homeruns

.4 Control devices

.5 Hatching of light fixtures or architectural elements

.2 CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

.2 Installation

.1 Install Relay Packs in accessible maintenance areas unless noted otherwise. Provide access doors if Relay Packs are installed above drywall ceilings.

.2 Install sensors in areas of high ceilings at height per manufacturer's recommendations unless noted otherwise.

.3 Provide wire guards for sensors in gymnasiums and other high abuse areas.

3.2 SYSTEM STARTUP

.1 Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.

.1 For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.

.2 System start-up and programming shall include:

.1 Verifying operational communication to all system devices.

.2 Programming the network devices into functional control zones to meet the required sequence of operation.

.3 Programming and verifying all sequence of operations.

.3 Manufacturer shall be capable of on-site or remote startup and programming.

.4 Lighting controls Manufacturer to include for the following visits to site:

.1 Pre-wiring visit.

.2 System setup and BAS integration visit.

.3 ASHRAE functional testing coordination visit.

.4 System startup and programming (commissioning) visit.

.5 Functional testing and documentation of the lighting control system shall be in accordance with the requirements of Ontario Building Code Supplemental Bulletin SB-10 and ASHRAE 90.1 (latest adopted version).

3.3 PROJECT TURNOVER

.1 System Documentation

.1 Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.

.2 Installing contractor to grant access to the owner for the programming database, if requested.

.2 Owner Training

.1 Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/ULC-S524 (latest edition), Installation of Fire Alarm Systems.

.2 ULC-S525 (latest edition), Audible Signal Appliances for Fire Alarm Systems.

.3 CAN/ULC-S526 (latest edition), Visual Signal Appliances, Fire Alarm.

.4 CAN/ULC-S527 (latest edition), Control Units, Fire Alarm.

.5 CAN/ULC-S528 (latest edition), Manual Pull Stations.

.6 CAN/ULC-S529 (latest edition), Smoke Detectors.

.7 CAN/ULC-S530 (latest edition), Heat Actuated Fire Detectors, Fire Alarm.

.8 CAN/ULC-S531 (latest edition), Smoke Alarms.

.9 CAN/ULC-S536 (latest edition), Inspection and Testing of Fire Alarm Systems.

.10 CAN/ULC-S537 (latest edition), Verification of Fire Alarm Systems.

.11 CAN/ULC-S552 (latest edition), Inspection, Testing and Maintenance of Smoke Alarms.

.12 CAN/ULC-S553 (latest edition), Installation of Smoke Alarms.

.13 OBC-2024, Ontario Building Code Compendium.

1.2 DESCRIPTION OF SYSTEM

.1 System includes:

.1 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.

.2 Trouble signal devices.

.3 Power supply facilities.

.4 Addressable manual alarm stations.

.5 Addressable and conventional automatic alarm initiating devices.

.6 Audible and visual signal devices.

.7 End-of-line devices.

.8 Annunciators.

.9 Ancillary devices.

.10 Interface and zone modules.

.11 Remote trouble indicator.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 This system is subject to review by local building department officials, local fire department officials. **Therefore, submission of verification certificate and field technician device verification sheets is required prior to inspection by these officials. Schedule accordingly.**

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Electrical General Requirements Section.

.2 Include:

.1 Layout of equipment.

.2 Zoning.

.3 Complete wiring diagram.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Electrical General Requirements Section.

.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

.4 List of recommended spare parts for system.

1.6 MAINTENANCE MATERIALS

.1 Include:

.1 10% spare glass rods for total number of manual pull box stations if applicable.

1.7 TRAINING

.1 Arrange and pay for on-site demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system. **Obtain written receipt of training session and include in maintenance manual.**

1.8 SYSTEM OPERATION

.1 The system shall be configured for single stage operation as outlined on the design drawings. Refer to Fire Alarm Sequence of Operation for specific fire alarm sequence functions which generally include the following:

.1 Activation of audible and visual signal devices.

.2 Cause alarm and supervisory zone of alarm device to be indicated on control panel and remote annunciator(s).

.3 Cause system trouble indications.

.4 Activate auxiliary functions.

.5 Transmit signal to fire department via monitoring station.

.6 Log the alarm in the historical alarm log file.

.7 System silence parameters.

.8 System reset parameters.

1.9 PERFORMANCE CRITERIA

.1 These specifications describe the minimum functional requirements for an electronically supervised, microprocessor based, fully integrated system. The initial installation shall include all the necessary electronic hardware, software and memory for a completely operable system in accordance with these specifications.

1.10 QUALITY ASSURANCE

.1 Each and all items of the fire alarm system shall be listed as the products of a single manufacturer under the appropriate category by the Underwriter's Laboratories of Canada and shall bear the "U.L.C." label.

.2 Each and all items of the fire alarm system shall be covered by a one year parts and labour warranty covering defects resulting from faulty workmanship and materials. The warranty shall be deemed to begin on the date the system is accepted by the Project Manager on issuance of the substantial performance certificate for the project.

.3 All control equipment must have Transient Protection Devices to comply with U.L.C. requirements.

Part 2 Products

2.1 GENERAL

.1 The fire alarm system shall be an addressable, single stage, zoned, non-coded, indicating, fully integrated fire alarm.

.2 The fire alarm control panel shall allow for loading or editing of special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate expansion, and changes required by local codes. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

.3 The ability to selectively program input/output control functions based on ANDing, ORing, NOTing, Timing and Special Coded Operations is also to be incorporated in the resident software programming of the system.

.4 The system shall have the ability to manually disable and enable any device/circuit individually for maintenance or testing purposes.

.5 It shall be possible to reprogram selected or all smoke detector initiating zones for alarm verification.

.6 It shall be possible to program an adjustable time delay circuit for each waterflow initiating circuit to prevent false alarms that may be caused by erroneous pressure surges in the sprinkler system.

.7 All on site programming changes to the fire alarm system shall be password protected.

.8 Wiring to any remote annunciator shall be supervised for open and ground conditions. A separate annunciator trouble indicator must be provided at the control panel, which shall illuminate and an audible trouble signal shall sound at the control panel upon the detection of an open or ground condition.

.9 All Control Panels and Remote Annunciator Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable. The green coloured grounding loop shall be a minimum #14 AWG insulated copper conductor run in conduit. The ground loop shall be connected to building water supply to the line side of the water meter. Ground wire must not be run in the same conduit as the Fire Alarm wiring.

2.2 POWER REQUIREMENTS

.1 The control panels shall receive 120 VAC power via a dedicated overcurrent protected circuit. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel and the remote annunciator. A green `Power On' LED shall be displayed continuously while incoming power is present.

.2 Control Panel output power supply shall have the following operating characteristics:

.1 Rated for five Amps continuous duty

.2 24 VDC filtered and regulated

.3 Power limited with a range of 20.4 VDC to 32 VDC.

.4 Automatic "Brownout" transfer to standby batteries when supply voltage falls to 102 VAC

.3 Standby power for the system shall be produced by dual-sealed, lead acid, gelled cell batteries, series connected with sufficient Amp. Hour capacity to operate the system under supervisory conditions with AC power disconnected for 24 hours and at the end of this period operate the alarm devices for thirty consecutive minutes. The batteries shall be dual-sealed, maintenance free type.

.4 The system batteries shall be supervised so that a low battery condition or disconnection of the batteries shall be audibly and visually annunciated at the control panel.

.5 Battery charger shall have the following operating characteristics:

.1 Ability to charge a range up to 33 AH to 70% of their capacity within 12 hours.

.2 Compatible with either lead acid or nicad batteries.

.6 All circuits requiring system operating power shall be individually fused at the control panel.

.7 The system shall be modular in design to allow future expansion with a minimum of hardware additions and system interruptions.

2.3 FIRE ALARM CONTROL PANEL

.1 The fire alarm control panel construction shall be modular in design with solid state microprocessor based electronics. An 80 character Liquid Crystal Display shall indicate alarms, supervisory service conditions and any troubles. The panel shall include but not be limited to the following:

.1 80 character LCD display

.2 Local Energy, Shunt Master Box, or Reverse Polarity Remote Station Connection

.3 Form C Trouble Contact

.4 Earth Ground Supervision Circuit

.5 Basic 8 A power supply

.6 Automatic Battery Charger

.7 Standby Batteries

.8 Resident non-volatile programmable operating system memory for all operating requirements.

.9 Five Programmable Multi-Function keys with status LED's

.10 Red Alarm LED and Acknowledge Button

.11 Yellow Supervisory Service LED and Acknowledge Button

.12 Yellow Trouble LED and Acknowledge Button

.13 Green Power on LED

.14 Alarm/Signal Silence Button

.15 System Reset Button

.16 Operator Interface Keypad for Manual Control and System Information Access

.17 Addressable Interface Control Card

.18 Supervised Annunciator Circuit

.2 The control Panel shall be capable of chronologically logging and storing 300 events in an alarm log and 300 events in a trouble log. The historical logs shall be stored in the CPU's memory and shall be protected by a lithium battery that is supervised for a low battery condition. Each recorded event shall include the time and date of that event's occurrence. The alarm log file must be separate from the trouble log file. It shall be possible for the user to generate a report of both logs upon request.

.3 All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.

.4 Signal Circuits shall be independently supervised and fused such that a fault on one circuit shall not affect the operation of any of the other circuits. All signal circuits shall be configured as follows:

.1 Class “B” wiring, current limited.

.2 Rated at two Amps of continuous power.

.3 Capable of powering polarised 24 VDC audible and visual signalling appliances.

.5 Provide dry contact auxiliary control circuits as follows:

.1 Central Station alarm output.

.2 Central Station trouble output.

.3 SPDT Form C relays fused at 2 A @ 24 VDC.

.6 System Expansion Modules connected by ribbon cables shall be supervised for module placement. Should a module become disconnected the system trouble indicator must illuminate and audible trouble signal must sound.

.7 The Fire Alarm Control Panel shall be capable of supporting RS-232-C I/O ports. CPU data output to the I/O ports shall be in a parallel ASCII format at field adjustable baud rates of 220, 300, 1200, 2400 and 4800.

.8 A walk test feature must be provided.

.9 All system controls shall be housed in a surface wall mounted steel cabinets. Finish shall be according to the manufacturer's standards.

.10 All modules shall be secured behind hinged locked door with a full viewing tempered plastic window. The hinged locked doors shall give access to all the operating controls but shall not expose live connections.

.11 All internal wiring, control circuits, connections and terminals shall only be accessible behind a removable metal retainer plate.

.12 All Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable.

.13 The system must provide communication with addressable initiating devices. All of these devices will be annunciated on the control panel's main LCD display. Annunciation shall include the following conditions for each point:

.1 40 Character Zone/Device Location

.2 Type of Device

.3 Detector Status (Normal/Alarm/Trouble)

.4 Device Missing/Failed

.14 The communication format must be a completely digital poll/response protocol to allow tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

.15 Each addressable device must be uniquely identified by an address code entered on each device base at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.

.16 It shall be possible for the owner's representative to change a smoke detector without any special tools or programming.

.17 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions. Systems, which cannot support 100% of their point capacity in alarm simultaneously, cannot assure appropriate system response and are not acceptable.

.18 **The appropriate quantity of isolator modules shall be installed so that a wiring fault (short, open or ground) within one floor area shall not prevent the normal operation of other addressable devices on other floor areas.**

.19 The system shall maintain the sensitivity level set, for each sensor, over time by automatically compensating for environmental factors such as dust and dirt accumulations in a smoke sensor's chamber. The smoke sensor shall be a smoke density measuring device having no self-contained set-point. **The control panel shall determine the alarm decision for each sensor.**

.20 The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value a `Dirty Sensor' trouble condition shall be audibly and visually indicated at the control panel for the individual sensor.

.21 All data transmissions, **including the analogue value**, between the smoke sensors and the control panel shall be digitally transmitted and incorporate parity and checksum digital data checks of each transmission.

.22 An operator from the control panel, having a proper access level, shall have the ability to:

.1 Manually access and print the following information for each sensor in a report format that can be easily understood by the user:

.1 Primary Status

.2 Device Type

.3 Present Average Value

.4 Present Sensitivity Selected

.5 Highest Peak Detection Values

.6 Sensor Chamber Status (Normal, Almost Dirty, Dirty, Excessively Dirty)

.2 Manually control the following of each sensor:

.1 Clear Peak Detection Values

.2 Enable or Disable the Point

.3 Clear Verification Tally

.4 Control a Sensor's Relay Driver Output

.23 It shall be possible to program the control panel to **automatically** change the sensitivity settings of each sensor based on **time-of-day** and **day-of-week**.

2.4 ADDRESSABLE MANUAL ALARM STATIONS

.1 Manual alarm stations shall be addressable, single action, non-coded, semi-flush mounted type. Pull stations shall be break-glass style. Contacts are to activate when the handle is pulled down.

.2 Addressable pull station electronics shall be mounted to the back plate of the station. The station's address will be set at the time of installation. Device addressing shall be accomplished by either an electrical or mechanical means.

.3 Where noted on drawings, stations are to be equipped with tamperproof guard equal to Stopper II Cat. # STI-1100.

2.5 INTELLIGENT DETECTORS-GENERAL OPERATION

.1 Addressable devices shall use simple to install and maintain decade, numbered 0 to 9, address switches. Detectors that have expanded addressing will have decade switch numbered from 0 to 15 for the most significant digit to allow detector addressing from 1 to 250.

.2 Device addressing shall be accomplished by either an electrical or mechanical means.

.3 Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel signalling line circuits.

.4 Addressable smoke detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

.5 The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.

.6 Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.

.7 The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

.8 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

.9 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).

.10 Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

.11 Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

.12 Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

.13 The sensors shall be of a low profile design and ULC listed for both ceiling and wall mount applications.

.14 Automatic smoke sensors shall be equipped with a dust cover, which shall be removed at the time of verification to prevent dust and dirt entering the smoke chamber during construction.

.15 A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

2.6 INTELLIGENT MULTI-DETECTOR

.1 The intelligent multi-detector shall be an addressable device, which is designed to monitor photoelectric, ionization, and thermal technologies in a single sensing device. This detector shall utilize advanced electronics which react to smaller products of combustion found in fast flaming fires (ionization), slow smouldering fires (photoelectric), and heat (thermal) all within a single sensing device.

.2 The multi-detector shall include two bicolor LEDs, which flash green in normal operation and turn on steady red in alarm.

.3 Detectors are to be provided with relay base where noted on the drawings.

.4 Separately mounted photoelectric ionization and heat detectors in the same location are not acceptable alternatives.

2.7 FIXED TEMPERATURE HEAT DETECTOR

.1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the/ time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. The heat detector shall have a nominal alarm point rating of 57ºC (1 35ºF). The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

2.8 FIXED TEMPERATURE / RATE OF RISE HEAT DETECTOR

.1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm, The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 57ºC (135ºF) and a rate-of-rise alarm point of 9ºC (15ºF) per minute. The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

2.9 PHOTOELECTRIC SMOKE DETECTOR

.1 The intelligent photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging, and humidity. The photo detector shall be rated for ceiling installation at a minimum of Soft (Olin) centres and be suitable for wall mount applications.

.2 The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:

.1 Temperature: 0ºC to 49ºC (32ºF to 120ºF)

.2 Humidity: 0-93% RH, non-condensing

.3 Elevation: no limit

.3 Detectors are to be provided with relay base where noted on the drawings.

2.10 STANDARD DETECTOR MOUNTING BASES

.1 Provide standard detector mounting bases suitable for mounting on North American 1-gang, 85mm (3 ½ ") or 100 mm (4") octagon box and 100 mm (4") square box. The base shall, contain no electronics, support all detector types and have the following minimum requirements:

.1 Removal of the respective detector shall not affect communications with other detectors.

.2 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

2.11 INTELLIGENT DUCT SMOKE DETECTOR

.1 The smoke detector housing shall accommodate an intelligent photoelectric detector (as noted above) that provides continuous analog monitoring and alarm verification from the panel.

.2 When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems or fire/smoke dampers to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. Remote indicator light to activate.

.3 Duct smoke detector sensor assemblies shall be complete with duct housing, photoelectric smoke detector, and sampling tubes as required. The duct-housing base shall come complete with an auxiliary set of form C dry contacts rated at 120 VAC, 3 Amps.

.4 Duct smoke detector sensor assemblies at fire/smoke dampers shall have associated relay module and remote indicator light. It shall be possible to reset the damper via the fire alarm system control panel.

.5 The system shall automatically indicate when an individual duct sensor needs cleaning.

2.12 AUDIBLE/VISUAL SIGNAL DEVICES

.1 Mini Horns: flush mounted temporal mini horn, 24Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10'), white or red coverplate, FM and ULC listed. Suitable for mounting on a single gang box.

.2 Speakers/Strobes: Recessed wall mounted speaker or speaker/strobe devices, red finish complete with “FIRE” marking, speaker to be 25 V RMS complete with selectable wattages (¼, ½, 1, or 2 watt), strobe to be selectable 15 to 110 cd and 16 – 33 VDC, FM and ULC listed.

.3 Strobe: semi-recessed, 24Vdc operation, complete with selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe, red finish, FM and ULC listed. Suitable for mounting on a single gang box.

.4 Mini Horn/Strobe: flush mounted temporal combination mini horn/strobe, 24 Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10') selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe white or red coverplate, FM and ULC listed. Suitable for mounting on a single gang box.

NOTES:

.1 Signal devices with integral strobe lights in high abuse areas (i.e. gymnasium, change rooms, etc.) must be provided with protective wireguards.

.2 Any surface mounted signal devices must be provided with suitable backboxes supplied by the manufacturer.

.3 Provide synchronization modules to suit signal devices (if required by manufacturer).

.4 Set signal devices in classrooms to LOW setting.

2.13 END OF LINE RESISTORS

.1 End-of-line resistors for signalling circuits shall be sized to ensure the correct supervisory current flows in each circuit.

.2 End-of-line resistors shall be mounted on a stainless steel plate for mounting on a standard single gang box and bear the ULC label.

2.14 REMOTE ANNUNCIATOR PANELS

.1 Each remote panel in the installed system shall include remote control display annunciators. These annunciators shall have integral membrane style, tactile push-button control switches for the control of system functions, and LED-s with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.

.2 The remote control display annunciators shall provide the system with individual zone and device annunciation.

.3 Annunciator must be keyed similar to control panel.

2.15 GRAPHIC DISPLAY (PASSIVE)

.1 Colour graphic layout of facility showing all zones as specified/indicated. Zones shall each have descriptions and zone number indications per fire alarm zone schedule.

.2 Display is to be found behind Plexiglas, approximate size: 500 mm x 500 mm (20" x 20"). Adjust frame size of graphic accordingly to clearly display building zones and zone labels clearly. Max frame size shall be coordinated with available wall space at indicated mounting location. Electrical trade to confirm final graphic location on site.

.3 Finish frame to architects' direction.

2.16 ANCILLARY DEVICES

.1 Relay unit to initiate fan shutdown on alarm condition.

.2 Relay unit to facilitate elevator recall functions as indicated.

.3 Relay unit to initiate damper closing on combination fire/smoke dampers.

2.17 INTELLIGENT MODULES – GENERAL OPERATION

.1 The modules shall have a minimum of 2 diagnostic LED's mounted behind a finished coverplate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

.1 Temperature: 0ºC to 49ºC (32ºF to 120ºF).

.2 Humidity: 0-93% RH, non-condensing.

2.18 MONITOR MODULE

.1 The monitor modules shall have the following operating characteristics:

A flashing LED indicates that the module is in communication with the control panel. The LED latches steady on alarm (subject to current limitations on the loop).

.2 The monitor modules shall have the following features:

Nominal operating voltage:	15 to 32 VDC.
Maximum current draw:	5.1 mA (LED on)
Average operating current:	400 uA (LED flashing)
EOL resistance:	47K ohms.
Temperature range:	0°C to 49°C (32°F to 120°F)
Humidity range:	10% to 93% noncondensing
Dimensions:	114.3mm (4.5") high x 101.6 mm (4") wide x 31.75 mm (1.25") deep. Mounts to a 101.6 mm (4") square x 53.975 mm (2.1/8") deep box.

2.19 ISOLATOR MODULE

.1 Fault isolator modules shall be provide to automatically isolate wire-to-wire short circuits on an SLC loop. The fault isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop. If a wire-to wire short occurs, the fault isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the fault isolator module shall automatically reconnect the isolated section of the SLC loop. The fault isolator module shall not require any address-setting, and its' operations shall be totally automatic. It shall not be necessary to replace or reset a fault isolator module after its normal operation. The fault isolator module shall mount in a standard 10.16 cm (4") deep electrical box, in a surface-mounted backbox, or in the fire alarm control panel. It shall provide a single LED which shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.20 CONTROL MODULE

.1 Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.

.2 The control module NACs may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% or all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

.3 The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 Amps at 30 VDC.

2.21 DOOR HOLD OPEN DEVICES

.1 Units to be complete with the following features:

.1 Wall mounted style.

.2 Long life electromagnet.

.3 Low current operation.

.4 Completely silent operation.

.5 25 lbf (111N) minimum holding force.

.6 Adjustable swivel contact plate.

.7 Brushed zinc finish.

.8 Maintenance free operation.

.9 Water resistant design.

.10 ULC, CSA, and FM approved.

2.22 SPRINKLER AND SUPERVISED VALVE CONNECTIONS

.1 Sprinkler and standpipe system contacts shall be provided by the mechanical/sprinkler contractor but connected into the fire alarm system by this Division.

2.23 REMOTE TROUBLE INDICATOR

.1 A system remote trouble indicator where noted on the drawings shall be provided complete with the following features:

.1 Flush mounted in a double gang box.

.2 Trouble LED.

.3 Trouble buzzer.

2.24 SMOKE ALARMS 120V HARDWIRED

.1 Photoelectric sensor 3-in-1 smoke alarm unit c/w LED strobe and CO alarm.

.2 Integral 177 candela strobe with ability to synchronize to other interconnected strobe alarms during an alarm event.

.3 120V hardwired with 10-year sealed battery backup (sealed 3V lithium battery on smoke and CO alarm portion only).

.4 Low profile construction.

.5 Auxiliary relay for use with smart building systems as specified.

2.25 SYSTEM WIRING

.1 The system wiring must be FSA rated in conformance with the Electrical Safety Code to suit the type of installation.

.2 Wiring shall be minimum #18 AWG twisted shielded pair in conduit. “Securex 2” armoured cable will be permitted to be used for “drops” to devices on accessible ceilings.

.3 As indicated on system riser diagram initiating device wiring shall be run in a loop with a home run from the last device to the control panel (Class ‘A’ configuration). Wiring from the “loop” module to conventional devices must be supervised, run in conduit, and conform to the standards of the Electrical Safety Code.

.4 Signal wiring is to be cross connected in a class ‘B’ configuration.

.5 Install isolator modules and end of line resistors in service rooms no higher than 2.4 M AFF. Provide location of these devices at the time of shop drawing submission.

.6 **These are the basic wiring requirements for system operation. Prior to tender close manufacturer and contractor are to confirm all necessary wiring specifications and requirements.**

2.26 APPROVED EQUIPMENT

DEVICE	**NOTIFIER**	**EDWARDS**	**SIMPLEX**	**MIRCOM**
Control Panel				
	N16-XUPG2	EST 4	4100-ES	FX-4000 Series
Intelligent Devices				
Manual Alarm Stations 1-Stage	NBG 12LX	SIGA-270	4099-9001	MPS-810MP
Addressable Multi-Sensor	FSP-951TA	SIGA-OSHD		MIX-4020-ISO (w/ isolator base)
Addressable Base	B710LPA	SIGA-SB	4098-9792	MIX-4001

Addressable Base c/w Relay	B224RBA	SIGA-RB	4098-9791 c/w 2098-9737	MIX-4003-R
Heat Sensor	FST-951RA	SIGA-HRD - RoR SIGA-HFD (fixed)	4098-9733	MIX-4030-ISO (w/ isolator base)
Smoke Detectors	FSI-951A	SIGA-OSD	4098-9714	MIX-4010-ISO (w/ isolator base)
Duct Type Smoke Detector (c/w Air Sampling Tubes)	DNRA + FSP-951RA DST-X	SIGA-SD SD-T78	4098-9755 and 4098-9714	MIX-4010-DUCT DUCT-ST1 DUCT-ST2 DUCT-ST5 DUCT-EXTEND MIX-4101-D (replacement)
Monitor Module	FMM-1A	SIGA-CT1 SIGA-CT2	ZAM-Monitor 4090-9001	MIX-4040
Control Module	FCM-1 or FRM-1	SIGA-CR SIGA-CRH	ZAM-Control 4090-9002	MIX-4046
Isolator Module	ISO-XA	SIGA-IM2	4090-9122	MIX-4070
Annunciator	ACM-30 RLD NCD (network)	EST3-6ANN 3LCD-ANN 4ANN	4602-8001 RCU/SCU 4603-9101 (LCD)	RAXN-4000LCD RAM-1032TZDS (LED) RAX-1048TZDS (LED)
Active Graphic Annunciator	LDM2-32 / LDM2-60	Envoy Series	4602 Series	Geographic Series
Conventional and Auxiliary Devices				
Manual Alarm Stations	N-MPS Series	270 Series	2099-9754	MS-800 Series
Thermal Detectors	CR Series 5600 Series	EC2-H	4255-51/54	5600 Series
Smoke Alarms 3-in-1 (120V hardwired) complete with Strobe, 10 Year Sealed Battery and CO Alarm	KIDDE Cat. # P4010ACLEDSCOCA	KIDDE Cat. # P4010ACLEDSCOCA	KIDDE Cat. # P4010ACLEDSCOCA	KIDDE Cat. # P4010ACLEDSCOCA

Smoke Detectors (System Type)	C2W-BA Series	EC2-OS	4098-9601C 4098-9788C	C2W-BA
Smoke Detectors (System Type c/w Relay Base)	C2WR-BA	EC2-OS w/EC2-RB	4098-9601C 4098-9682C	C2WTR-BA
Duct type Smoke Detector (c/w Air Sampling Tubes.)	D4120A	SD-2W	4098-9685C	D2A (Housing) 2151A (Detector) DSTSeries (Tubes)
Mini Horn	MHRA (System Sensor)	G1ARF	4901-9858	FH-400-RR or WW
Door Holder	FMM Series	1500 Series	2088 Series	DH Series
Mini Horn complete with strobe	P2RLED-B	G1AVRF	4906-9127	FS-400-RR or WW
Strobe	SRLED-B	G1VRF	4906-9101	FS-400-RR or WW
Remote Trouble Indicator	RA100ZA	RTU	RT1-1C	RTI-1

Part 3 Execution

3.1 INSTALLATION

.1 The entire system shall be installed in accordance with CAN/ULC-S524 (latest edition) and approved manufacturers manuals and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation, All wiring shall be of the type recommended by the Electrical Safety Code, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.

.2 Install main control panel and connect to ac power supply.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. **Do not mount detectors within 1 m (39") of air outlets.** Maintain at least 600 mm (24") radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to main control panel.

.6 Locate and install signal devices and connect to signalling circuits.

.7 Connect signalling circuits to main control panel.

.8 Install end-of-line devices at end of applicable alarm and signalling circuits.

.9 Install remote annunciator panels and connect to annunciator circuit wiring.

.10 Locate and install door releasing devices.
Note: Door holders must release by way of local smoke detector and signal from main control panel. Provide additional relays to suit.

.11 Locate and install remote relay units to control fan shut down.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.13 Connect fire suppression systems to control panel.

.14 Elevator controllers are to be connected with 4 #14 conductors in conduit from fire alarm control panel to signal elevator recall in the event of a general alarm.

.15 **Provide power connection(s) and addressable style duct detector c/w all required field wiring at all combination fire/smoke damper locations shown on drawings via field relay with output connected to the associated damper. In alarm condition the duct detector shall signal the fire alarm system and the relay module to open and signal the damper actuator to close the damper. Include and connect remote indicator light at ceiling tile or drywall bulkhead in the vicinity of the damper.**

.16 **Fire/smoke dampers located at transfer grilles shall be provided with a duct detector on both sides of the fire separation as shown. Duct detectors shall operate the common damper actuator through programming of a common relay module.**

.17 **Install interlock conductors for duct shaft smoke venting dampers to activate dampers on signal from smoke detector at top of shaft or manual activation from CACF controls.**

.18 Where more than one smoke alarm is installed within a space or dwelling unit, interconnect smoke alarms to each other such that audible signal sounds throughout the space upon activation of any smoke alarm. Smoke alarms are to be interconnected with 3#12 conductors in conduit and connected per manufacturers recommendations.

3.2 PROTECTION

.1 Contractor is to ensure all fire protection system detectors are protected from dust, dirt, humidity, and water at all times during construction. This applies to detectors installed, stored on site or stored in storage containers. Any detectors that are damaged or dirty shall be replaced at the contractor's expense.

3.3 FIELD QUALITY CONTROL

.1 The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

3.4 ACCEPTABLE INSTALLER

.1 The fire alarm / life safety system specified herein shall be installed by an Authorized Electrical Contractor who is CFAA certified.

3.5 EXAMINATION

.1 Prior to the commencement of any of the work detailed herein, an examination and analysis of the area(s) where the Fire Alarm / Life Safety System and all associated components are to be installed shall be made.

.2 Any of these area(s) which are found to be outside the manufacturers' recommended environments for the particular specified products shall be noted on a Site Examination Report which shall be given to the Building Owners Representative, and the Consultant.

.3 Any shorts, opens, or grounds found on existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

3.6 DEMONSTRATION

.1 Each of the intended operations of the installed Fire Alarm / Life Safety System shall be demonstrated to the Building Owners' Representative and the Consultant.

3.7 SYSTEM TEST

.1 Perform tests in accordance with General Electrical Requirements Section and CAN/ULC-S537-(latest building code adopted edition) Standard for the Verification of Fire Alarm Systems.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure noted devices transmit alarm to control panel and actuate general alarm and ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Class A circuits.

.1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on all circuits for capability of providing alarm signals during ground-fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits

.1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.3 The control panel shall continuously perform as automatic self-test routine on each sensor, which will functionally check the sensor electronics and ensure the accuracy of the valves being transmitted to the control panel.

.4 Automatic testing will occur at a rate of one sensor every four minutes.

.5 The sensor's average analogue value is the average of the last 2000 recorded analogue entries of its chamber.

.6 Any sensor that fails this test shall indicate a '**SELF-TEST ABNORMAL'** trouble condition with the sensor's address at the control panel.

.7 The system shall automatically indicate when an individual sensor needs cleaning. When the sensor's average value reaches a predetermined value, a **'DIRTY SENSOR'** trouble condition shall be audibly and visually indicated at the local control panel for that sensor. IF a **'DIRTY SENSOR'** indication is left unattended and its average value increases to a second predetermined value, an **'EXCESSIVELY DIRTY SENSOR'** trouble condition shall be indicated at the local control panel for that sensor. To prevent false alarms, these **'DIRTY'** conditions shall in no way decrease the amount of smoke obscuration necessary to generate an alarm condition.

.8 An operator having a proper access level, shall have the capability to manually access the following information from the control panel:

.1 Primary Status

.2 Device Type

.3 Present Average Value

.4 Present Sensitivity Selected*

.5 Highest Peak Detection Values (HVP)*

.6 Sensor Range (Normal, Dirty, Excessively Dirty)

* Values shall be in 'percent of smoke obscuration' format so that no interpretation is required by the operator.

3.8 AUDIBILITY TESTING

.1 Audibility Testing:

.1 The contractor is to coordinate an audibility test prior to occupancy of the facility. The test is to be performed by the representatives of the fire alarm manufacturer in the presence of the consultant. The test report is to be in chart form indicating:

.1 Project

.2 Date of test

.3 Room name and number

.4 Ambient dB level

.5 Alarm dB level

.6 Name of testing technician

.2 The test results are to be submitted to the consultant for review prior to issuing to owner's representatives and/or authorities having jurisdiction.

3.9 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 This electrical contractor shall participate in integrated testing of this life safety system in conformance with Electrical General Requirements. Include all associated costs in tender.

3.10 ADDITIONAL INSTALLED FIRE ALARM SYSTEM COMPONENTS

.1 The electrical contractor is to include in their bid the cost to add five (5) additional signaling devices to be installed and verified in locations as directed by the consultant. Note: This installation and verification and subsequent audibility test will be occurring after the initial audibility testing is complete.

.2 The electrical contractor is to include in their bid the cost to add three (3) additional fire initiating devices (heat or smoke detectors or manual pull stations) to be installed and verified in locations as directed by the consultant.

.3 The electrical contractor is to include in their bid the cost to add three (3) additional fire alarm zones with associated zone modules and including six (6) additional isolation modules to be installed and verified as directed by the consultant.

.4 The electrical contractor is to include in their bid the cost to provide and install three (3) additional duct detectors and associated relay modules and remote indicator lights for combination fire smoke dampers c/w field wiring connections for fire alarm, control, and 120V AC power. Include six (6) additional isolation modules to be installed and verified as directed by the consultant. Include for 120V branch circuit wiring connections to each damper assembly from nearby panel board spare 15A-1P breaker, as directed by the consultant, with up to 30m of minimum branch circuit wiring in conduit.

END OF SECTION

SECTION 10 14 53
TRAFFIC SIGNAGE

PART 1 GENERAL

1.1 RELATED REQUIREMENTS (N/A)

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, (5th Edition).

.2 ASTM International

.1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes.

.3 ASTM B209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.4 ASTM B210M-05, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes (Metric).

.5 ASTM B211M-03, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire (Metric).

.3 Canadian General Standards Board (CGSB)

.1 CGSB 62-GP-9M-80, Prefabricated Markings, Positionable, Exterior, for Aircraft Ground Equipment and Facilities.

.2 CGSB 62-GP-11M-78, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing and Amendment.

.4 CSA Group (CSA)

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA O80 Series-08, Wood Preservation.

.3 CSA O121-08, Douglas Fir Plywood.

.4 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.

.5 CAN/CSA-Z809-08, Sustainable Forest Management.

.5 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.6 Green Seal Environmental Standards (GS)

.1 GS-11-11, Paints and Coatings.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2011, Architectural Coatings.

.8 Sustainable Forestry Initiative (SFI)

.1 SFI-2010-2014 Standard.

.9 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual-current edition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

.1 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

2.2 MATERIALS

.1 Sign supports:

.1 Steel posts: to CSA G40.21, 4 m long, flanged "U" shaped in cross section, measuring 65 mm wide x 30 mm deep. Metal thickness: 4.5 mm. Hot dipped galvanized: to ASTM A123/A123M, minimum zinc coating 600 g/m^2.

.2 Standard tubular supports for small signs: to ASTM B210M

.3 Timber posts:

.1 Sawn timber posts:

.1 Species: SPF.

.2 Type: pressure treated.

.3 Grade: No. 1/2.

.4 Dimensions: as indicated.

.5 CAN/CSA-Z809 or FSC or SFI certified

.4 Vertical tubular supports and connecting diagonal members: to ASTM B210M

.5 Truss members: to ASTM B210M

.6 Aluminum tubular members: belt ground satin finish.

.7 Base plates for ground mounted signs: to ASTM B209M. Base plates for overhead supports: to ASTM B209M

.8 Tubular support caps for ground mounted signs: to ASTM B210M or fabricated from aluminum plate as specified in ASTM B209M. Castings for overhead signs: to ASTM B211M

.9 Aluminum flanges: to ASTM B211M

.10 Anchor and connecting bolts, 'U' clamps and miscellaneous hardware for overhead sign installations: fabricate from 304 stainless steel as specified in ASTM A276

.11 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

.2 Signboards:

.1 Plywood: to CSA O121, 19 mm thick. Overlaid Douglas Fir, Medium Density CAN/CSA-Z809 or FSC or SFI certified, overlaid one side only with fibre or plastic sheet surfacing material

.2 Aluminum sheet: to ASTM B209M, precut to required dimensions

.1 Thickness for signboards up to 750 mm wide: 1.6 mm minimum.

.2 Thickness for signboards 750-1200 mm wide: 2.1 mm minimum.

.3 Thickness for refurbishing existing sign panels: 1.0 mm minimum.

.3 Aluminum extrusions: to ASTM B211M, 150 mm or 300 mm panels suitable for bolting together.

.4 T-shape stiffeners for signboards: to ASTM B210M

.5 Connecting straps and brackets: to ASTM B209M

.6 Aluminum materials: to ASTM B209M

.7 Xylene thinner: to 15%

.8 Primer for plywood: to MPI #5 VOC limit of 350 g/L to SCAQMD Rule 1113.

.9 Chemical conversion coating for aluminum: Chromate Conversion Coating / Chem Film / Alodine.

.10 Primer for aluminum: to MPI # 8, VOC limit of 250 g/L to GS-11.

.11 Silk screen ink:

.1 Transparent or opaque colours: selected by department representative, or as indicated.

.12 Reflective sheeting and tape: to CGSB 62-GP-11M. Adhesive, class of reflectivity and colour as indicated.

.13 Transparent tape: flexible, smooth-surfaced, moisture resistant tape with pressure sensitive adhesive.

.14 Clear varnish protective coat: MPI-EXT 6.4H VOC limit of 350 g/L to SCAQMD Rule 1113.

2.3 FABRICATION

.1 Supports:

.1 Connect aluminum support members by welding in accordance with CSA W47.2. Work to be performed by Canadian Welding Bureau qualified members only. Flame cutting of members not permitted

.2 Welds to be of same strength as adjacent member or casting.

.3 Reinforce in area of electrical hand holes to equal strength of full section member.

.4 Remove sharp edges and burrs.

.2 Signboards:

.1 Plywood blanks:

.1 Cut plywood blanks to required shapes and dimensions. Fill edges with wood filler suitable for outdoor use and sand smooth.

.2 Lightly sand surfaces, wipe clean with xylene thinner and allow to dry for 8 hours.

.3 Spray signboard back and edges with one prime coat maximum VOC content 350 g/L to GS-11 and two white finish coats maximum VOC content 350 g/L to GS-11 in the same colour as the sign face.

.2 Aluminum blanks:

.1 Degrease, etch and bonderize with chemical conversion coating.

.2 Clean surfaces with xylene thinner. Dry.

.3 For non-reflective signs, spray face with one coat vinyl pretreatment coating and two finish coats of required colour.

.4 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with MPI-EXT 5.4A.

.3 Reflective background sheeting and lettering:

.1 Cut and apply in accordance with manufacturer's instructions.

.2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.

.3 Edge wrap sheeting on each extrusion prior to bolting extrusions. Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.

.4 Reflective signboard faces may be prepared using silk screen transparent ink.

.4 Non-reflective lettering and symbols: cut from vinyl film as specified in CGSB 62-GP-9M, or paint using required colour of finish paint maximum VOC of 350g/L to GS-11 or silk screen transparent ink.

.5 Clean signboards completely and apply transparent tape over top edge and extending 25 mm minimum down back and front of signboard.

.6 Protect finished signboard faces with one coat of clear varnish with maximum VOC limit of 350 g/L.

.7 Apply two coats of white paint with maximum VOC content of 50 g/L to GS-11 to wooden sign posts. Allow initial coat to dry before applying second coat. Apply paint only when relative humidity is below 85% and ambient temperature is above 5 degrees C.

.3 Sign identification:

.1 Apply sign number and date of installation with 25 mm high stencil painted black letters on lower left back face of each signboard.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Sign bridge:

.1 Erect sign bridge as indicated. Permissible tolerance: 12 mm maximum departure from vertical.

.2 Sign support:

.1 Erect supports as indicated. Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers. Permissible tolerance: 12 mm maximum departure from vertical.

.2 Coat underside of base plate with corrosion protective paint before installation. Connect shoe base to shaft with inside and outside fillet welds.

.3 Close open aluminum tubes and posts with aluminum cap. Cut oblong holes in shoe bases to drain condensation. Install aluminum bolt cover on each base plate restraining nut.

.4 Erect posts plumb and square to details as indicated.

.5 Single channel steel posts:

.1 Drive to required depth without damage to posts.

.2 If rock or concrete is encountered, drill hole to required depth and set post in sand.

.3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

.6 Wooden post installation:

.1 Excavate post holes to 300 mm minimum diameter. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.

.2 Leave or make depression, approximately 150 mm deep, around posts until paint is dry, then backfill and compact with excavated material to ground elevation.

.7 Join truss sections with wrought aluminum flanges welded to chords with inside and outside fillet welds. Build in camber to truss and monotube bridge supports

to allow for deflection due to dead load of sign support, signboards, appurtenances; and an additional 1:300 camber.

.3 Signboard:

.1 Fasten signboards to supporting posts and brackets as indicated.

.2 Fasten lane markers to signboard.

.3 Use T-shape aluminum stiffeners to join portions of sign panel on site. Cover face of T-stiffener with material identical to face of sign panel.

3.2 CORRECTING DEFECTS

.1 Correct defects, identified by departmental Representative, in sign message, consistency of reflectivity, colour or illumination. Correct angle of signboard and adjust luminaire aiming angle for optimum performance during night conditions to approval of department representative.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

END OF SECTION

SECTION 31 05 16
AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete

1.2 ABBREVIATIONS

.1 GW: Well-graded gravel

.2 GP: Poorly graded gravel

.3 GC: Clayey gravel

.4 SW: Well-graded sand

.5 SP: Poorly graded sand

.6 SC: Clayey sand

.7 CL: Lean clay

.8 ML: Silt

.9 CH: Fat clay

.10 MH: Elastic silt

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.2 ASTM D1140-17, Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No.200) Sieve in Soils by Washing

.3 ASTM D2487-17e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

.4 ASTM D4318–17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

.5 ASTM D4791-19, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit manufacturer's instructions, product literature, and data sheets for aggregate materials. Include product characteristics, performance criteria, practical size, finishes, and limitations.

.3 Samples:

.1 Submit 5-kg samples of each type of aggregate, as specified.

.2 Allow continual sampling by department representative during production.

.3 Supply new or clean sample bags or containers appropriate for the type of aggregate materials.

.4 Install sampling facilities at discharge end of production conveyor to allow department representative to obtain representative samples of items being produced. Stop conveyor belt when requested by department representative to permit full cross-section sampling.

.5 Provide front-end loader or other suitable equipment and a trained operator for stockpile sampling as necessary. Move samples to storage location reviewed by department representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Segregation, contamination, and degradation of aggregates during handling and transportation is not permissible.

.3 Store washed materials or materials excavated from underwater for a minimum of 24 hours to allow for free drainage of water and for materials to reach uniform water content.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Aggregate Quality: Sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, and adherent coatings or other deleterious substances.

.2 Flat and Elongated Particles of Coarse Aggregate: To ASTM D4791.

.1 Length to thickness ratio equal to or greater than 5:1.

.3 Fine aggregates satisfying requirements of applicable sections, such as Section 03 30 00 - Cast-in-Place Concrete to be one of or a blend of the following:

.1 Screenings produced from crushing quarried rock, boulders, gravel or slag.

.2 Reclaimed asphalt pavement.

.3 Reclaimed concrete material.

.4 Coarse aggregates satisfying requirements of applicable sections, such as Section 03 30 00 - Cast-in-Place Concrete to be one of or a blend of the following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.3 Lightweight aggregate, including slag and expanded shale.

.4 Reclaimed asphalt pavement.

.5 Reclaimed concrete material.

2.2 SOURCE QUALITY CONTROL

.1 Inform department representative of proposed source of aggregates and provide access for sampling a minimum 4 weeks before starting production.

.2 If materials from proposed source do not meet or cannot reasonably be processed to meet specified requirements then locate alternative source.

.3 Advise department representative a minimum 4 weeks in advance of proposed change of material source.

.4 Provide department representative with access to source and processed material for sampling.

.5 Acceptance of material at source does not exclude it from potential future rejection if it fails to conform to specified requirements, lacks uniformity, or if its site performance is found to be unsatisfactory.

.6 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify conditions in accordance with Section 01 71 00 - Examination and Preparation.

.1 Topsoil:

.1 Examine topsoil for clods, rocks, snow, large roots, litter, and toxic substances before proceeding with stripping.

.2 Proceed with topsoil stripping, after unacceptable conditions have been remedied.

3.2 PROCESSING

.1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

.2 Blend aggregates as required, including reclaimed materials that meet specified requirements in order to satisfy gradation requirements or specified particle shapes.

.1 Use methods and equipment reviewed in writing by department representative.

.3 When operating in stratified deposits use excavation equipment and methods that produce uniform and homogeneous aggregate gradation.

.4 Screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

.1 Use only equipment reviewed in writing by department representative.

3.3 STOCKPILING

.1 Stockpile aggregates on site in locations as indicated in the contract drawings, unless directed otherwise by Departmental Representative and/or the department representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Use stockpile sites that are level, well-drained and have adequate bearing capacity to support the weight of stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas:

.1 Provide compacted sand base minimum of 300 mm in depth to prevent contamination of aggregate; or,

.2 Stockpile aggregates on ground but do not incorporate bottom 300 mm of stockpile into Work.

.5 Divide different aggregates by strong, full depth bulkheads, or separate each stockpile by a sufficient distance to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials in accordance with Section 01 74 19 - Waste Management and Disposal within 48 hours of rejection.

.7 Stockpile materials in uniform layers a maximum 1.5 m in depth. Complete and level each layer before placing the subsequent layer.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles. Keep the completed stockpiles neat, regular in form and occupying the smallest possible area.

.10 Do not use stacking conveyors.

.11 During winter operations, prevent penetration of ice and snow into stockpile or in material being removed from stockpile.

3.4 CLEANING

.1 Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.

.2 Leave aggregate stockpile site in tidy, well-drained condition, free of standing surface water.

.3 Leave any unused aggregates in neat compact stockpiles in locations directed by Departmental Representative.

.4 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

.5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of AHJ.

.6 Restrict public access to temporary or permanently abandoned stockpiles in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

END OF SECTION

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling

1.2 DEFINITIONS

.1 Clearing: Removal of trees, brush, and other vegetation from a designated area. Clearing is the first step in preparing land for construction or development.

.2 Grubbing: Removal of roots, stumps, and other underground vegetation remnants after the initial clearing. Grubbing is essential for preparing the soil for further development or excavation.

1.3 REFERNCE STANDARDS

.1 Canadian Food Inspection Agency (CFIA):

.1 S.C. 1997, c. 6, Canadian Food Inspection Agency Act

.2 Environment and Climate Change Canada (ECCC):

.1 S.C. 1999, c. 33, Canadian Environmental Protection Act, 1999

.2 S.C. 2019, c. 28, s. 1, Impact Assessment Act, 2019

.3 Health Canada (HC):

.1 S.C. 2022, c. 28, Pest Control Products Act

.4 Transport Canada (TC):

.1 S.C. 1992, c. 34, Transportation of Dangerous Goods Act, 1992

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate work of this section with submittal requirements in Section 01 35 29 - Health, Safety, and Emergency Response Procedures for a site-specific health and safety plan (HSP).

.2 Coordinate work of this section with submittal requirements in Section 01 35 43 - Environmental Procedures for a site-specific environmental protection plan (EPP).

.2 Pre-installation meetings: Conduct a site meeting in accordance with Section 01 31 19 - Project Meetings and attended by the department representative and appropriate Subcontractors to:

.1 Verify project requirements.

.1 Identify, flag, or otherwise mark, items designated to remain or to be salvaged.

.2 Review delivery, storage, and handling requirements.

.1 Special requirements for infested materials.

.3 Review existing surface conditions.

.4 Identify the unintended potential environmental impact on existing site conditions.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Site-specific pest management plan (PMP) in compliance with Canada Pest Control Products Act, provincial, and municipal regulations.

1.6 QUALITY ASSURANCE

.1 Comply with the requirements of Section 01 43 00 - Quality Assurance.

.2 Regulatory requirements:

.1 Comply with Canadian Environmental Protection Act, Canadian Food Inspections Agency Act, Impact Assessment Act, Transportation of Dangerous Goods Act, and applicable provincial, and municipal regulations.

1.7 SITE CONDITIONS

.1 Examine subsurface investigation report as indicated in Section 00 31 00 - Available Project Information.

.2 Known underground utility lines and buried objects are as indicated on Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Fill:

.1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Soil: Free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, or deleterious materials.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation.

.2 Verify clearing and grubbing work is coordinated with erosion and sedimentation control measures in Section 01 57 00 - Temporary Controls.

3.2 PREPARATION

.1 Locate and protect utility lines: Preserve in operating condition active utilities traversing site.

.2 Notify Departmental Representative immediately of damage to, or when unknown existing utility lines are encountered.

.3 Notify utility authorities impacted before performing clearing and grubbing work.

3.4 CLEARING

.1 Clearing: In locations as indicated on the Drawings.

.1 Cut off trees, stumps, roots, brush, and other vegetation to ground level.

.2 Tree designated to remain:

3.5 GRUBBING

.1 Grubbing: In locations as indicated in the Drawings.

.2 Remove stumps, roots larger than 75 mm in diameter, matted roots, other organic debris, and visible rock fragments to a minimum of 200 mm below ground surface from grubbing areas.

.3 Remove visible rock fragments and boulders greater than 300 mm in any dimension, but less than 0.25 m^3 in accordance with Section 31 23 16.26 - Rock Removal.

.1 Notify department representative immediately when unanticipated rock fragments or boulders exceeding these dimensions are encountered.

3.6 FINISHED SURFACE

.1 Fill depressions resulting from clearing and grubbing] operations with fill material, and compact to make surface uniform with existing adjacent ground surface.

.2 Leave ground surface in condition ready for immediate grading operations or stripping of topsoil.

3.7 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Clean and remove debris and sediment from drainage devices in work areas, and dispose of in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Do not clean equipment in waterbodies or where the wash-water can enter waterbodies.

.2 Waste management:

.1 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Remove cleared and grubbed materials.

.3 Chip or mulch and spread cleared and grubbed vegetative material on site in locations indicated on Drawings.

.4 Cut timber greater than 125 mm diameter to 1800 mm lengths and stockpile as indicated on Drawings. Stockpiled timber becomes property of Owner.

.5 Diseased trees identified on Drawings: Remove and dispose of in accordance with municipal / provincial regulations.

.6 Infested materials:

.1 Removal of potentially infested materials from regulated area are to be accompanied by a movement certificate issued by the Canadian Food Inspection Agency (CFIA).

.1 Clean vehicles used to transport regulated articles of debris before loading at origin and before departure from the receiving facility.

.2 Movement of any ash tree from regulated area without consent of the CFIA is prohibited.

.1 Ash tree articles include:

.1 ash trees (whole or parts);

.2 ash nursery stock;

.3 ash logs and branches;

.4 ash lumber;

.5 wood packaging materials with an ash component;

.6 ash wood or bark;

.7 ash wood chips or bark chips; and,

.8 ash firewood.

.2 Removal of non-ash firewood from regulated area is only permitted by facilities registered under the Emerald Ash Borer Approved Facility Compliance Program (EABAFCP).

.3 Remove infested materials in accordance with provincial and municipal regulations.

3.8 PROTECTION

.1 Protect existing fencing, trees, shrubs, landscaping, natural features, benchmarks, buildings, pavement, utility lines, site appurtenances, water courses, and root systems of trees designated to remain.

END OF SECTION

SECTION 31 14 13
SOIL STRIPPING AND STOCKPILING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 11 00 - Clearing and Grubbing

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 [NOT USED]

.1 Not used.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation.

.1 Verify areas affected by work of this section have been cleared and grubbed in accordance with Section 31 11 00 - Clearing and Grubbing.

.2 Verify temporary erosion and sedimentation control measures are installed in accordance with Section 01 57 00 - Temporary Controls.

.3 Verify grades are correct.

3.2 STRIPPING OF TOPSOIL

.1 Conduct topsoil stripping procedures in accordance with applicable provincial and municipal requirements.

.1 To avoid compaction of topsoil, remove topsoil before other construction procedures commence.

.2 Handle topsoil only when it is dry and warm.

.3 Strip topsoil to full depth as directed by departmental Representative.

.1 Avoid mixing topsoil with subsoil. Refer to Section 00 31 00 - Available Project Information for geotechnical report on subsurface soil information.

.4 Stockpile topsoil for reuse in locations as indicated on Drawings.

.1 Stockpile height: maximum 3 m.

.2 Avoid placing stockpile in low areas where natural drainage or storm water could pond or erode these materials during inclement weather.

.5 Protect stockpiles from adverse weather conditions, contamination, and compaction.

.6 Cover topsoil that has been piled for 30 days, with sterile plants, such as ray florets, or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

.1 Grade area only when soil is dry to lessen soil compaction.

.2 Grade soil with scrapers, establishing natural contours to eliminate uneven areas and low spots, and to provide positive drainage.

3.4 SUBSOILING

.1 Perform subsoiling to designated areas to improve drainage and agricultural potential of soil.

.2 Work subsoiled area following natural grade contour lines, with vibrating subsoiler to depth of 40 cm.

.3 Cross subsoiled area following the first pass.

.4 Cultivate the soil with a chain harrow to break up soil clod.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

.3 Dispose of unused topsoil offsite at the Contractors discretion.

END OF SECTION

SECTION 31 22 13
ROUGH GRADING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 11 00 - Clearing and Grubbing

.2 Section 31 14 13 - Soil Stripping and Stockpiling

.3 Section 31 23 33.01 - Excavating, Trenching and Backfilling

.4 Section 32 01 90.33 - Tree and Shrub Preservation

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.2 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

1.3 EXISTING CONDITIONS

.1 Known underground and surface utility lines and buried objects are indicated on the Drawings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation.

.1 Examine soil for unsuitable conditions such as surface water, clods, rocks, snow, frost, freezing, mud, large roots, litter, potentially toxic substances, and unstable material.

.2 Proof roll the subgrade areas indicated on the Drawings and as per the request of the department representative.

.2 Verify and coordinate rough grading with:

.1 Erosion and sedimentation control measures in Section 01 57 00 - Temporary Controls.

.2 Clearing and grubbing, performed in accordance with Section 31 11 00 - Clearing and Grubbing.

.3 Topsoil removal, performed in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.

.3 Verify subgrades are correct and sloped as indicated on the Drawings.

3.2 PREPARATION

.1 Remove litter and unsatisfactory and unstable materials.

.2 Stake and flag locations of utilities.

.3 Protect existing underground and above head utilities.

3.3 GRADING

.1 Rough grade to levels, profiles, and contours as indicated on the Drawings.

.2 Rough grade to the following depths below finish grades:

- .1 Grassed areas: 100 mm or as indicated on the Drawings.
- .2 Flowerbeds: 150 mm or as indicated on the Drawings.
- .3 Shrub beds: 150 mm or as indicated on the Drawings.
- .4 Asphalt paving: As indicated on the Drawings.
- .5 Concrete paving, Concrete walks: As indicated on the Drawings.

.3 Slope rough grade away from building minimum 2% or as indicated on the Drawings.

.4 Grade ditches to depth required for maximum runoff or as indicated on the Drawings.

.5 Remove soil to a minimum depth of 150 mm from the surface before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding, unless otherwise specified by a professional geotechnical engineer.

.6 Compact filled and disturbed areas to maximum dry density, in accordance with ASTM D698 or ASTM D1557 if approved by the Consultant:

- .1 Under landscaped areas: 95%.
- .2 Under paved and walk areas: 98%.

3.4 SITE QUALITY CONTROL

.1 Site tests and inspections:

- .1 Perform in accordance with Section 01 45 00 - Quality Control.
  - .1 Test compact soil in accordance with ASTM D698 to verify conformance with specified requirements.
  - .2 Two to Three tests per 1000 m^2 of compacted area.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

.3 Remove and dispose of surplus material and material that is unsuitable for fill, for grading purposes, or for landscaping purposes.

3.6 PROTECTION

.1 Maintain finished surfaces until succeeding material is applied or until reviewed by the department representative.

END OF SECTION

SECTION 31 22 16.13
ROADWAY SUBGRADE RESHAPING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS (NOT USED)

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 DEFINITIONS

.1 Subgrade: Well-graded and compacted surface, constructed to the grades, lines, and cross-section indicated on Drawings, bladed and compacted to the specified density, preparatory to constructing pavements, or other improvements.

.2 Scarifying: Loosening the roadbed surface and removing rocks larger than 100 mm. Tilling and manipulating the Subgrade to achieve specified optimum moisture content.

1.4 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))

.2 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with Section 01 57 00 – Temporary Controls for erosion and sediment control measures.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 SCARIFYING AND RESHAPING

.1 Scarify Subgrade to full width indicated on Drawings and to a minimum depth of 150 mm.

.2 Pulverize and break down scarified material to maximum 50 mm soil clod size, except stones larger than this size may be left intact as directed by the Departmental Representative.

.3 Blade and trim pulverized material to elevation and cross section dimensions indicated on Drawings.

.4 Add and blend additional Subgrade material as directed by the department representative where deficiency of material exists.

.1 Subgrade material: Existing subgrade material, Engineered Fill approved by the department representative.

.5 Re-use excess material in areas of material deficiency.

3.2 COMPACTING

.1 Compact to maximum dry density to ASTM D698 or ASTM D1557 if approved by the Consultant.

.2 Shape and roll alternately to obtain smooth, even, and uniformly-compacted Subgrade surface.

.3 Apply water as necessary during compaction to obtain specified density.

.4 If material is excessively moist, aerate by Scarifying until moisture content is corrected to value maximum of 2% moisture above optimum value for compaction in accordance with ASTM D698.

3.3 SITE TOLERANCES

.1 Reshaped compacted surface to be within ±10 mm of elevation indicated on Drawings.

3.4 PROTECTION

.1 Protect and maintain reshaped surface in condition conforming to this Section until subsequent material is placed or until receipt of written acceptance from the department representative.

END OF SECTION

SECTION 31 23 33.01
EXCAVATING, TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 02 41 13 - Selective Site Demolition

.2 Section 31 05 16 - Aggregates for Earthwork

.3 Section 32 91 19.13 - Topsoil Placement and Grading

.4 Section 33 14 16 - Site Water Utility Distribution Piping

.5 Section 33 31 11 - Public Sanitary Sewerage Gravity Piping

.6 Section 33 41 16 - Sub-drainage Piping

.7 Section 33 42 11 – Stormwater Gravity Piping

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 DEFINITIONS

.1 Industry-average environmental product declaration: Developed by an industry association and represents the average product of multiple companies. Products covered by industry-average environmental product declarations are required to follow the same product category rule. Industry-average environmental product declarations cannot represent a certain manufacturer or its product. Industry-average environmental product declarations may be referred to as "industry-wide environmental product declarations" or "generic environmental product declarations."

.2 Product-specific type III environmental product declaration: Provides data on one product made by one manufacturer, but can involve multiple factories. Product-specific type III environmental product declarations can cover a product produced by a manufacturer in several plants throughout the world if all plants use the same processes. Product-specific environmental product declarations cannot represent several products or several manufacturers.

1.4 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C117-23, Standard Test Method for Material Finer than 75-µm (No.200) Sieve in Mineral Aggregates by Washing

.2 ASTM C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM D422-63e2, Standard Test Method for Particle-Size Analysis of Soils

.4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.5 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

.6 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

.3 CSA Group (CSA):

.1 CSA A23.1:19, Concrete materials and methods of concrete construction

.2 CSA A3001-18, Cementitious materials for use in concrete

.3 CSA B602:20, Mechanical couplings for drain, waste, and vent pipe and sewer pipe

.4 CSA B1800:24, Thermoplastic nonpressure piping compendium

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation meetings: Conduct a site meeting in accordance with Section 01 31 19 - Project Meetings and attended by the department representative and appropriate Subcontractors to:

.1 Verify project requirements.

.2 Review delivery, storage, and handling requirements.

.3 Review installation and substrate conditions.

.4 Coordination with other Subcontractors.

.5 Review manufacturer's instructions and warranty requirements.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: Product literature and data sheets for French drain piping and fittings, including product characteristics, performance criteria, physical sizes and limitations.

.3 Samples:

.1 Samples for verification:

.1 10 kg samples of fill materials.

.2 1 kg of fly ash.

.2 Submit samples in tightly closed containers to prevent contamination and exposure to elements.

.4 Source quality control submittals:

.1 Inform the department representative, at least 4 weeks before beginning work, of proposed sources of fill materials.

.2 Inform the department representative, at least 4 weeks before beginning work, of proposed sources of fly ash.

.1 Do not change source of fly ash without written notice of acceptability from the department representative.

.5 Site quality control submittals: Copies of daily work records to indicate results of compaction tests demonstrating specified densities.

.1 Submit within 5 Working Days after completing tests or inspections.

.6 Sustainable design submittals: Information demonstrating sustainability characteristics specified in this section and in accordance with Section 01 33 29 - Sustainable Design.

1.7 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and maintenance data:

.1 Include, in the operation and maintenance manual, manufacturer's maintenance instructions and recommended cleaning materials and methods.

1.8 QUALITY ASSURANCE

.1 Do not use soil material until written report of soil test results are reviewed and approved by department representative.

1.9 SITE CONDITIONS

.1 Review available site surveys, geotechnical data, and existing hazardous materials information in accordance with Section 00 31 00 - Available Project Information.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Type 1 and Type 2 fills:

.1 Crushed, pit run or screened stone, gravel, or sand in accordance with Section 31 05 16 - Aggregates for Earthwork.

.2 Gradations to be within limits specified when tested in accordance with ASTM C136M and ASTM C117. Sieve sizes in accordance with CAN/CGSB-8.2.

Sieve Designation	**% Passing**	
	Select Subgrade Material	**19mm Clear Stone**
150 mm	100	-
106 mm	-	-
37.5 mm	-	-
26.5 mm	50 to 100	100
19 mm	-	85 to 100
13.2 mm	-	0 to 40
9.5 mm	-	-
4.75 mm	20 to 100	0 to 5
2.36 mm	-	0 to 2
1.18 mm	10 to 100	-
0.300 mm	5 to 95	-
0.150 mm	2 to 65	-

0.075 mm	0 to 25	0 to 1

.2 Type 3 fill: selected material from excavation or other sources, approved by department representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse, or other deleterious materials.

.3 Unshrinkable fill: To CSA A3001, Type GU Portland cement, maximum 25 kg/m^3 cement content, and 40% fly ash replacement by volume, mixed to settle when placed and resist easy excavation.

.1 Concrete aggregate: To CSA A23.1.

.2 Performance/design criteria:

.1 28 day compressive strength: Maximum 0.4 MPa.

.2 24-hour strength: 0.07 MPa.

.3 Slump: 160 mm to 200 mm.

.3 Unshrinkable fill: Very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

.4 Shearmat: Honeycomb-type biodegradable cardboard, 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete is cured.

.5 French drain piping: To CSA B1800, rigid pipe with 150 mm perforations, complete with fittings.

.1 French drain couplings: To CSA B602, compatible with adjoining materials.

.6 Topsoil: In accordance with Section 32 91 19.13 - Topsoil Placement and Grading.

2.2 SOURCE QUALITY CONTROL

.1 Non-conforming work:

.1 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost-susceptible materials:

.1 Fine-grained soils with plasticity index less than 10 when tested in accordance with ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136M: Sieve sizes to CAN/CGSB 8.2.

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 to 100
0.02 mm	10 to 80
0.005 mm	0 to 45

.3 Coarse-grained soils containing more than 20% by mass passing 0.075 mm sieve.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation, and:

.1 Verify conditions in accordance with Section 02 41 13 - Selective Site Demolition.

.2 Verify locations of underground services, on and adjacent to site, before beginning work.

.2 Evaluation and assessment:

.1 Photograph existing conditions of adjoining construction and site improvements in accordance with Section 02 41 13 - Selective Site Demolition.

3.2 PREPARATION

.1 Protection of in-place conditions:

.1 Comply with Section 02 41 13 - Selective Site Demolition.

.2 Cover and protect soils subject to volume change due to changing moisture content.

.2 Surface preparation:

.1 Prepare surfaces in accordance with Section 01 71 00 - Examination and Preparation, and:

.1 Remove obstructions, ice, and snow from surfaces to be excavated within limits indicated.

.2 Remove pavement and sidewalks along limits of proposed excavation in accordance with Section 02 41 13.13 - Paving Removal.

.3 Demolition/removal:

.1 Underground services: In accordance with Section 02 41 13 - Selective Site Demolition.

3.3 STRIPPING TOPSOIL

.1 Begin topsoil stripping areas indicated on Drawings after area has been cleared of brush, weeds, and grasses and removed from site.

.2 Strip topsoil to depths indicated on Drawings.

.3 Do not mix topsoil with subsoil.

3.4 STOCKPILING

.1 Protect fill materials from contamination.

.2 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

.3 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.4 Topsoil: Stockpile in locations indicated on Drawings.

.1 Maximum stockpile height: 2 m.

.5 Fill materials: Stockpile fill materials in locations indicated on Drawings.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Maximum stockpile height: 2 m.

3.5 COFFERDAMS, SHORING, BRACING, AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

.2 Construct temporary works to depths, heights, and locations as acceptable to the Departmental Representative.

.3 During backfill operation:

.1 Remove sheeting and shoring from excavations, unless otherwise indicated or directed by the Departmental Representative.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.

.4 Cut off sheeting tops required to remain in place, at elevations as indicated on Drawings.

.5 Upon completion of substructure construction:

.1 Remove cofferdams, shoring, and bracing.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water in accordance with Section 01 71 00 - Examination and Preparation.

.2 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

3.7 EXCAVATION AND TRENCHING

.1 Excavation classes:

.1 Common excavation: Excavation of materials excluding rock excavation.

.2 Rock excavation: Excavation of solid materials in excess of 1 m^3 and that cannot be removed by means of heavy-duty mechanical excavating equipment with 0.95 m^3 to 1.15 m^3 bucket. Frozen material is not classified as rock.

.2 Excavate and trench to lines, grades, elevations, and dimensions as indicated on Drawings.

.3 Remove concrete, masonry, paving, walks, demolished foundations, rubble and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.4 Trenching: Excavate trenches maximum 30 m ahead of installation; leave maximum 15 m exposed at end of each work day. Obtain department representative's written authorization to exceed these limits.

.5 Leave excavation and trench soil bottoms undisturbed, level, and free from loose, soft, or organic matter.

.6 Remove unsuitable material from trench bottoms, including those that extend below required elevations, to extent and depth as directed by the department representative.

.7 Hand trim, make firm, and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout as acceptable to the Department representative.

.8 Install geotextiles in accordance with Section 31 32 19.16 - Geotextile Soil Stabilization.

.9 Site quality control:

.1 Site tests and inspections:

.1 Arrange for department representative review when bottom of excavation is reached.

.2 Non-conforming work:

.1 Correct unauthorized over-excavation:

.1 Fill under bearing surfaces and footings with Type 3 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.

3.8 FILLING AND COMPACTION

.1 Use fill types as indicated on Drawings or specified. Compaction densities are percentages of maximum densities obtained from ASTM D698.

.1 Exterior sides of perimeter walls: Use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.

.2 Within building areas: Use Type 2 to underside of base course for floor slabs. Compact to 100% of corrected maximum dry density.

.3 Under concrete slabs: Provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.

.4 Retaining walls: Use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95%. Use Type 3 fill compacted to 95% for remaining portions.

.5 Place unshrinkable fill in areas as indicated on Drawings.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated on Drawings and in accordance with Section 33 14 16 - Site Water Utility Distribution Piping, Section 33 31 11 - Public Sanitary Sewerage Gravity Piping, and Section 33 41 16 - Sub-drainage Piping.

.2 Place bedding and surround material in unfrozen condition.

.3 French drains:

.1 Slope bedding under French drains minimum 1:100.

.2 Lay French drain piping with perforations facing downward.

.3 Backfill with Type 2 fill to maximum 150 mm compacted thickness over pipe.

3.10 BACKFILLING

.1 Vibratory compaction equipment: Maximum 15kN and 50 Hz.

.2 Proceed with backfilling operations after:

- .1 The department representative has reviewed installations and work below finished grades.
- .2 Inspection, testing, approval of regulatory authorities, and recording location of underground utilities.
- .3 Removal of concrete formwork.
- .4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.3 Verify areas to be backfilled are free from debris, snow, ice, water, and frozen ground.

.4 Use backfill material that is not frozen or containing ice, snow, or debris.

.5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated on Drawings. Compact each layer before placing succeeding layer.

.6 Backfilling around installations:

- .1 Place bedding and surround material as specified in related technical sections.
- .2 Allow cast-in-place concrete to cure minimum 24 hours before backfilling.
- .3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 150 mm.
- .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
  - .1 allow concrete to cure minimum 14 days, or until it has sufficient strength to withstand earth and compaction pressure, or the department representative confirms curing is complete; or
  - .2 if acceptable to the department representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is acceptable to the department representative.

.7 Place unshrinkable or recycled fill in areas as indicated on Drawings.

.8 Consolidate and level unshrinkable fill with internal vibrators.

.9 Install drainage system in backfill as indicated on Drawings.

3.11 RESTORATION

.1 Restore backfilled areas in accordance with Section 02 41 13 - Selective Site Demolition.

3.12 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.2 Waste management:

- .1 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal, and:
  - .1 Remove and dispose of excavated material unsuitable for use in the work.
  - .2 Remove and dispose of surplus excavated materials as indicated on Drawings.

3.13 PROTECTION

.1 Protect partially installed and completed work from damage in accordance with Section 01 76 00 - Protecting Installed Construction, and:

.1 Restrict vehicle operations directly adjacent to open trenches.

.2 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.3 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

SECTION 31 32 19.16
GEOTEXTILE SOIL STABILIZATION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling

.2 Section 33 41 16 - Sub-drainage Piping

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.2 ASTM D3787-16, Standard Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test

.3 ASTM D4491M-22, Standard Test Methods for Water Permeability of Geotextiles by Permittivity

.4 ASTM D4595-23, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Method

.5 ASTM D4716M-22, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head

.6 ASTM D4751-21a, Standard Test Method for Determining Apparent Opening Size of a Geotextile

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-4.2 No. 11.2-M89, Textile Test Methods - Bursting Strength - Ball Burst Test

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes

.1 No. 2-M85, Methods of Testing Geosynthetics - Mass per Unit Area

.2 No. 3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles

.3 No. 6.1-93, Methods of Testing Geotextiles and Geomembranes Bursting Strength of Geotextiles Under No Compressive Load

.4 No. 7.3-92, Methods of Testing Geotextiles and Geomembranes Grab Tensile Test for Geotextiles

.5 No. 10-94, Methods of Testing Geosynthetics: Geotextiles - Filtration Opening Size

.3 CSA Group (CSA):

.1 CSA G40.20-13/G40.21-13, General requirements for rolled or welded structural quality steel/Structural quality steel

.4 Ontario Provincial Standard Specifications (OPSS):

.1 OPSS 1860-2019, Material Specification for Geotextiles

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit the following action submittals minimum 4 weeks before starting work of this Section:

.1 Product data: Product literature and data sheets for geotextiles, including product characteristics, performance criteria, physical sizes, finishes, and limitations.

.2 Samples:

.1 Minimum length of 2 m of roll width of geotextile.

.2 Methods of joining.

.3 Source Quality Control Submittals:

.1 Mill test data.

.2 Certificates: Certifying materials that comply with specified performance characteristics and physical properties, and signed by the manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and:

.1 Inspect geotextiles, upon delivery, to confirm materials have good appearance qualities and are free from defects that might affect their specific properties.

.2 Store and protect geotextiles from direct sunlight and UV rays.

PART 2 PRODUCTS

2.1 MATERIAL

.1 Geotextiles: Non-woven synthetic fibre fabric, supplied in rolls.

.1 Composed of minimum 85%, by mass, of propylene.

.2 Width: 2 m minimum.

.3 Length: 100 m minimum.

.4 Physical properties:

.1 Thickness: To CAN/CGSB-148.1, No. 3, minimum 1.5 mm.

.2 Mass per unit area: To CAN/CGSB-148.1, No. 2, minimum 150 g/m^2.

.3 Tensile strength and elongation (in any principal direction): To ASTM D4595.

.1 Tensile strength: Minimum 400 N, wet condition.

.2 Elongation at break: 50-100%.

.3 Seam strength: Minimum equal to or greater than tensile strength of fabric.

.4 Grab tensile strength and elongation: To CAN/CGSB-148.1, No. 7.3.

.1 Breaking force: Minimum 400 N, wet condition.

.2 Elongation at break: 50-100%.

.5 Ball burst strength: To CAN/CGSB-4.2, No. 11.2, minimum 1500 N, wet condition.

.6 Bursting strength: To CAN/CGSB-148.1, No.6.1, minimum 1500 kPa, wet condition.

.5 Hydraulic Properties:

.1 Apparent opening size (AOS): To ASTM D4751, 150-425 µm.

.2 Filtration opening size (FOS): To CAN/CGSB-148.1 No.10/OPSS 1860, 150-425 µm.

.3 Transmissivity: To ASTM D4716/D4716M, minimum $1x10^{-4}$ to $1x10^{-3}$ m^2/s.

.4 Permittivity: To ASTM D4491/D4491M, 0.5-2.0 per s.

.6 Factory seams: Sewn in accordance with manufacturer's recommendations.

.7 Thread for sewn seams: Equal or higher resistance to chemical and biological degradation than geotextile.

.2 Securing Pins and Washers: To CSA G40.20/G40.21, Grade 300W, hot-dip galvanized with minimum zinc coating of 600 g/m^2 to ASTM A123/A123M.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation, manner, and locations indicated on Drawings. Secure in position with securing pins and washers spaced at 0.6 m on-center.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Overlap each successive strips of geotextile 600 mm over previously laid strip.

.5 Pin successive strips of geotextile with securing pins and washers at 0.6 m interval at midpoint of lap.

.6 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling and 33 41 16 - Sub-drainage Piping.

3.2 PROTECTION

.1 Protect installed geotextile material from displacement, damage, or deterioration before, during, and after placement of material layers.

.2 Vehicular traffic is not permitted directly on geotextile.

.3 Avoid overloading soil or aggregate on geotextile.

.4 Replace damaged or deteriorated geotextile to acceptance of the department representative.

END OF SECTION

SECTION 31 37 00
RIP-RAP

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregates for Earthwork

.2 Section 31 32 19.16 – Geotextile soil stabilization

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C109/C109M-21, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50 mm Cube Specimens)

.2 ASTM C144-18, Standard Specification for Aggregate for Masonry Mortar

.3 ASTM C185-20, Standard Test Method for Air Content of Hydraulic Cement Mortar

.4 ASTM C618-23e1, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

.5 ASTM C952-12, Standard Test Method for Bond Strength of Mortar to Masonry Units

.6 ASTM C1506-17, Standard Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters

.2 CSA Group (CSA):

.1 CSA A23.1/A23.2:19, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

.2 CAN/CSA-A179-14, Mortar and grout for unit masonry

.3 CSA A3000-18, Cementitious materials compendium

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Product literature and data sheets for stone, geotextile filter, ready-mixed mortar and grout, including product characteristics, performance criteria, physical sizes, finishes, WHMIS SDSs, and limitations.

PART 2 PRODUCTS

2.1 MATERIAL

.1 Stone:

.1 Hard, dense, durable quarry stone, free from seams, cracks or other structural defects, to meet the following size distribution for use intended:

.1 Armour rip-rap:

.1 Maximum of 10% of total volume of stones, with individual volume less than 30 dm^3.

.2 Minimum of 50% of total volume of stones, with individual volume of 225 dm^3 or more.

.3 Remaining percentage of total volume with uniform distribution of stones between 30 and 225 dm^3.

.2 Heavy rip-rap:

.1 Maximum of 10% of total volume of stones, with individual volume less than 30 dm^3.

.2 Minimum of 50% of total volume of stones, with individual volume of 140 dm^3 or more.

.3 Remaining percentage of total volume with uniform distribution of stones between 30 and 140 dm^3.

.3 Random rip-rap:

.1 Maximum of 10% of total volume of stones, with individual volume less than 15 dm^3.

.2 Minimum of 50% of total volume of stones, with individual volume of 85 dm^3 or more.

.3 Remaining percentage of total volume with uniform distribution of stones between 15 and 85 dm^3.

.4 Hand placed rip-rap:

.1 Minimum volume of individual stones 10 dm^3.

.2 Maximum of 75% of total volume of stones with individual volume of 25 dm^3 or more.

.3 Supply rock spalls or cobbles to fill open joints.

.2 Geotextile Filter:

.1 Geotextile soil stabilization: In accordance with Section 31 32 19.16 - Geotextile Soil Stabilization.

.3 Bedding Material:

.1 Aggregate: Sand, gravel, or crushed rock, well graded, or poor graded with a maximum particle size of 50 mm.

.2 Compose material of tough, durable particles.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: In accordance with Section 01 71 00 - Examination and Preparation.

3.2 SURFACE PREPARATION

.1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated on Drawings.

.2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable aggregate material and compact to provide firm bed.

3.3 PLACING

.1 Place rip-rap to thickness and details as indicated on Drawings.

.2 Produce a well graded mass with a maximum 5% of voids, in conformance with lines and grades indicated.

.3 Place stones in manner acceptable to department representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.2 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

.3 Fold up metal banding, flatten and place in designated area for recycling.

.4 Divert left over aggregate materials from landfill to local facility acceptable to department representative for reuse.

END OF SECTION

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 - Aggregate Materials

.2 Section 32 11 16.01 - Granular Sub-base

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing

.2 ASTM C131/C131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.3 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3)

.5 ASTM D1557-12, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3)

.6 ASTM D1883-16, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils

.7 ASTM D4318-17el, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

1.3 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 The Contractor to supply granular base material at pit.

1.4 MEASUREMENT AND PAYMENT

.1 This item forms part of the stipulated contract lump sum.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Sustainable Design Submittals:

.1 Regional Materials: Submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for the Project.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 31 05 16 - Aggregate Materials.

.2 Storage and Handling Requirements:

.1 Stockpile minimum 50% of total aggregate required prior to beginning operation.

.2 Store materials in clean dry location and in accordance with manufacturer's recommendations.

.3 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

.3 Packaging Waste Management: Remove for reuse by manufacturer of pallets as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and the following requirements:

.1 Crushed stone or gravel.

.2 Gradations to be within limits specified when tested to ASTM C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.1 Gradation Method #2:

	% Passing		
Sieve Designation	**Granular A**	**Granular B (Type 1)**	**Granular B (Type 2)**
150 mm	-	100	-
106 mm	-	-	100
37.5 mm	-	-	-
26.5 mm	100	50-100	50-100
19 mm	85-100	-	-
13.2 mm	65-90	-	-
9.5 mm	50-73	-	-
4.75 mm	35-55	20-100	20-55
1.18 mm	15-40	10-100	10-40
0.300 mm	5-22	2-65	2-22
0.150 mm	-	-	-

0.075 mm	2-8	0-8	0-10

.2 Gradation Method #2 to: CAN/CGSB-8.2 Granular A, Granular B (Type I) shall not exceed 8% passing 0.075 sieve. Granular B (Type II) shall not exceed 10% passing 0.075mm sieve.

.3 Liquid limit: To ASTM D4318, maximum 25

.4 Plasticity index: To ASTM D4318, maximum 6.

.5 Los Angeles degradation: To ASTM C131/C131M. Max.% loss by weight: 45

.6 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136/C136M.

Passing	**Retained on**
50 mm	to 25 mm
25 mm	to 19.0 mm
19.0 mm	to 4.75 mm

.7 Soaked CBR: to ASTM D1883, minimum 100, when compacted to 100% of ASTM D1557.

PART 3 EXECUTION

3.1 PLACEMENT AND INSTALLATION

.1 Place granular base after subgrade surface is inspected and approved in writing by department representative.

.2 Placing:

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Place material using methods which do not lead to segregation or degradation of aggregate.

.5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.1 Department representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.7 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment:

.1 Ensure compaction equipment is capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from department representative before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compacting:

.1 Compact to density not less than 98% maximum dry density to ASTM D698.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by department representative.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Divert unused granular material from landfill to local facility approved by department representative.

3.4 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by department representative.

END OF SECTION

SECTION 32 11 16.01
GRANULAR SUB-BASE

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 - Aggregate Materials

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing

.2 ASTM C131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.3 ASTM C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.4 ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils

.5 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3)

.6 ASTM D1557-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3)

.7 ASTM D1883-16, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils

.8 ASTM D4318-17el, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

1.3 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Granular based material: supplied by Contractor at pit.

1.4 MEASUREMENT AND PAYMENT

.1 This item forms part of the stipulated contract lump sum.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table 1:

	% Passing		
Sieve Designation	**Granular A**	**Granular B (Type 1)**	**Granular B (Type 2)**
150 mm	-	100	-
106 mm	-	-	100
37.5 mm	-	-	-
26.5 mm	100	50-100	50-100
19 mm	85-100	-	-
13.2 mm	65-90	-	-
9.5 mm	50-73	-	-
4.75 mm	35-55	20-100	20-55
1.18 mm	15-40	10-100	10-40
0.300 mm	5-22	2-65	2-22
0.150 mm	-	-	-
0.075 mm	2-8	0-8	0-10

.4 Other properties as follows:

.1 Liquid Limit: to ASTM D4318, Maximum 25.

.2 Plasticity Index: to ASTM D4318, Maximum 6.

.3 Los Angeles degradation: to ASTM C131M.

.1 Maximum loss by mass: 40%.

.4 Soaked CBR: to ASTM D1883, Minimum 40 when compacted to 100% of ASTM D1557.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from department representative.

3.2 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by department representative.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.1 Department representative may authorize thicker lifts if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace portion of layer in which material has become segregated during spreading.

3.3 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from department representative before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698.

.5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.6 Apply water as necessary during compaction to obtain specified density.

.7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by departmental representative.

.8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.6 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by department representative.

END OF SECTION

SECTION 32 12 10
MARSHALL IMMERSION TEST FOR BITUMEN

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 32 12 16-Asphalt Paving.

1.2 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASTHO)

.1 AASHTO T245-97-UL-2004, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

.2 Ministry of Transportation Ontario (MTO)

.1 MTO Laboratory Testing Manual-09: LS-283, Resistance to Stripping of Asphalt Cement in Bituminous Mixtures by Immersion Marshall.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:

.1 Submit 1 sample of each proposed asphalt paving mixture. Ensure the sample has enough material for the test preparation in 3.1.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Representative samples of each asphalt paving mixture proposed for use on Project.

2.2 EQUIPMENT

.1 One or more water baths with automatic controls for immersing specimens. Baths normally used for Marshall Immersion Test are suitable for test.

.2 Scale and water bath with suitable accessory equipment for weighing test specimens in air and in water to determine their densities.

.3 Flat transfer plates of glass or metal. Keep 1 plate under each specimen during immersion period and during subsequent handling, except when weighing and testing, to prevent breakage or distortion of specimens.

.4 Apparatus required to conduct Marshall Immersion Test.

PART 3 EXECUTION

3.1 PREPARATION

.1 Prepare at least 8 specimens for each test with a hand-operated hammer, in accordance with AASHTO T245-97-UL and LS-283, except where specified otherwise.

3.2 TEST PROCEDURE

.1 Do Marshall testing to AASHTO T245-97-UL.

.2 Weigh each specimen in air and in water. Weigh in water as rapidly as possible to minimize absorption.

.3 Calculate specific gravity of each specimen as follows:

.1 Specific Gravity = A/A-B

.2 Where A = weight of specimen in air in grams

.3 B = weight of specimen in water in grams

.4 Sort each set of 8 specimens into 2 groups of 4 specimens each so that average specific gravity of specimens in group 1 is essentially same as that of group 2.

.5 Test group 1 specimens for Marshall stability. Calculate S1 = Marshall stability of group 1 (average).

.6 Immerse group 2 specimens in water for 24 hours at 60 degrees C, then test immediately for Marshall stability. Calculate S2 = Marshall stability of group 2 (average).

3.3 CLOSEOUT ACTIVITIES

.1 Report test results to department representative.

.2 Report numerical index of retained stability as resistance of asphaltic paving mixtures to detrimental effect of water, expressed as percentage of original stability retained after immersion period.

.3 Calculate index as follows:

.1 Index of Retained Stability = S2/S1 x 100.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 - Aggregate Materials General

.2 Section 32 12 10 - Marshall Immersion Test for Bitumen

.3 Section 32 12 13.16 - Asphalt Tack Coats

.4 Section 32 12 13.23 - Asphalt Prime Coats

1.2 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO):

.1 AASHTO M320-21, Standard Specification for Performance Graded Asphalt Binder

.2 AASHTO R29-15, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder

.3 AASHTO T245-15, Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus

.2 Asphalt Institute (AI):

.1 AI MS-2-1994, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types

.3 ASTM International (ASTM):

.1 ASTM C88/C88M-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate

.2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing

.3 ASTM C123/C123M-14, Standard Test Method for Lightweight Particles in Aggregate

.4 ASTM C127-15, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate

.5 ASTM C128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

.6 ASTM C131/C141M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.7 ASTM C136/C136M-19, Standard Method for Sieve Analysis of Fine and Coarse Aggregates

.8 ASTM C207-18, Standard Specification for Hydrated Lime for Masonry Purposes

.9 ASTM D995-95b, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

.10 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

.11 ASTM D3203/C3203M-17, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures

.12 ASTM D4791-19, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series

.2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric

1.3 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

.1 Notify department representative and supplier authorized to release material of proposed date for use of materials; order and schedule shipments to coincide with construction schedule.

1.4 MEASUREMENT AND PAYMENT

.1 This item forms part of the stipulated contract lump sum.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks before beginning work.

.3 Samples:

.1 Inform department representative of proposed source of aggregates and provide access for sampling 4 weeks before beginning work.

.2 Submit samples of the following materials proposed for use 4 weeks before beginning work.

.1 Two 2 L container of asphalt cement.

.2 1 kg of hydrated lime.

.4 Test and Evaluation Reports:

.5 Certificates:

.1 Certification to be marked on pipe.

.6 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.

.2 Submit asphalt concrete mix design and trial mix test results to department representative for review at least 4 weeks before beginning work.

.3 Submit printed record of mix temperatures at end of each day.

.7 Sustainable Design Submittals:

.1 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for the Project.

.2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Submit to department representative copies of freight and waybills for asphalt cement as shipments are received.

.1 department representative reserves right to check weights as material is received.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Performance graded asphalt cement: To AASHTO M320, grade PG 58 - 28 when tested to AASHTO R29.

.2 Aggregates: in accordance with Section 31 05 16 - Aggregate Materials General and requirements as follows:

.1 Crushed stone or gravel.

.2 Gradations: within limits specified when tested to ASTM C136/C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table:

Sieve Designation	Lower Course	Surface Course
25 mm	-	-
19 mm	100	-
16 mm	98-100	100
13.2	83-95	98-100
9.5 mm	62-82	75-90
4.75 mm	45-60	50-60
2.36 mm	27-60	36-60
1.18 mm	16-60	25-58
0.600 mm	8-47	16-45
0.300 mm	4-27	7-26

0.150 mm	1-10	3-10
0.075 mm	0-6	0-5

.4 Coarse Aggregate: Aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136M.

.5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.6 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.7 Sand equivalent: ASTM D2419. Min: 50.

.8 Magnesium Sulphate soundness: To ASTM C88M. Max% loss by mass:

.1 Coarse aggregate surface course: 12%

.2 Coarse aggregate lower course: 12%

.3 Fine aggregate, surface course: 16%

.4 Fine aggregate, lower course: 16%

.9 Los Angeles degradation: Grading B, to ASTM C131M. Max% loss by mass:

.1 Coarse aggregate, surface course: 25%

.2 Coarse aggregate, lower course: 35%

.10 Absorption: To ASTM C127. Max% by mass:

.1 Coarse aggregate, surface course: 1.75%

.2 Coarse aggregate, lower course: 2.00%

.11 Loss by washing: To ASTM C117. Max% passing 0.075 mm sieve:

.1 Coarse aggregate, surface course: 1.5%

.2 Coarse aggregate, lower course: 2.0%

.12 Lightweight particles: To ASTM C123M. Max% by mass less than 1.95 relative density:

.1 Surface course: 1.5%

.2 Lower course: 3.0%

.13 Flat and elongated particles: To ASTM D4791, (with length to thickness ratio greater than 5): Max% by mass:

.1 Coarse aggregate, surface course: 15%

.2 Coarse aggregate, lower course: 15%

.14 Crushed fragments: At least 60% of particles by mass within each of the following sieve designation ranges, to have 1 minimum freshly fractured face. Material to be divided into ranges, using methods of ASTM C136M.

Passing	**Retained on**

25 mm to 12.5 mm

12.5 mm to mm

.15 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.3 Mineral filler:

.1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by department representative are thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by department representative to improve mix properties.

.3 Ensure mineral filler is dry and free flowing when added to aggregate.

.4 Anti-stripping agent: Hydrated lime to ASTM C207 type N.

.1 Add lime at rate of approximately 2-3% of dry weight of aggregate.

.5 Water: To approval of department representative.

2.2 EQUIPMENT

.1 Pavers: Mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: Sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Drum diameter: 1200 mm minimum.

.2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.

.4 Haul trucks: Sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by department representative, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

2.3 MIX DESIGN

.1 Mix design to be approved in writing by department representative.

.2 Mix design to be developed by testing laboratory approved in writing by department representative.

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 50.

.2 Mix physical requirements:

Property	Roads
Marshall Stability at 60 degrees C kN min	8.9 surface course/ 8.0 lower course
Flow Value mm	1.6
Air Voids in Mixture,%	3.5-4.5 surface course
Voids in Mineral Aggregate,% min	14 surface course/ 13 lower course
Index of Retained Stability% minimum	75

.3 Measure physical requirements as follows:

.1 Air voids: To ASTM D3203M.

.2 Voids in mineral aggregates: To MS2.

.3 Index of Retained Stability: Measure in accordance with Section 32 12 10 - Marshall Immersion Test for Bitumen.

.4 Do not change job-mix without prior approval of department representative. When change in material source proposed, new job-mix formula will be provided to be reviewed by department representative.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the department representative.

3.2 PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:

.1 To ASTM D995.

.2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.

.1 Do not load frozen materials into bins.

.3 Feed cold aggregates to plant in proportions to ensure continuous operations.

.4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.5 Before mixing, dry aggregates to moisture content not greater than 1% by mass or to lesser moisture content if required to meet mix design requirements. Heat to temperature required to meet mixing temperature as directed by departmental representative.

.6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.

.7 Store hot screened aggregates in manner to minimize segregation and temperature loss.

.8 Heat asphalt cement and aggregate to mixing temperature directed by departmental representative. Do not heat asphalt cement above 160 degrees C.

.9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, departmental representative to approve temperature of completed mix at plant and at paver after considering hauling and placing conditions.

.10 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.

.11 Mixing time:

.1 In batch plants, both dry and wet mixing times as directed by departmental representative. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.

.2 In continuous mixing plants, mixing time as directed by departmental representative but not less than 45s.

.3 Mixing time as directed by departmental representative.

.2 Dryer drum mixing plant:

.1 To ASTM D995.

.2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.

.4 Meter total flow of aggregate using electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump to ensure proportions of aggregate and asphalt entering mixer remain constant.

.5 Allow for easy calibration of weighing systems for aggregates without having material enter mixer.

.6 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.1 Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time.

.2 Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.

.7 Make provision for conveniently sampling full flow of materials from cold feed.

.8 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed before entering drum.

.9 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

.10 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream.

.1 Control heating to prevent fracture of aggregate or excessive oxidation of asphalt.

.2 Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator.

.3 Submit printed record of mix temperatures at end of each day.

.11 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is 2% maximum.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 3 hours.

.4 While producing asphalt mix for this Project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied to this project.

.5 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass).

4.75 mm sieve and larger

2.00 mm sieve

0.425 mm sieve

0.180 mm sieve

0.075 mm sieve 2.0

.2 Permissible variation of asphalt cement from job mix: 0.25%.

.3 Permissible variation of mix temperature at discharge from plant: [5] degrees C.

.6 Addition of anti-stripping agent:

.1 Plant to be equipped with pug mill to thoroughly mix aggregates and lime before entering the plant.

.2 Plant to be equipped with suitable conveyor systems capable of supplying aggregates and lime at constant rate.

.3 Plant and equipment used for addition of lime to be equipped with covers to control loss of lime.

.4 Plant to be equipped to control rate of lime incorporation to within 1/4%.

.5 Add water to aggregate before entering pug mill.

.6 Add water to lime sufficiently in advance to permit time to slake before entering pug mill.

3.3 PREPARATION

.1 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.

.1 When levelling course is not required, patch and correct depressions and other irregularities to approval of department representative before beginning paving operations.

.2 Apply tack coat in accordance with Section 32 12 13.16 - Asphalt Tack Coats before paving.

.3 Before laying mix, clean surfaces of loose and foreign material.

3.4 TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.

.1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.

.3 Schedule delivery of material for placing in daylight, unless department representative approves artificial light for night placing.

.4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.

.1 Do not dribble mix into trucks.

.5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.

.6 Deliver loads continuously in covered vehicles and immediately spread and compact.

.1 Deliver and place mixes at temperature within range as directed by department representative, but not less than 135 degrees C.

3.5 PLACING

.1 Obtain department representative's approval of granular road base or base course and tack coat before placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as indicated in the contract drawings.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.

.2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.

.3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place asphalt concrete in compacted lifts of thickness as follows:

.1 Lower course in 1 layer of 40 mm.

.2 Surface course in 1 layer of maximum 40 mm.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 500 mm.

.6 Spread and strike off mixture with self propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings.

.1 department representative to establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.

.2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver.

.1 Work pavers as close together as possible and in no case permit them to be more than 30 m apart.

.3 Maintain constant head of mix in auger chamber of paver during placing.

.4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.5 Correct irregularities in alignment left by paver by trimming directly behind machine.

.6 Correct irregularities in surface of pavement course directly behind paver.

.1 Remove excess material forming high spots using shovel or lute.

.1 Fill and smooth indented areas with hot mix.

.2 Do not broadcast material over such areas.

.7 Do not throw surplus material on freshly screeded surfaces.

.7 When hand spreading is used:

.1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.

.1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.2 Distribute material uniformly without broad casting material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.

.1 Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt.

.1 Control temperature to avoid burning material.

.2 Do not use tools at higher temperature than temperature of mix being placed.

3.6 COMPACTING

.1 Do not change rolling pattern unless mix changes or lift thickness changes.

.1 Change rolling pattern only as directed by department representative.

.2 Roll asphalt continuously to density not less than 92% - 96.5% of 50 blow Marshall density to AASHTO T245.

.3 General:

.1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.

.4 Use static compaction for levelling coarse less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per meter of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

.1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.4 Breakdown rolling:

.1 Begin breakdown rolling with static steel wheeled roller immediately following rolling of transverse and longitudinal joint and edges.

.2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.

.4 Use only experienced roller operators.

.5 Intermediate rolling:

.1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.

.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.6 Finish rolling:

.1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.

.1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.

.2 Conduct rolling operations in close sequence.

3.7 JOINTS

.1 General:

.1 Remove surplus material from surface of previously laid strip.

.1 Do not deposit on surface of freshly laid strip.

.2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.

.3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material before placing adjacent pavement.

.2 Transverse joints:

.1 Offset transverse joint in succeeding lifts by at least 600 mm.

.2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt before continuing paving.

.3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:

.1 Offset longitudinal joints in succeeding lifts by at least 150 mm.

.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C before paving of adjacent lane.

.1 For airfield runway paving, avoid cold joint construction in mid 30 m of runway.

.2 If cold joint can not be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.

.3 Overlap previously laid strip with spreader by 25 to 50 mm.

.4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.

.5 Roll longitudinal joints directly behind paving operation.

.6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.

.1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.

.5 Construct butt joints as indicated.

3.8 FINISH TOLERANCES

.1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

3.9 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.10 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

SECTION 32 12 13.16
ASPHALT TACK COATS

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 32 12 16 – Asphalt Paving.

1.2 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M081-92-UL-04, Standard Specification for Cutback Asphalt (Rapid-Curing Type).

.2 ASTM International

.1 ASTM D140/D140M-09, Standard Practice for Sampling Bituminous Materials.

.2 ASTM D633-11, Standard Volume Correction Table for Road Tar.

.3 ASTM D1250-08, Standard Guide for Use of the Petroleum Measurement Tables.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.3 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Departmental Representative will supply:

.1 Asphalt tack coat material delivered by tank truck.

1.4 MEASUREMENT AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt tack coat and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit two - 4 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars, bottles made with plastic, or plastic lined cans to department representative, at least 2 weeks prior to beginning Work.

.2 Sample asphalt tack coat material to: ASTM D140.

.3 Provide access on tank truck for department representative to sample asphalt material to be incorporated into Work to ASTM D140.

1.6 QUALITY ASSURANCE

.1 Upon request from department representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect asphalt tack coats from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Deliver, store and handle materials in accordance with ASTM D140.

.5 Provide, maintain and restore asphalt storage area.

.6 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1h.

.2 Cut-back asphalt; to AASHTO M081-92-UL, grade RC-70 or RC-250.

.3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

.1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.

.2 Pressure distributor:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5 m.

.3 Applied at readily determined and controlled rates from 0.2 to 5.4 $L/m^2$with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m^2.

.4 Distribute in uniform spray without atomization at temperature required.

.2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow metre graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.1 Measure temperature to closest whole number.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.

.8 Cleaned if previously used with incompatible asphalt material.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt tack coat installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from department representative.

3.2 APPLICATION

.1 Apply asphalt tack coat only on clean and dry surface.

.2 Dilute asphalt emulsion with water at 1:1 ratio for application.

.1 Mix thoroughly by pumping or other method approved by departmental representative.

.3 Apply asphalt tack coat evenly to pavement surface at rate as directed by departmental representative, between 0.09 and 0.5 L/m^2 but not to exceed 0.7 L/m^2.

.4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.5 Apply asphalt tack coat only when air temperature greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.

.6 Apply asphalt tack coat only on unfrozen surface.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.

.8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.

.1 Control traffic in accordance with Section 01 55 26 - TRAFFIC CONTROL.

.9 Keep traffic off tacked areas until asphalt tack coat has set.

.10 Re-tack contaminated or disturbed areas as directed by department representative.

.11 Permit asphalt tack coat to set break before placing asphalt pavement.

.12 Submit summary report within 7 days minimum of date of application and include information as follows:

- .1 Total area tack coated.
- .2 Quantity of tack coat used.
- .3 Mean application rate.
- .4 Actual product quantity used when using equipment on pressure distributors.
- .5 Dipstick measurements or electronic printouts are acceptable.

.13 Carry out measurements in presence of department representative upon request.

.14 Inspect tack coat application to ensure uniformity.

- .1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by department representative.
- .2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal Requirements.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

SECTION 32 12 16.02
ASPHALT PAVING FOR BUILDING SITES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 32 12 16 – Asphalt Paving

.2 Section 31 05 16 - Aggregate Materials

.3 Section 32 12 10 - Marshall Immersion Test for Bitumen

.4 Section 32 12 13.16 - Asphalt Tack Coats

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C88/C88M-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate

.2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing

.3 ASTM C123/C123M-14, Standard Test Method for Lightweight Particles in Aggregate

.4 ASTM C127-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

.5 ASTM C128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

.6 ASTM C131/C131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.7 ASTM C136/C136M-19, Standard Method for Sieve Analysis of Fine and Coarse Aggregates

.8 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3)

.9 ASTM D995-95b, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

.10 ASTM D1557-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3)

.11 ASTM D1559-89, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

.12 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

.13 ASTM D3203/D3203M-17, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures

.14 ASTM D4318-17el, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

.15 ASTM D4791-19, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

.2 Asphalt Institute (AI):

.1 AI MS-2-94, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series

.2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric

1.3 MEASUREMENT AND PAYMENT

.1 This item forms part of the stipulated contract lump sum.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt paving mix, aggregate, and coatings and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit asphalt concrete mix design and trial mix test results for review.

.2 Inform department representative and Owner of proposed source of aggregates and provide access for sampling at least 4 weeks before commencing work.

.3 Submit samples of following materials proposed for use at least 4 weeks before commencing work:

.1 Two 2 L containers of asphalt cement.

.4 Test and Evaluation Reports:

.1 Materials to be tested by third party testing laboratory approved by department representative.

.2 Submit test certificates showing suitability of materials at least 4 weeks before commencing work.

.5 Sustainable Design Submittals:

.1 Regional Materials: Submit evidence that the Project incorporates required percentage of regional materials and products, showing their cost, distance from the Project to furthest site of extraction or manufacture, and total cost of materials for the Project.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect aggregate from damage.

.3 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular base and sub-base material: To Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations: within limits specified when tested to ASTM C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table 1:

Sieve Designation	Granular Base	Granular Sub-Base
150 mm	-	100
106 mm	-	-
37.5 mm	-	-
26.5 mm	100	50-100
19 mm	85-100	-
13.2 mm	65-90	-
9.5 mm	50-73	-
4.75 mm	35-55	20-100
1.18 mm	15-40	10-100
0.300 mm	5-22	2-65
0.150 mm	-	-
0.075 mm	2-8	0-8

.4 Granular base aggregates:

.1 Crushed particles: at least 60% of particles by mass retained on 4.75 mm sieve to have at least 1 freshly fractured face.

.2 Liquid limit: To ASTM D4318, maximum 25.

.3 Plasticity index: To ASTM D4318, maximum 6.

.2 Asphalt concrete aggregates:

.1 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C117.

.2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.3 Separate stock piles for coarse and fine aggregate are not required for sheet asphalt.

.4 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.5 Aggregate: material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed stone or gravel.

.2 Gradations to be within limits specified when tested to ASTM C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table 2:

Sieve Designation	Lower Course	Surface Course
25 mm	-	-
19 mm	100	-
16 mm	98-100	100
13.2	83-95	98-100
9.5 mm	62-82	75-90
4.75 mm	45-60	50-60
2.36 mm	27-60	36-60
1.18 mm	16-60	25-58
0.600 mm	8-47	16-45
0.300 mm	4-27	7-26
0.150 mm	1-10	3-10
0.075 mm	0-6	0-5

.4 Sand equivalent: To ASTM D2419, Minimum 50.

.5 Magnesium Sulphate soundness: To ASTM C88M. Max% loss by weight: coarse aggregate 12, fine aggregate 16.

.6 Los Angeles Degradation: To ASTM C131M. Max% loss by weight: coarse aggregate, 35.

.7 Absorption: To ASTM C127. Max% by weight: coarse aggregate, 1.75.

.8 Lightweight particles: To ASTM C123/C123M. Max% by mass, with less than 1.95. Relative density (formally Specific Gravity): 1.5.

.9 Flat and elongated particles: To ASTM D4791, (with length to thickness ratio greater than 5): Max% by weight: coarse aggregate, 15.

.10 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136M.

Table 3:

Passing	Retained on
19 mm	to 9.5 mm
9.5 mm	to 4.75 mm

.11 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.3 Mineral filler for asphalt concrete:

.1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by department representative to improve mix properties.

.4 Asphalt tack coat: To 32 12 1316-Asphalt Tack Coats.

2.2 EQUIPMENT

.1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers for parking lots and driveways:

.1 Minimum drum diameter: 750 mm.

.2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.

.4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.5 Suitable hand tools.

2.3 MIX DESIGN

.1 Mix design to AI MS-2.

.2 Job mix formula to be approved by department representative.

.3 Design of mix: by Marshall method to requirements below:

.1 Compaction blows on each face of test specimens: 50.

.2 Mix physical requirements:

Property	Parking Lots
Marshall Stability at 60 degrees C, kN minimum.	8.9 surface course/ 8.0 lower course
Flow Value, mm.	1.6
Air Voids in Mixture,%	3.5-4.5 surface course
Voids in Mineral Aggregate,% minimum	14 surface course/ 13 lower course
Index of Retained Stability,% minimum	75

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: To ASTM D1559.

.2 Air voids: To ASTM D3203M.

.3 Voids in mineral aggregate: To AI MS-2, chapter 4.

.4 Index of Retained Stability: Measure in accordance with Section 32 12 10 - Marshall Immersion Test for Bitumen.

.4 Do not change job-mix without prior approval of department representative. When change in material source proposed, new job-mix formula will be provided to the department representative for approval.

.5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from department representative.

3.2 SUBGRADE AND SURFACE PREPARATION AND INSPECTION

.1 Verify grades of subgrade drains and other items set in paving area for conformity with elevations and sections before placing granular base and sub-base material. If asphalt concrete is to be placed directly on existing asphalt concrete, ensure surface is clean, dry, and asphalt tack coat is applied. Refer to 32 12 1316-Asphalt Tack Coats.

.2 Obtain written approval of subgrade by department representative before placing granular sub-base and base.

3.3 GRANULAR SUB-BASE AND GRANULAR BASE

.1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.

.2 Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material.

.3 Place in layers not exceeding 150mm compacted thickness. Compact to density not less than 98% corrected maximum dry density ASTM D698.

.4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

3.4 ASPHALT PRIME

.1 Emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved in writing by Departmental Representative.

.2 Apply diluted asphalt emulsion at rate directed by Departmental Representative but do not exceed 5 L/m^2.

.3 Apply on damp surface unless directed by Departmental Representative.

.2 Do not apply primer when air temperature is below 5 degrees C or when rain is forecast within 2 hours.

.3 If asphalt prime fails to set, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

3.5 ASPHALT TACK COAT

.1 In accordance with Section 32 12 13.16 - Asphalt Tack Coats.

3.6 PLANT AND MIXING REQUIREMENTS

.1 In accordance with ASTM D995.

3.7 ASPHALT CONCRETE PAVING

.1 Obtain written approval of tack coat from department representative before placing asphalt mix.

.2 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees C.

.3 Place asphalt concrete in compacted layers as per the contract drawings.

.4 Minimum 135 degrees C mix temperature required when spreading.

.5 Maximum 160 degrees C mix temperature permitted at any time.

.6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.

.7 Compact parking lot asphalt concrete to density between 92% and 96.5% of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated.

.8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.

.9 Moisten roller wheels with water to prevent pick up of material.

.10 Compact mix with hot tampers or other equipment approved in writing by Departmental Representative, in areas inaccessible to roller.

.11 Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.

.12 Repair areas showing checking, rippling or segregation as directed by department representative.

3.8 JOINTS

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.

.2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material before placing adjacent pavement.

.3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.

.4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

3.9 ASPHALTIC CURBS

.1 Form asphalt curbs by machine to profiles as indicated. Curve curbs uniformly.

3.10 SPEED BUMPS

.1 Form speed-limiting bumps as indicated. Stop bumps 300 mm short of curb.

3.11 TESTING

.1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory in accordance with Section 01 45 00 - Quality Control.

.2 Costs of tests will be paid under Contract Allowance.

3.13 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

3.14 PROTECTION

.1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C.

.1 Do not permit stationary loads on pavement until 24 hours after placement.

.2 Provide access to buildings as required.

.1 Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

SECTION 32 15 60
ROADWAY DUST CONTROL

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 22 13-Rough Grading, Section 32 11 23-Aggregate Base Course, and Section 32 11 1601-Granular Sub-Base.

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-15.1-92, Calcium Chloride

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Supply calcium chloride in quantities and at times as directed by Department representative.

.2 Deliver calcium chloride to site in moisture-proof bags. Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.

.3 Storage and Handling Requirements:

.1 Store bags of calcium chloride in weather-proof enclosures.

.4 Packaging Waste Management: remove for reuse and return of pallets as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Calcium chloride, Type I: To CAN/CGSB-15.1, flake.

.2 Water: in accordance with department representative's approval.

PART 3 EXECUTION

3.1 APPLICATION

.1 Apply calcium chloride and water with equipment approved by department representative. at rate of 6.5 tonnes/km for flake when directed by department representative.

.2 Apply water with distributors equipped with means of shut-off and with spray system to ensure uniform application.

3.2 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Place materials defined as hazardous or toxic in designated containers.

END OF SECTION

SECTION 32 16 00
CURBS, GUTTERS AND SIDEWALKS

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming and Accessories

.2 Section 03 20 00 – Concrete Reinforcing

.3 Section 03 30 00 – Cast-in-Place Concrete

.4 Section 31 05 16 – Aggregates for Earthwork

.5 Section 31 23 33.01 – Excavating, Trenching and Backfilling

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 ABBREVIATIONS AND ACRONYMS

.1 EPD: Environmental Product Declaration.

.2 LCA: Life cycle assessment.

.3 LCI: Life cycle inventory.

.4 PCR: Product category rule.

1.4 DEFINITIONS

.1 Environmental Product Declaration: Third-party verified documentation with the supporting product category rule and life cycle assessment information, including at least a cradle-to-gate scope. Prepared in accordance with ISO 14025, ISO 14040, ISO 14044, and EN 15804 or ISO 21930.

.2 Industry-Average Environmental Product Declaration: Developed by an industry association and represents the average product of multiple companies. Products covered by Industry-Average Environmental Product Declarations are required to follow the same product category rule. Industry-Average Environmental Product Declarations cannot represent a certain manufacturer or its product. Industry-Average Environmental Product Declarations may be referred to as "industry-wide Environmental Product Declarations" or "generic Environmental Product Declarations."

.3 Product-Specific Type III Environmental Product Declaration: Provides data on one product made by one manufacturer, but can involve multiple factories. Product-Specific Environmental Product Declarations can cover a product produced by a manufacturer in several plants throughout the world if all plants use the same processes. Product-Specific Environmental Product Declarations cannot represent several products or several manufacturers.

1.5 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO):

.1 AASHTO M 182-05, Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

.2 ASTM International (ASTM):

.1 ASTM C117-23, Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

.2 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM C171-20, Standard Specification for Sheet Materials for Curing Concrete

.4 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

.5 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants

.6 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3 (600 kN-m/m^3))

.7 ASTM D1751-23, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)

.8 ASTM D5893/D5893M-16, Standard Specification for Cold-Applied, Single-Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

.3 CSA Group (CSA):

.1 CSA A23.1:19/A23.2:19, Concrete materials and methods of concrete construction/ Test Methods and Standard Practices for concrete

.2 CSA B651-18, Accessible design for the built environment

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Product literature and data sheets, including product characteristics, performance criteria, WHMIS SDSs, and limitations.

.1 Submit product data for:

.1 Concrete.

.2 Tactile warning indicators.

.3 Curing agent.

.4 Joint filler strips.

.3 Sustainable Design Submittals: Information demonstrating sustainability characteristics specified in this Section and in accordance with Section 01 33 29 – Sustainable Design Reporting.

.1 Submit machine-readable EPDs or equivalent documents used to substantiate the carbon footprint of materials:

.1 in accordance with ISO 14025 Type III and ISO 21930; or

.2 generated by a software application validated as producing EPDs, compliant with ISO 14025 Type III and ISO 21930, and using input data produced from plant-specific, regional or Canadian industry-specific LCI data; or

.3 developed using similarly robust LCA methods in accordance with ISO 14040 and ISO 14044 or ISO 14067 and documented and validated by a third-party accredited professional in a letter of assurance.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

1.8 SITE CONDITIONS

.1 Ambient Conditions:

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/CSA A23.2.

.3 Cold Weather Protection:

.1 Maintain protection equipment in readiness on site.

.2 Use protection equipment when ambient temperature is below 5°C or when temperature may fall below 5°C before concrete has cured.

.4 Hot Weather Protection:

.1 Protect concrete from direct sunlight when ambient temperature is above 27°C.

.2 Prevent forms from getting too hot before concrete is placed. Apply accepted methods of cooling that will not negatively affect concrete.

.5 Protect concrete from drying.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Concrete Mixes and Materials: In accordance with Section 03 30 00 – Cast-in-Place Concrete

.1 Minimum strength: 32 MPa.

.2 Minimum size of aggregate: 19 mm.

.2 Reinforcing Steel: In accordance with Section 03 20 00 – Concrete Reinforcing.

.3 Granular Base and Backfill: Material to Section 31 05 16 – Aggregates for Earthwork and the following:

.1 Type 1, 2 or 3 fill.

.2 Crushed stone or gravel.

.3 Gradations: Within limits specified when tested to ASTM C136 and ASTM C117.

.4 Non-Staining Mineral Type Form Release Agent: Chemically active release agents containing compounds reacting with free lime to provide water-soluble soap.

.5 Joint Filler Strips:

.1 Contraction joint filler for curb and gutter: Hard-pressed fiberboard contraction joint filler.

.2 Expansion and control joint filler: To ASTM D1751, pre-moulded bituminous fibreboard.

.6 Joint Sealants: Cold-applied joint sealant to ASTM C920.

.7 Concrete Protection Materials: Linseed oil mixture, consisting of equal parts, by volume, linseed oil and either mineral spirits, naphtha, or turpentine.

.8 Tactile Walking Surface Indicators: To CSA B651, cast iron, with truncated domes.

.9 Form Work: Sidewalk forms and Curb and gutter forms in accordance with Section 03 10 00 – Concrete Forming and Accessories.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 – Examination and Preparation.

3.2 PREPARATION

.1 Perform grade preparation work in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.2 Clean the underlying subgrade of all foreign substances before placing granular base.

.3 Granular Base Preparation:

.1 Obtain department representative's review of subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated on the Drawings.

.1 Use base course materials equal in bearing capacity to the base under the adjacent pavement for curb and gutter.

.3 Compact granular base in maximum 150 mm layers to minimum 98% of maximum density to ASTM D698.

.4 Maintain granular base in smooth and compacted condition until the concrete is placed.

.1 Keep base course in a moist condition when concrete is placed.

.2 Protect base course from frost when concrete is poured.

3.3 APPLICATION

.1 Form Setting:

.1 Prepare and construct formwork in accordance with Section 03 10 00 – Concrete Forming and Accessories.

.2 Set forms to the alignment, grade, and dimensions indicated on the Drawings.

.1 Verify grade and alignment of sidewalk forms with a 3 m straightedge. Allowable tolerance of 3 mm in any 3 m long section.

.2 Sidewalks transverse slope: As indicated on the Drawings (2%).

.3 Hold forms in place with a minimum of 3 stakes for each form, placed at intervals not exceeding 1.2 m.

.1 Use additional stakes and braces at corners, deep sections, and radius bends to provide rigidity in the forms.

.4 After completion of concrete placement:

.1 For sidewalk, keep side forms in place for a minimum of 12 hours.

.2 Keep forms used along the front of the curb in place for a minimum of 2 hours and maximum of 6 hours.

.3 Keep forms used along the back of curb until the concrete finishing of the face and top of the curb are completed.

.4 Keep gutter forms in place while the concrete is sufficiently plastic to prevent slump in any direction.

.2 Reinforcement Steel Placement:

.1 Fasten reinforcement steel in place with suitable supports and ties, and in accordance with Section 03 20 00 – Concrete Reinforcing.

.3 Concrete Placement:

.1 Obtain department representative's review of granular base and reinforcing steel before placing concrete.

.2 Perform concrete work in accordance with Section 03 30 00 – Cast-in-Place Concrete.

.3 Place concrete in formed sidewalk in one layer.

.4 Consolidate and finish concrete to thickness indicated on the Drawings.

.5 Consolidate concrete by tamping and spading or with an acceptable vibrator.

.6 Immediately after floating, give sidewalk surface a uniform broom finish to produce regular corrugations not exceeding 2 mm depth, by drawing a broom side to side across sidewalk.

.7 Finish edges as indicated on the Drawings with 5 mm radius edging tool.

.1 Edge transverse joints before brooming.

.2 Round the edges of the gutter and top of the curb.

.3 Eliminate the flat surface left by the surface face of the edger with brooming.

.8 Finish curve shaped gutters with standard curb mule.

.9 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to department representative can be demonstrated. Hand-finish surfaces when directed by department representative.

.10 Maximum variations in finished surfaces: 6 mm from the measured edge of a 3 m straightedge.

.4 Expansion and Contraction Joints:

.1 Construct tooled transverse contraction joints after floating, when concrete is stiff but still plastic, at intervals of 1.5 m. Construct longitudinal contraction joints along the centreline of all sidewalks 3 m or more in width.

.1 Cut a grove in the concrete surface to a minimum depth of 1/4 of sidewalk slab thickness.

.2 Construct expansion joints at intervals of 6 m.

.1 Form expansion joints using 13 mm joint filler strips.

.2 Hold joint filler in place with steel pins to prevent warping of the filler during floating and finishing.

.3 Round joint edges using an edging tool having a radius of 5 mm after finishing is completed. Remove any concrete over the joint filler.

.4 Clean the top of expansion joints and fill with cold-applied joint sealant at the end of curing time.

.5 When sidewalk is adjacent to curb, make the joints in curb, gutter, and sidewalk coincide.

.5 Isolation Joints:

.1 Install isolation joints around manholes, catch basins, and along the length adjacent to concrete curbs, buildings, or permanent structures.

.2 Install joint filler in isolation joints in accordance with Section 03 30 00 – Cast-in-Place Concrete.

.3 Seal isolation joints with reviewed sealant.

.6 Tactile Walking Surface Indicators:

.1 Install tactile walking surface indicators at curb ramp edges, where indicated on the Drawings, in accordance with CSA B651, and local municipal bylaws.

.2 Maximum height of the base surface carrying the tactile walking surface indicator: 3 mm above adjacent paving.

.7 Curing:

.1 Cure concrete by adding moisture continuously in accordance with CSA A23.1/A23.2 to exposed finished surfaces for minimum 7 days after placing, or seal moisture in using curing compound reviewed by department representative.

.2 Protect unhardened concrete from rain and flowing water.

.3 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period. Overlap mats minimum 150 mm.

.4 Where impervious sheeting material is used, wet the entire exposed surface with a fine spray of water and then cover with sheeting.

.1 Place the sheets directly on the concrete surface with the light-coloured side facing upward. Overlap sheets minimum 300 mm.

.2 Sheeting width: 450 mm wider than the concrete surface.

.3 Secure sheeting and replace torn or damaged sheets.

.5 Where membrane is used, apply a uniform coating of white-pigmented membrane-curing compound to the entire exposed surface of the concrete as soon as the free water has evaporated from the finished surface.

.1 Coat formed surfaces immediately after removing forms and a maximum of 1 hour after the removal of forms.

.2 Apply curing compound evenly to form continuous film, in accordance with manufacturer’s requirements.

.3 Respray concrete surfaces that are subjected to heavy rainfall within 3 hours of curing compound application.

.8 Backfill:

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with fill material in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.1 Compact and shape to contours as indicated on the Drawings.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.2 Waste Management:

.1 Manage waste in accordance with Section 01 74 19 – Waste Management and Disposal.

.3 Divert unused concrete materials from landfill to local pit.

END OF SECTION

SECTION 32 91 19.13
TOPSOIL PLACEMENT AND GRADING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 11 00 - Clearing and Grubbing

.2 Section 31 14 13 - Soil Stripping and Stockpiling

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 Agriculture and Agri-Food Canada (AAFC):

.1 The Canadian System of Soil Classification 3rd edition, 1998

.2 ASTM International (ASTM):

.1 ASTM C602-23, Standard Specification for Agricultural Liming Materials

.2 ASTM D5268-23, Standard Specification for Topsoil Used for Landscaping and Construction Purposes

.3 Canadian Council of Ministers of the Environment (CCME):

.1 PN 1340-2005, Guidelines for Compost Quality

.4 Canadian Society of Landscape Architects (CSLA) & Canadian Nursery Landscape Association (CNLA):

.1 Canadian Landscape Standard, Second Edition

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation meetings: Conduct a site meeting in accordance with Section 01 31 19 - Project Meetings and attended by the department representative and appropriate Subcontractors to:

.1 Verify project requirements.

.2 Review delivery, storage, and handling requirements.

.3 Review substrate conditions.

.4 Coordinate with other Subcontractors.

.5 Review manufacturer's instructions.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: Product literature and data sheets including product characteristics, performance criteria, WHMIS SDSs, and limitations.

.3 Manufacturer's instructions:

.1 Special delivery, storage, and handling requirements.

.2 Application instructions.

.3 Recommended sequencing.

.4 Cleaning procedures.

.4 Source quality control submittals:

.1 Comply with the requirements of Section 01 45 00 - Quality Control.

.2 Compost tests and analysis: In accordance with the Compost Quality Alliance (CQA).

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscaper: Member in good standing of Landscape Ontario Green for Life (LO).

.2 Landscape supervisor: Landscape horticulturist journeyperson or certified landscape horticulturist technician with softscape installation designation or equivalent.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.1 Storage and handling requirements:

.1 Handle materials only when in a dry and unfrozen state.

1.8 SITE CONDITIONS

.1 Ambient conditions:

.1 Do not disturb wet or frozen soil with 27% (or higher) clay content.

PART 2 PRODUCTS

2.1 PERFORMANCE/DESIGN CRITERIA

.1 Topsoil and soil amendments to provide suitable medium for supporting intended plant growth:

.1 pH range: 6.5 to 8.0.

.2 Provide materials without toxic or growth-inhibiting contaminates.

.3 Fertilizer:

.1 Major soil nutrient concentrations per gram of topsoil:

.1 Nitrogen (N): 20 µg to 40 µg.

.2 Phosphorus (P): 40 µg to 50 µg.

.3 Potassium (K): 75 µg to 110 µg.

.2 Provide calcium (C), magnesium (Mg), sulphur (S), and other micro-nutrients in balanced ratios to support germination and establishment of intended vegetation.

2.2 TOPSOIL

.1 Topsoil for seeded areas and sodded areas: Mixture of particulates, micro-organisms, and organic matter.

.1 Consistency: Friable when moist.

.2 Topsoil for seeded or sodded areas:

.1 Natural or manufactured.

.2 Rich in organic matter (humas) and mineral elements.

.3 Screened, free of unwanted large particles such as roots, gravel, and rocks.

2.3 SOIL AMENDMENTS

.1 Fertilizers: Industry-accepted mediums containing nitrogen, phosphorus, potassium, and other micro-nutrients suitable to specific plant species or application, or as recommended based on soil test results.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation, and:

.1 Before stripping topsoil, verify areas affected by work of this section have been cleared of items indicated in Section 31 11 00 - Clearing and Grubbing.

.2 Verify subgrades are correct and sloped as indicated on the Drawings.

3.2 TOPSOIL STRIPPING

.1 Strip topsoil in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.

3.3 PREPARATION

.1 Surface preparation:

.1 Clear surface in accordance with Section 31 11 00 - Clearing and Grubbing.

.2 Cultivate entire area to receive topsoil to minimum 150 mm deep.

.1 Cross cultivate areas where equipment used for hauling and spreading has compacted soil. Cultivate compacted areas to minimum 150 mm deep.

3.4 PLACING AND SPREADING TOPSOIL

.1 Place topsoil after the department representative has reviewed the prepared subgrade.

.2 Spread topsoil during dry conditions in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.

.3 Spread topsoil as indicated on Drawings to the following minimum depths after settlement:

.1 Seeded areas: 150 mm.

.2 Sodded areas: 150 mm.

.1 Keep topsoil 15 mm below finished grade for sodded areas.

.4 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.

.5 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.

.6 After spreading procedures are complete, cultivate soil.

3.5 SOIL AMENDMENTS (NOT USED)

3.6 FINISH GRADING

.1 Grade to eliminate rough spots and low areas to provide positive drainage.

.1 Slope grades: Minimum 2% away from buildings.

.2 Prepare loose, friable beds by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density.

.1 Leave surfaces smooth, uniform, and firm against deep foot printing.

.3 Finish graded surfaces to be free of:

.1 Debris and stones over 50 mm diameter.

.2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

3.7 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

.3 Dispose of surplus materials off site, including topsoil.

END OF SECTION

SECTION 33 05 16
MAINTENANCE HOLES AND CATCH BASIN STRUCTURES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS (NOT USED)

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A48/A48M-03(2012), Standard Specification for Grey Iron Castings.

.2 ASTM A123/A123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM C117-13, Standard Test Method for Materials Finer than 75-mm (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C139-11, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.6 ASTM C478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).

.7 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CSA Group (CSA)

.1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A165 Series-04(R2009), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 407-November 2007(R2010), Construction Specification For Maintenance Hole, Catch Basin, Ditch Inlet And Valve Chamber Installation.

1.3 MEASUREMENT PROCEDURES (NOT USED)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for maintenance holes and catchbasin structures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.5 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 43 00 - Quality Assurance.

.2 Certifications:

.1 Submit manufacturer's test data and certification at least 4 weeks before beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect maintenance holes and catch basin structures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Precast maintenance hole units: to ASTM C478M, circular or oval.

.1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.

.2 Monolithic bases to be approved by department representative.

.2 Precast catch basin sections: to ASTM C139, ASTM C478M.

.3 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.

.4 Mortar:

.1 Masonry Cement: to CAN/CSA-A3002.

.5 Ladder rungs: to CSA G30.18, No.25M billet steel deformed bars, hot dipped galvanized to ASTM A123/A123M.

.1 Rungs to be safety pattern (drop step type).

.6 Adjusting rings: to ASTM C478M.

.7 Concrete Brick: to CAN/CSA-A165 Series.

.8 Drop maintenance hole pipe: same as sewer pipe.

.9 Galvanized iron sheet: approximately 2 mm thick.

.10 Steel gratings, I-beams and fasteners: as indicated.

.11 Frames, gratings, covers to dimensions as indicated and following requirements:

.1 Metal gratings and covers to bear evenly on frames.

.1 Frame with grating or cover to constitute one unit.

.2 Assemble and mark unit components before shipment.

.2 Maintenance hole frames and covers: cover cast with perforations and complete with two 25 mm square lifting holes to OPSS 407.

.3 Catch basin frames and covers: to OPSS 407.

.4 Size: 762 mm clear diameter.

.12 Granular bedding and backfill: in accordance with Section 31 05 16 - Aggregate Materials.

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.

.2 Obtain approval of department representative before installing maintenance holes or catch basins.

3.3 CONCRETE WORK

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Position metal inserts in accordance with dimensions and details as indicated.

3.4 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses.

.3 Dewater excavation to approval of department representative and remove soft and foreign material before placing concrete base.

.4 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% maximum dry density.

.5 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.

.2 Make each successive joint watertight with department representative's approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.

.3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.6 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide smooth U-shaped channel.

.1 Side height of channel to be 0.5 times diameter of sewer.

.2 Slope adjacent floor at 1 in 20.

.3 Curve channels smoothly.

.4 Slope invert to establish sewer grade.

.7 Compact granular backfill to 95% maximum dry density.

.8 Installing units in existing systems:

.1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.9 Set frame and cover to required elevation on no more than 4 courses of brick.

.1 Parge and make smooth and watertight.

.10 Place frame and cover on top section to elevation as indicated.

.1 If adjustment required use concrete ring.

.11 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

.12 Install safety platforms in maintenance holes having depth of 5 m or greater, as indicated.

3.5 ADJUSTING TOPS OF EXISTING UNITS

.1 Remove existing gratings and frames, and store for re-use at locations designated by department representative.

.2 Sectional units:

.1 Raise or lower straight walled sectional units by adding or removing precast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.

.1 When amount of raise is less than 600 mm use standard maintenance hole brick, moduloc or grade rings.

.3 Monolithic units:

.1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration.

.2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.

.3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.

.4 Install additional maintenance hole ladder rungs in adjusted portion of units as required.

.5 Re-use existing gratings and frames.

.6 Re-set gratings and frames to required elevation on not more than 4 courses of brick.

.1 Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.

.2 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

3.6 SEALING OVER EXISTING UNITS (NOT USED)

3.7 SITE QUALITY CONTROL

.1 Leakage Test:

.2 Install watertight plugs or seals on inlets and outlets of each new sanitary sewer maintenance hole and fill maintenance hole with water.

.3 Leakage not to exceed 0.3% per hour of volume of maintenance hole.

.4 If permissible leakage is exceeded, correct defects.

.5 Repeat until approved by department representative.

.6 department representative will issue Test Certificate for each maintenance hole passing test.

3.8 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

SECTION 33 14 16
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Department of Justice Canada (Jus):

.1 SOR/2018-196 Prohibition of Asbestos and Products Containing Asbestos Regulations

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA):

.1 ANSI/AWWA B300-18, Standard for Hypochlorites

.2 ANSI/AWWA B301-18, Liquid Chlorine

.3 ANSI/AWWA B303-18, Sodium Chlorite

.4 ANSI/AWWA C500-19, Standard for Metal-Seated Gate Valves for Water Supply Service

.5 ANSI/AWWA C651-14, Standard for Disinfecting Water Mains

.6 ANSI/AWWA C800-21, Standard for Underground Service Line Valves and Fittings

.7 ANSI/AWWA C900-16, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution

.3 ASTM International (ASTM):

.1 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

.2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.3 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength

.4 ASTM B88M-20, Standard Specification for Seamless Copper Water Tube (Metric)

.5 ASTM C117-17, Standard Test Method for Materials Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing

.6 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.7 ASTM C478/C478M-20, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)

.8 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.9 ASTM D2310-06, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

.10 ASTM F714-21, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

.4 American Water Works Association (AWWA)/Manual of Practice:

.1 AWWA M11-2018, Steel Pipe - A Guide for Design and Installation

.2 AWWA M17-2016, Installation, Field Testing, and Maintenance of Fire Hydrants

.5 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

.3 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids

.6 CSA Group (CSA):

.1 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

.2 CAN/CSA-B137:20 Series, Thermoplastic Pressure Piping Compendium (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12)

.3 CSA G30.18-09, Carbon and Steel Bars for Concrete Reinforcement

.7 The Master Painters Institute (MPI):

.1 Architectural Painting Specification Manual, current edition

.8 ULC Standards (ULC):

.1 CAN/ULC-S520:2016, Standard for Fire Hydrants

.2 CAN/ULC-S543-09, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose

1.2 MEASUREMENT PROCEDURES (NOT USED)

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Schedule Work to minimize interruptions to existing services.

.1 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by department representative.

.2 Notify department representative, superintendent minimum of 24 hours in advance of interruption in service.

.3 Notify fire department of planned or accidental interruption of water supply to hydrants.

.4 Provide and post "Out of Service" sign on hydrant not in use.

.5 Advise local police department of anticipated interference with movement of traffic.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Pipe certification to be on pipe.

.3 Shop Drawings: submit complete drawings and construction schedule for water mains 600 mm diameter and larger. Include method for installation of water main.

.4 Samples:

.1 Inform department representative of proposed source of bedding materials and provide access for sampling at least 4 weeks before commencing work.

.2 Submit for testing 4 weeks minimum before beginning work, samples of materials proposed for use as follows:

.1 Granular A for pipe bedding and cover.

.3 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4 weeks minimum before beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit operation and maintenance data for pipe, valves, valve boxes, valve chambers and hydrants for incorporation into manual.

.3 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.

.1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

1.7 MAINTENANCE MATERIAL SUBMITTALS (NOT USED)

PART 2 PRODUCTS

2.1 PIPE, JOINTS, AND FITTINGS

.1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end.

.1 CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.

.2 Composite epoxy impregnated fibreglass PVC pipe to ASTM D2996, class H. Unplasticized PVC core over wrapped with bonded fibreglass reinforced epoxy resin. Pressure class 300, 2.4 MPa with cast iron outside diameter and integral bell gasketted joints to ANSI/ASTM D2992. Material to ASTM D2310, classification RTRP-11HZ-5001-PVC-13223.

.3 Cast iron fittings: to ANSI/AWWA C110/A21.10, and for pipe diameters larger than NPS 4 cement mortar lined to ANSI/AWWA C104/A21.4.

2.2 PIPE PROTECTION (NOT USED)

2.3 VALVES AND VALVE BOXES

.1 Valves to be right hand closing (clockwise)

.2 Gate valves: to ANSI/AWWA C500, standard iron body, bronze mounted wedge valves with non-rising stems, suitable for 1 Pa with mechanical joints.

.3 Cast iron valve boxes: sliding type adjustable over minimum of 450 mm complete with valve operating extension rod, 30 mm diameter, 25 x 25 mm cross section, of such length that when set on valve operating nut top of rod will not be more than 150 mm below cover.

.1 Base to be large round type with minimum diameter of 300 mm.

.2 Top of box to be marked "WATER"/"EAU".

2.4 VALVE CHAMBERS

.1 Concrete and reinforcing steel: to Section 03 30 00 - Cast-in-Place Concrete and Section 03 20 00 - Concrete Reinforcing.

.2 Precast concrete sections to ASTM C478/C478M. Cast ladder rungs integral with unit; site installation not permitted.

.3 Valve chamber frames and covers: grey iron castings, minimum tensile strength 200 MPa, with two coats, shop applied, approved asphalt coating with a mass of approximately 215 kg per set.

.1 Design and dimensions as indicated.

.2 Cover to be marked "WATER"/"EAU".

.4 Jointing materials:

.1 Manufacturer's rubber ring gaskets.

.5 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CSA G30.18, hot-dipped galvanized after fabrication to ASTM A123/A123M. Rungs to be safety pattern.

2.5 SERVICE CONNECTIONS

.1 Copper tubing: to ASTM B88M type K, annealed.

.2 Polyvinyl chloride pressure pipe: to CAN/CSA-B137.5, 1.1 MPa SDR 9

.3 Copper tubing joints: compression type suitable for 1 MPa working pressure.

.4 PVC joints: solvent welded in accordance with manufacturer's specifications.

.5 Brass inverted key-type curb stops: red brass to ASTM B62, compression type without drains.

.1 Curb stops to have adjustable [bituminous coated] cast iron service box with stem to suit depth of bury.

.2 Top of cast iron box marked "WATER"/"EAU".

.6 Service connections for PVC pipe:

.1 Service connections less than 100 mm: corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.

.2 Service connections 100 mm and over: use tee fitting or tapping valve and sleeve.

.7 Bronze type service clamps: for PVC pipe service connections.

.1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.

.2 Clamps to be tapped with threads to ANSI/AWWA C800.

.8 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

2.6 HYDRANTS

.1 Post type hydrants: compression type hydrant, to CAN/ULC-S520, designed for working pressure of 1210 kPa with two 63.5 mm threaded hose outlets, one 100 mm quick connect pumper connection, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main.

.1 Hydrants to open clockwise, CSA standard threads, fittings to be internal lug quick-connect to CAN/ULC-S543. Provide metal caps.

.2 Provide key operated gate valve located 1 m from hydrant.

.3 Depth of bury 1.8 m.

.2 Hydrant paint: exterior enamel to MPI #96, yellow.

2.7 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 /C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

2.8 BACKFILL MATERIAL

.1 As indicated. In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.9 PIPE DISINFECTION

.1 Sodium hypochlorite to ANSI/AWWA B300 or Liquid Chlorine to ANSI/AWWA B301 to disinfect water mains.

.2 Disinfect water mains in accordance with ANSI/AWWA C651/05.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrates previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrates in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from department representative.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of department representative.

.2 Remove defective materials from site as directed by department representative.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Ensure trench depth allows coverage over pipe of 1.8 m minimum from finished grade or as indicated on the contract drawings.

.3 Trench alignment and depth require department representative's approval before placing bedding material and pipe.

3.4 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Place concrete to details as indicated in the contract drawings.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placing.

3.5 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to 95% minimum of maximum dry density.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted bedding material.

3.6 PIPE INSTALLATION

.1 Terminate building water service at property line opposite point of connection to main.

.1 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Lay pipes to manufacturer's standard instructions and specifications.

.1 Do not use blocks except as specified.

.3 Join pipes in accordance with manufacturer's recommendations.

.4 Bevel or taper ends of PVC pipe to match fittings.

.5 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.6 Lay pipes on prepared bed, true to line and grade.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe.

.3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 4 m.

.7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

.8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with equipment and methods approved by department representative.

.11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.12 Align pipes before jointing.

.13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.14 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by department representative.

.19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.21 Do not lay pipe on frozen bedding.

.22 Do hydrostatic and leakage test and have results approved by Departmental Representative, department representative before surrounding and covering joints and fittings with granular material.

.23 Backfill remainder of trench.

3.7 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Support valves located in valve boxes or valve chambers by means of Bedding same as adjacent pipe. Valves not to be supported by pipe.

.3 Install underground post-type indicator valves as indicated.

3.8 VALVE CHAMBERS

.1 Use precast units as approved by department representative.

.2 Construct units as indicated, plumb and centred over valve nut, true to alignment and grade, and not resting on pipe.

.3 Place reinforcing steel and miscellaneous metals required to be embedded in concrete to details indicated and in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.4 Plug lifting holes with precast concrete plugs set in cement mortar, or with grout.

.5 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.

.6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

3.9 UNDERCROSSING (NOT USED)

3.10 SERVICE CONNECTIONS

.1 Terminate building water service at property line opposite point of connection to main.

.1 If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.3 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300mm in right-of-way.

.4 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.6 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.7 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m minimum, whichever is greater.

.8 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.9 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

.10 Install curb stop with corporation box on services NPS 2 or less in diameter.

.1 Equip larger services with gate valve and cast iron box.

.2 Set box plumb over stop and adjust top flush with final grade elevation.

.3 Leave curb stop valves fully closed.

.11 Place temporary location marker at ends of plugged or capped unconnected water lines.

.1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.

.2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.11 HYDRANTS ASSEMBLIES

.1 Install hydrants at locations as indicated.

.2 Install hydrants in accordance with AWWA M17.

.3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.

.4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.

.5 Place concrete thrust blocks as indicated and specified.

.6 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.

.7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.12 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by department representative.

.3 Keep joints and watermain corporation std couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

.5 For restrained joints: only use restrained joints approved by department representative.

3.13 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C605, OPSS 441, OPSS 701.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify department representative at least 24 hours in advance of proposed tests.

.1 Perform tests in presence of department representative.

.4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by department representative.

.6 Upon completion of pipe laying and after department representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.

.7 Leave hydrants, valves, joints and fittings exposed.

.8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.

.9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.10 Open valves.

.11 Expel air from main by slowly filling main with potable water.

.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.

.2 Remove stops after satisfactory completion of test and seal holes with plugs.

.12 Thoroughly examine exposed parts and correct for leakage as necessary.

.13 Apply leakage test pressure of 1050 kPa minimum to a maximum of after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.

.14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.16 Repeat hydrostatic test until defects have been corrected.

.17 Define leakage as amount of water supplied from water storage tank or meter in order to maintain test pressure for 2 hours.

.18 Do not exceed allowable leakage of 0.082 L/mm of pipe diameter per kilometer or pipe length, including lateral connections.

.19 Locate and repair defects if leakage is greater than amount specified.

.20 Repeat test until leakage is within specified allowance for full length of water main.

3.14 PIPE SURROUND

.1 Upon completion of pipe laying and after department representative has inspected Work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% of maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 95% of maximum dry density.

3.15 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under paving and walks, compact backfill to at least 98% maximum dry density.

.1 In other areas, compact to at least 95% corrected maximum dry density.

3.16 HYDRANT FLOW TESTS

.1 Conduct flow tests on every hydrant to determine fire flows before painting hydrant caps and ports.

3.17 PAINTING OF HYDRANTS

.1 After installation, paint hydrants yellow.

.2 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

3.18 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations: witnessed by Departmental Representative and department representative, carried out by specialist contractor or local water work department.

.1 Notify Departmental Representative and department representative at least 5 days in advance of proposed date when disinfecting operations will begin.

.2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 15 minutes, or until foreign materials have been removed and flushed water is clear.

.3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
150 and below	38
200	75
250	115
300	150

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been completed to department representative approval, introduce strong solution of chlorine as approved by department representative into water main and ensure that it is distributed throughout entire system.

.7 Chlorine application to be close to point of filling water main and to occur at same time.

.8 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.9 Measure chlorine residuals at extreme end of pipe-line being tested.

.10 After adequate chlorine residual between 40 mgl/ and not more than 100 mg/l has been obtained leave system charged with chlorine solution for 24 hours.

.11 After 24 hours, take further samples to ensure that there is still not less than 25 mg/l of chlorine residual remaining throughout system.

.12 Flush line to remove chlorine solution after 24 hours.

.13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.

.1 Take samples daily for minimum of 2 days.

.2 Should contamination remain or recur during this period, repeat disinfecting procedure.

.3 Specialist contractor to submit certified copy of test results.

.14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

3.19 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by department representative.

END OF SECTION

SECTION 33 14 16.13
INCOMING SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 33 14 16 - Site Water Utility Distribution Piping

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C901-08, AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½ Inch (13 mm) through 3 Inch (76 mm), for Water Service.

.2 ASTM International (ASTM)

.1 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 Manufacturer's Standardization Society of the Valve and Fittings Industry

.1 MSS-SP-70-11, Grey Iron Gate Valves, Flanged and Threaded Ends.

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for valves, couplings and mechanical joints and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store and protect piping materials from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 PIPE

.1 Service water pipe: polyethylene (PE) from 1 m outside of building or as indicated in.

.1 Polyethylene (PE) pipe: ANSI/AWWA C901.

2.2 CATHODIC PROTECTION

.1 Cathodic Protection: to Section 26 42 00.01 - Telethermics: Cathodic Protection.

2.3 FITTINGS

.1 NPS 3 and larger mechanical joints : to ANSI/AWWA C110/A21.10.

2.4 JOINTS

.1 Rubber gaskets for mechanical joints: to ANSI/AWWA C111/A21.11.

.2 Bolts, nuts, hex head with washers: to ASTM A307, heavy series.

2.5 GATE VALVES

.1 Rising stem: to MSS SP-70, class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.6 PROTECTIVE COATING (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of department representative.

.2 Inform department representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install in accordance with local authority having jurisdiction.

.2 Piping cut square, reamed, free of cuttings and foreign material.

.3 Minimum depth of bury: 1.8m.

.4 Lay buried piping in compacted washed sand in accordance with AWWA Class "B" bedding, where existing ground below bedding is unstable, install pipe on continuous concrete support.

.5 Where piping enters building, provide support, and seal with approved construction sealants against ingress of moisture; to approval of authority having jurisdiction.

.6 Assemble piping using fittings manufactured to ANSI standards and in accordance with manufacturer's instructions.

3.3 PRESSURE TESTING

.2 Conform to Section 33 14 16 - Site Water Utility Distribution Piping

.1 3.4 Disinfection

.1 Co-ordinate with Section 33 14 16 - Site Water Utility Distribution Piping.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

SECTION 33 31 11
PUBLIC SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete

.2 Section 31 05 16 - Aggregate for Earthwork

.3 Section 31 11 00 - Clearing and Grubbing

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling

.5 Section 33 05 16 – Maintenance Holes and Catchbasin Structures

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA):

.1 ANSI/AWWA C900-22, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)

.2 ASTM International (ASTM):

.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.2 ASTM C117-23, Standard Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

.3 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.4 ASTM C443-21, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

.5 ASTM C478/C478M-22, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

.6 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.7 ASTM D1785-21a, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

.8 ASTM D2241-24, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

.9 ASTM D2680-20, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping

.10 ASTM D3350-21, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

.11 ASTM F2487-21, Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene and Polypropylene Pipelines

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

.4 CSA Group (CSA):

.1 CSA A257 Series:19, Standards for concrete pipe and manhole sections

.2 CSA A3000-18, Cementitious materials compendium

.1 CSA A3001-18, Cementitious materials for use in concrete

.3 CSA B1800-18, Thermoplastic nonpressure piping compendium

.1 CSA B182.1-18, Plastic drain and sewer pipe and pipe fittings

.2 CSA B182.2-18, PSM type polyvinylchloride (PVC) sewer pipe and fittings

.3 CSA B182.6-18, Profile polyethylene (PE) sewer pipe and fittings for leak-proof sewer applications

.4 CSA B182.11-18, Standard practice for the installation of thermoplastic drain, storm, and sewer pipe and fittings

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Product literature and data sheets for pipes and fittings, including product characteristics, performance criteria, dimensions, WHMIS SDS's and limitations.

.3 Shop Drawings:

.1 Signed and sealed by a qualified professional in accordance with Section 01 43 00 – Quality Assurance.

.2 Include:

.1 Proposed method of installation for sewerage installation drawings.

.2 Concrete placement details.

.3 Joint connections details.

.4 Blocking method to guide sanitary sewer pipe in true alignment.

.5 Proposed method for installing carrier pipe for undercrossing.

.4 Samples:

.1 Submit proposed source of bedding materials and provide access for sampling minimum 4 weeks before beginning the Work.

.5 Manufacturer's Instructions:

.1 Special delivery, storage, and handling requirements.

.2 Installation instructions.

.3 Flushing procedures.

.6 Site Quality Control Submittals:

.1 Indicating results of tests specified in SITE QUALITY CONTROL.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements

.1 Store and handle pipes, fittings and accessories to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

.2 Prevent damage to machined ends of pipes while handling and moving pipe.

.2 Carefully examine delivered materials to confirm type and grade of material.

.3 Handle pipe:

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

PART 2 PRODUCTS

2.1 DESCRIPTION (NOT USED)

2.2 MATERIALS

.1 Plastic Pipe

.1 Type PSM Polyvinyl Chloride (PVC): To CSA B182.2.

.1 Standard Dimensional Ratio (SDR) 35, to ASTM D2241.

.2 Locked-in gasket and integral bell system.

.3 Nominal lengths: 4 m.

.4 Schedule 40, to ASTM D1785, for PVC pipe and fittings less than 100 mm diameter.

.5 For PVC and fittings less than 100 mm diameter: To ASTM D1785, Schedule 40.

.2 Acrylonitrile - Butadiene - Styrene (ABS): To CSA B182.2.

.2 Service Connections

.1 Type PSM Poly (Vinyl) Chloride: To CSA B182.2.

.2 Plastic Pipe: To CSA B182.1, with push-on joints.

.3 Plugs: Pre-fabricated plugs.

.3 Cement Mortar:

.1 Portland Cement: To CSA A3000 (specifically CSA A3001), normal type 10.

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry.

.1 Add only sufficient water after mixing to give optimum consistency for placement.

.2 Do not use additives.

.4 Concrete grout in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.5 Manhole:

.1 Precast Manhole: To ASTM C478/C478M and in accordance with Section 33 05 16 – Maintenance Holes and Catchbasin Structures

.2 Ladder Rungs: To ASTM C478, 19 mm diameter aluminum to CSA S157/S157.1.

.3 O-Ring Rubber Gaskets: To ASTM C443

2.3 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to Section 31 05 16 - Aggregate for Earthwork.

.2 Concrete mixes and materials for cradles, encasement, supports: In accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.4 BACKFILL MATERIAL

.1 Type 1, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 – Examination and Preparation.

.2 Verify removal of trees, brush vegetation, tree stumps, and roots is completed in accordance with Section 31 11 00 - Clearing and Grubbing.

3.2 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.3 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Provide erosion and sediment control measures in accordance with Section 01 57 00 - Temporary Controls.

.3 Protect trench from contents of sewer or sewer connection.

.4 Trench alignment and depth require review from department representative before placing bedding material and pipe.

3.4 CONCRETE BEDDING AND ENCASEMENT (NOT USED)

3.5 GRANULAR BEDDING

.1 Place granular bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated on the Drawings.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to minimum 95% maximum dry density.

.6 Fill excavation below design elevation of specified bedding adjacent to manholes or structures with compacted bedding material.

3.6 INSTALLATION

.1 Install pipe, pipe fittings, and appurtenances at locations indicated on the Drawings.

.1 Install plastic pipe and fittings in accordance with CSA B182.11.

.2 Lay and join pipes in accordance with manufacturer's recommendations, referenced standards and acceptable to department representative.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Barrel of each pipe to be in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Joint deflection permitted within limits recommended by pipe manufacturer.

.6 Water to flow through pipe during construction, only as permitted by department representative.

.7 When stoppage of Work occurs, block pipes as directed by department representative to prevent entry of foreign materials.

.8 Plug lifting holes with pre-fabricated plugs, set in shrinkage compensating grout.

.9 Cut pipes as required for special inserts, fittings, or closure pieces as recommended by pipe manufacturer without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.10 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.11 Use pre-fabricated saddles or site connections, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

.12 Pipe Surround:

.1 Place surround material in unfrozen condition.

.2 Surround and cover pipes as indicated on the Drawings after completion of pipe laying, and review of the pipe joints by department representative.

.1 Leave joints and fittings exposed until site testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated on the Drawings.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to minimum 95% maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill elevation to at least 95% maximum dry density.

.7 When site test results are acceptable to department representative, place surround material at pipe joints.

.13 Backfill:

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated on the Drawings.

.3 Under paving and walks, compact backfill to minimum 98% maximum dry density.

.1 In other areas, compact to minimum 95% maximum dry density.

.14 Service Connections:

.1 Install pipe to CSA B182.11 and manufacturer's instructions.

.2 Maintain grade for 100 and 125 mm diameter sewers at 1 vertical to 50 horizontal (2%).

.3 Service connections to main sewer: Standard Tee or Wye fittings, or department representative reviewed saddles.

.1 Do not use break-in and mortar patch-type joints.

.4 Do not extend service connection pipe into interior of main sewer.

.5 Make up required horizontal and vertical bends from 45° bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.

.1 Use long sweep bends where applicable.

.6 Plug service laterals with water tight caps or plugs.

.7 Place location marker at the ends of unconnected plugged or capped sewer lines.

.1 Each marker: 38 x 89 mm stake extending from pipe end at pipe level to 0.6 m above grade.

.2 Paint exposed portion of stake red with designation SAN SWR LINE in black.

.15 Manhole

.1 Manhole locations as indicated on the Drawings.

.2 Excavate, backfill, and compact manhole bases in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Construct manhole as indicated on the Drawings and in accordance with Section 33 05 16 – Maintenance Holes and Catchbasin Structures

3.7 UNDERCROSSING (NOT USED)

3.8 SITE QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Perform in accordance with Section 01 45 00 – Quality Control.

.1 Carry out inspection of installed sewers by video camera, digital camera or by other related means.

.2 When directed by department representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to verify that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.6 Repair and retest sewer line as required, until test results are within limits specified.

.7 Repair visible leaks regardless of test results.

3.9 CLEANING

.1 Perform in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

SECTION 33 41 16
SUB-DRAINAGE PIPING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 - Aggregates for Earthwork

.2 Section 31 23 33.01 - Excavating, Trenching and Backfilling

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 DEFINITIONS

.1 Industry average environmental product declaration: Developed by an industry association and represents the average product of multiple companies. Products covered by industry average environmental product declarations are required to follow the same product category rule. Industry average environmental product declarations cannot represent a certain manufacturer or its product. Industry average environmental product declarations may be referred to as "industry-wide environmental product declarations" or "generic environmental product declarations".

.2 Product-specific type III environmental product declaration: Provides data on one product made by one manufacturer, but can involve multiple factories. Product-specific type III environmental product declarations can cover a product produced by a manufacturer in several plants throughout the world if all plants use the same processes. Product-specific environmental product declarations cannot represent several products and several manufacturers.

1.4 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.2 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

.3 CSA Group (CSA):

.1 CSA B1800-18, Thermoplastic non-pressure piping compendium

.1 CSA B182.1-18, Plastic drain and sewer pipe and pipe fittings

.2 CAN/CSA-G401-14, Corrugated steel pipe products

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: Product literature and data sheets for pipes, fittings, including product characteristics, performance criteria, dimensions, and limitations.

.3 Manufacturer’s instructions:

.1 Special delivery, storage, and handling requirements.

.2 Installation instructions.

.3 Flushing procedures.

1.6 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and maintenance data:

.1 Include, in the operation and maintenance manual, manufacturer's maintenance instructions and recommended cleaning materials and methods.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements, and:

.1 Carefully examine delivered materials to confirm type and grade of material.

.2 Prevent damage to machined ends of pipes while handling and moving pipes.

.1 Do not use chains or cables passed through rigid pipe bore so the weight of pipe bears upon pipe ends.

1.8 SITE CONDITIONS

.1 Examine geotechnical data as indicated in Section 00 31 00 - Available Project Information.

.2 Dewatering: In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Known underground utility lines and buried objects are as indicated on Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Regulatory requirements:

.2 Perforated plastic pipe and fittings: To CSA B182.1.

.3 Bedding gravel or crushed stone: Hard, durable particles, graded evenly in sizes from 16 to 8 mm.

.4 Granular filter material: In accordance with Section 31 05 16 - Aggregates for Earthwork, and:

.5 Geotextile filter: In accordance with Section 31 32 19.16 - Geotextile Soil Stabilization.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation, and:

.1 Verify graded base conforms with required drainage pattern before placing bedding material.

.2 Remedy improper slopes, unstable areas, areas requiring additional compaction, and other unsatisfactory conditions.

3.2 TRENCHING

.1 Trench and backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Provide erosion and sediment control measures in accordance with Section 01 57 00 - Temporary Controls.

.3 Place bedding material after review of excavations by the department representative.

3.3 BEDDING PLACEMENT

.1 Place 100 mm layer of bedding material to full trench width and compact to minimum 95% of maximum dry density.

3.4 PIPE SUB-DRAIN INSTALLATION

.1 Lay pipe drains on prepared bed, true to line and grade, with inverts smooth and free of sags or high points.

.1 Install pipes with barrels in contact with bed throughout full length.

.2 Begin laying at outlet and proceed in upstream direction.

.3 Lay perforated pipes with perforations downwards at 4 o'clock and 8 o'clock positions.

.4 Lay bell and spigot pipe with bell ends facing upstream.

.1 Do not mortar joints.

.5 Make joints tight in accordance with manufacturer's instructions.

.6 Make watertight connections to existing drains, new or existing manholes, and catch basins as indicated on Drawings.

.7 Plug open upstream ends of pipes with watertight concrete, steel, or wood bulkheads.

.8 Surround material placement: Wrap or sleeve perforated pipe with geotextile filter and cover drain with filter material in uniform 150 mm layers as indicated on Drawings,

.1 Compact filter material to minimum 95% of maximum dry density.

.9 Backfill remainder of trench in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.10 Do not place bedding, surround, or backfill materials in frozen conditions.

.11 Protect sub-drains against flotation during installation.

.12 Install “Y” connections to surface for flushing as indicated on Drawings.

3.5 CONNECTIONS TO MUNICIPAL FACILITIES

.1 Connect pipe sub-drains to municipal storm sewer system as indicated on Drawings.

3.6 INSTALLATION - FRENCH DRAINS (NOT USED)

3.7 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.2 Waste management:

.1 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal

End of Section

SECTION 33 42 11
STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete

.2 Section 31 05 16 - Aggregate for Earthwork

.3 Section 31 11 00 - Clearing and Grubbing

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling

.5 Section 33 05 16 – Maintenance Holes and Catchbasin Structures

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA):

.1 ANSI/AWWA C900-22, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)

.2 ASTM International (ASTM):

.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.2 ASTM C12-22a, Standard Practice for Installing Vitrified Clay Pipe Lines

.3 ASTM C14M-20, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric)

.4 ASTM C76M-22a, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric)

.5 ASTM C117-23, Standard Test Method for Material Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

.6 ASTM C136/C136M-19, Standard Method for Sieve Analysis of Fine and Coarse Aggregates

.7 ASTM C425-22, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings

.8 ASTM C443M-21, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)

.9 ASTM C478/C478M-22, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

.10 ASTM C506M-22a, Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe (Metric)

.11 ASTM C507M-22, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe (Metric)

.12 ASTM C700-18, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated

.13 ASTM C828-23, Standard Test Method for Low-pressure Air Test of Vitrified Clay Pipe Lines

.14 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.15 ASTM D1056-20, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber

.16 ASTM D2680-20, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping

.17 ASTM D3034-24, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

.18 ASTM F405-13, Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings

.19 ASTM F667/F667M-16, Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

.20 ASTM F794-21, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

.21 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric

.3 CSA Group (CSA):

.1 CSA A257 Series:19, Standards for concrete pipe and manhole sections

.2 CSA A3000-18, Cementitious materials compendium

.1 CSA A3001-18, Cementitious materials for use in concrete

.3 CSA B1800-18, Thermoplastic non-pressure piping Compendium

.1 CSA B181.1-18, Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings

.2 CSA B182.1-18, Plastic drain and sewer pipe and pipe fittings

.3 CSA B182.2-18, PSM type polyvinylchloride (PVC) sewer pipe and fittings

.4 CSA B182.11-18, Standard practice for the installation of thermoplastic drain, storm, and sewer pipe and fittings

.4 CAN/CSA G401-14, Corrugated steel pipe products

.5 CSA S157/S157.1-17, Strength design in aluminum/Commentary on CSA S157-17, Strength design in aluminum

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: Product literature and data sheets for pipes, fittings, and backfill, including product characteristics, performance criteria, dimensions, WHMIS SDS's and limitations.

.3 Shop drawings:

.1 Signed and sealed by a qualified professional in accordance with Section 01 43 00 - Quality Assurance.

.2 Include:

.1 Proposed method of installation for stormwater installation drawings.

.2 Concrete placement details.

.3 Joint connections details.

.4 Blocking method to guide stormwater pipe in true alignment.

.4 Manufacturer's instructions:

.1 Special delivery, storage, and handling requirements.

.2 Installation instructions.

.3 Flushing procedures.

.5 Source quality control submittals:

.1 Submit proposed source of bedding materials and provide access for sampling minimum 4 weeks before beginning the Work.

.6 Site quality control submittals:

.1 Indicating results of tests specified in SITE QUALITY CONTROL.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.1 Store and handle pipes, fittings and accessories to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

.2 Prevent damage to machined ends of pipes while handling and moving pipe.

.2 Carefully examine delivered materials to confirm type and grade of material.

1.7 SITE CONDITIONS

.1 Dewatering: In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Examine subsurface investigation report as indicated in Section 00 31 00 - Available Project Information.

.3 Known underground utility lines and buried objects are as indicated on the Drawings.

PART 2 PRODUCTS

2.1 DESCRIPTION

.1 Regulatory requirements (Not Used)

2.2 MATERIALS

.1 High Density Polyethylene (HDPE) pipe:

.1 Corrugated HDPE pipe: To CSA B182.6, ASTM F2306M, ASTM F667M

.1 Standard dimensional ratio (SDR): To ASTM F2306M, ASTM F2648

.2 Locked-in gasket and integral bell system.

.3 Nominal lengths: 6 m.

.4 HDPE and fittings less than 300 mm diameter: To ASTM F2306M, ASTM F477

.2 Corrugated high density polyethylene pipe: To ASTM F667M ASTM F405.

.2 Service connections:

.1 HDPE: To CSA B182.6, ASTM F905

.2 HDPE pipe: To CSA B182.6, with push-on joints.

.3 Plugs: Pre-fabricated plugs.

.3 Joint mortar:

.1 Portland cement: To CSA A3000 (specifically CSA A3001), normal type 10

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry.

.1 Add only sufficient water after mixing to give optimum consistency for placement.

.2 Do not use additives.

.4 Concrete grout: In accordance with Section 03 30 00 - Cast-in-Place Concrete.

.5 Manhole:

.1 Precast manhole: To ASTM C478/C478M and in accordance with Section 33 05 16 – Maintenance Holes and Catchbasin Structures.

.2 Ladder rungs: To ASTM C478/C478M, 19 mm diameter aluminum to CSA S157/S157.1.

.3 O-ring rubber gaskets: To ASTM C443M.

2.3 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material: In accordance with Section 31 05 16 - Aggregate for Earthwork.

.2 Concrete mixes and materials for bedding, cradles, encasement, supports: In accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.4 BACKFILL MATERIAL

.1 As indicated on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation.

.2 Verify removal of trees, brush vegetation, tree stumps and roots is completed in accordance with Section 31 11 00 - Clearing and Grubbing.

3.2 PREPARATION

.1 Remove trees, brush vegetation, tree stumps and roots in accordance with Section 31 11 00 - Clearing and Grubbing.

.2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Provide erosion and sediment control measures in accordance with Section 01 57 00 - Temporary Controls and temporary controls.

.3 Trench alignment and depth require department representative's review before placing bedding material and pipe.

3.4 CONCRETE BEDDING AND ENCASEMENT

.1 Perform concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Place concrete to details as indicated on the contract drawings.

.2 Position pipe on concrete blocks to facilitate placing of concrete.

.1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Backfill over concrete once cured.

3.5 GRANULAR BEDDING

.1 Place granular bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm.

.3 Shape bed true to grade and to provide continuous and uniform bearing surface for the pipe.

.1 Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to minimum 95% maximum dry density.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted common backfill.

3.6 INSTALLATION

.1 Install pipe, pipe fittings, and appurtenances at locations indicated on the Drawings.

.1 Install plastic pipe and fittings in accordance with CSA B182.11.

.2 Lay and join pipe in accordance with manufacturer's recommendations and acceptable to department representative.

.3 Lay pipes on prepared bed, true to line, and grade with pipe inverts smooth and free of sags or high points.

.1 Confirm barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Lay corrugated steel pipe:

.1 With outside circumferential laps facing upgrade and longitudinal laps or seams at side or quarter points.

.2 With longitudinal centre line of paved invert coinciding with flow line.

.6 Joint deflection permitted within limits recommended by pipe manufacturer.

.7 Water to flow through pipes during construction only when permitted by department representative.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Joints:

.1 Corrugated steel pipe:

.1 Install gaskets as recommended by manufacturer.

.2 Match corrugations or indentations of coupler band with pipe sections before tightening.

.3 Tap coupler firmly while tightening, to take up slack and provide snug fit.

.4 Insert and tighten bolts.

.2 Concrete and clay pipe:

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel, and other foreign material.

.5 Protect gaskets from displacement and contamination. Remove disturbed or contaminated gaskets; keep clean and free from dirt. Lubricate before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Apply sufficient pressure to make complete joints as outlined in manufacturer's recommendations.

.8 Mortared joints:

.1 For bell and spigot pipes, apply layer of mortar to the bottom half of bell end and layer of mortar to the top half of spigot end.

.1 Align spigot end and bell end and confirm that applied mortar on both ends is in contact when pipes are joined.

.2 Allow mortar to set for minimum of 1 hour before backfilling.

.10 When any stoppage of Work occurs, restrain pipes as directed by department representative, to prevent "creep" during down time.

.11 Plug lifting holes with prefabricated plugs, set in shrinkage compensating grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes and catch basins.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or approved field connections for connecting pipes to existing stormwater pipes.

.1 Joint to be structurally sound and watertight.

.15 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

.16 Pipe Surround:

.1 Place surround material in unfrozen condition.

.2 Surround and cover pipes as indicated on the Drawings after completion of pipe laying, and review of the pipe joints by department representative.

.1 Leave joints and fittings exposed until site tests and inspections are completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated on the Drawings.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill elevation to at least 95% maximum dry density.

.7 Water jetting of backfill under haunches of corrugated steel pipe may be permitted if recommended by manufacturer and acceptable to department representative.

.8 When site test results indicate compliance with specified requirements, and are acceptable to department representative, place surround material at pipe joints.

.17 Backfilling

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated on the Drawings.

.3 Under paving and walks, compact backfill to at least 98% maximum dry density.

.1 In other areas, compact backfill to at least 95% maximum dry density.

.18 Manhole

.1 Maximum distance between manholes as indicated on the Drawings.

.2 Manhole locations as indicated on the Drawings.

.3 Excavate, backfill, and compact manhole bases in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.4 Construct manhole as indicated on the Drawings and in accordance with Section 33 05 16 – Maintenance Holes and Catchbasin Structures.

3.7 UNDERCROSSING (NOT USED)

3.8 SITE QUALITY CONTROL

.1 Site tests and inspections:

.1 Perform in accordance with Section 01 45 00 - Quality Control.

.1 Carry out inspection of installed stormwater by video camera, digital camera or by other related means.

.2 Draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through stormwater to ensure that pipe is free of obstruction as directed by department representative.

.3 Remove foreign material from stormwater and related appurtenances by flushing with water.

.4 Repair and retest stormwater line as required, until test results are within limits specified.

.5 Repair visible leaks regardless of test results.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

SECTION 33 42 13
STORMWATER CULVERTS

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete

.2 Section 31 05 16 - Aggregate for Earthwork

.3 Section 31 11 00 - Clearing and Grubbing

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling

.5 Section 31 24 13 - Roadway Embankments

1.2 PRICE AND PAYMENT PROCEDURES

.1 This item forms part of the stipulated contract lump sum.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C14M-20, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric)

.2 ASTM C76M-22a, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric)

.3 ASTM C117-23, Standard Test Method for Material Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

.4 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.5 ASTM C144-18, Standard Specification for Aggregate for Masonry Mortar

.6 ASTM C443M-21, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)

.7 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.8 ASTM D1056-20, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber

.9 ASTM D1248-16, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable

.10 ASTM F667/F667M-16, Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.2-M 88, Sieves, Testing, Woven Wire, Metric

.3 CSA Group (CSA):

.1 CSA A257 Series:19, Standards for Concrete Pipe and Manhole Sections

.2 CSA A3000-18, Cementitious Materials Compendium

.1 CSA A3001-18, Cementitious materials for use in concrete

.3 CAN/CSA G401-14, Corrugated Steel Pipe Products

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: Product literature and data sheets for pipes, and fittings, including product characteristics, performance criteria, dimensions, WHMIS SDS's and limitations.

.3 Source Quality Control Submittals:

.1 Submit proposed source of bedding materials and provide access for sampling minimum 4 weeks before beginning the Work.

.4 Manufacturer's instructions:

.1 Special delivery, storage, and handling requirements.

.2 Installation instructions.

.3 Flushing procedures.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.1 Store and handle pipes, fittings and accessories to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

.2 Prevent damage to machined ends of pipes while handling and moving pipe.

.2 Carefully examine delivered materials to confirm type and grade of material.

1.7 SITE CONDITIONS

.1 Dewatering: In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Examine subsurface investigation report as indicated in Section 00 31 00 - Available Project Information.

.3 Known underground utility lines and buried objects are as indicated on the Drawings.

PART 2 PRODUCTS

2.1 DESCRIPTION

.1 Regulatory requirements:

.1 Identification:

.1 Cast, stamp or indelibly mark every length of pipe and every fitting with the maker's name or mark and the weight or class or quality of the product, or mark in accordance with the relevant standard.

2.2 MATERIALS

.1 Corrugated steel pipe:

.1 Corrugated steel pipe and couplers, fittings, and appurtenances: To CAN/CSA-G401.

.1 Gaskets: To ASTM D1056.

.2 Coatings: Galvanized.

.2 Prefabricated Headwalls: As indicated on the Drawings.

.2 Concrete pipe:

.1 Reinforced concrete pipe: To CSA A257, as indicated on the Drawings.

.2 Rubber gaskets for joints: To CSA A257.

.3 Bituminous joint compound: In accordance with manufacturer recommendations.

.4 Cement mortar joint filler:

.1 Portland cement: To CSA A3000 (specifically CSA A3001).

.2 Sand: To ASTM C144.

.3 Mortar: One part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

.3 Corrugated high density polyethylene pipe and fittings: To ASTM F667/F667M.

.1 Polyethylene resin: To ASTM D1248, grade W8.

.2 Weathering resistance: To ASTM D1248, Class C.

2.3 GRANULAR BEDDING AND SURROUND MATERIAL

.1 Granular bedding and surround material: In accordance with Section 31 05 16 - Aggregate for Earthwork and the following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified in Section 31 05 16 – Aggregate for Earthwork.

.2 Concrete mixes and materials for bedding, cradles, encasement, supports: In accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.4 BACKFILL MATERIAL

.1 Type 1: In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation.

.2 Verify removal of trees, brush vegetation, tree stumps and roots is completed in accordance with Section 31 11 00 - Clearing and Grubbing.

3.2 PREPARATION

.1 Clean pipes and fittings of debris and water before installation.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Provide erosion and sediment control measures in accordance with Section 01 57 00 - Temporary Controls and temporary controls.

.3 Trench alignment and depth require department representative's review before placing bedding material and pipe.

3.4 GRANULAR BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place bedding in unfrozen condition.

.3 Place 200 mm minimum thickness of granular material on bottom of excavation and compact to 95% minimum of maximum dry density.

.4 Shape bedding to fit lower segment of pipe exterior so that width of at least [50]% of pipe diameter is in close contact with bedding and to provide camber as indicated on the Drawings, free from sags or high points.

3.5 INSTALLATION

.1 Install pipe, pipe fittings, and appurtenances at locations indicated on the Drawings.

.2 Lay and join pipe in accordance with manufacturer's recommendations and acceptable to department representative.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.

.1 Confirm barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Lay corrugated steel pipe:

.1 With outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.6 Prevent water from flowing through pipes during construction except as permitted by department representative.

.7 Joints:

.1 Corrugated steel culverts:

.1 Corrugated steel pipe:

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened, to take up slack and provide snug fit.

.3 Insert and tighten bolts.

.4 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich paint for department representative's review.

.2 Concrete pipe:

.1 Joints may be made with rubber gaskets, bituminous joint compound or Portland cement mortar.

.1 Rubber gasket joints:

.1 Install in accordance with manufacturer’s recommendations.

.2 Verify that tapered ends are fully entered into flanged ends.

.2 Bituminous filled joint:

.1 Make joint, with excess of filler, to form continuous bead around outside of pipe, and finish the inside of pipe smooth.

.3 Mortar joints:

.1 Clean pipe ends and wet with water before joint is made.

.2 Place mortar in lower half of flanged end of pipe section in place.

.3 Apply mortar to upper half of tapered end of pipe section being installed.

.4 Join pipe ends and force joint up tight, inner surfaces of abutting pipe sections to be flush and even.

.5 Clean inside of pipe and annular space between ends of pipes after each joint is made.

.6 Fill joint with mortar and finish smooth and even.

.7 For pipes 800 mm or less in diameter, fill joints before mortar in joints has set.

.8 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

.3 Corrugated polyethylene pipe:

.1 Install couplings in accordance with manufacturer's instructions.

.8 Pipe surround:

.1 Place surround material in unfrozen condition.

.2 Surround and cover pipes as indicated on the Drawings after completion of pipe laying, and review of the pipe joints by departmental representative.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated on the Drawings.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer to at least 95% maximum dry density.

.9 Backfilling

.1 Place backfill material in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Place backfill in unfrozen condition.

.3 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated on the Drawings.

.4 Compact each layer to 95% maximum dry density taking special care to obtain required density under haunches.

.5 Protect installed culvert with minimum 900 mm cover of compacted fill before heavy equipment is permitted to cross.

.1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

3.6 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION