



SPECIFICATIONS FOR

NEW DAIN CITY PUBLIC SCHOOL

415 Eastbridge Avenue,

Welland, Ontario

for the

District School Board of Niagara

#26051

Consulting Team

Architect
Civil Engineering
Structural Engineering
Mechanical Engineering
Electrical Engineering
Landscape Architecture

Whiteline Architects Inc.
Hallex Engineering Ltd.
Hallex Engineering Ltd.
Quartek Group Inc.
Quartek Group Inc.
Hill Design Studio Inc.

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.....	Mandatory Separate Prices (bound separately)
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01500	Temporary Facilities
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01600	Material and Equipment
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07260	Below Grade Gas / Vapour Membranes
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07420	Aluminum Composite Panels
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07465	Prefinished Metal Soffit
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07520	2-Ply Modified Bitumen Roof Membrane (<u>Jocelyn Roof Consultants</u>)
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07620	Prefinished Metal Flashing & Sheet Metal
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23 05 23	Electric Motors and Mechanical Wiring
23 05 24	Variable Frequency Drives
23 05 29	Hangers and Supports
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DSBN Tender 26051 – New Dain City Elementary School

INVITATION TO BID

Section 00010

Page 1

- | | | |
|---|----|---|
| 1.1 Outline of Work | .1 | The work is outlined in General Requirements Section 01001. |
| 1.2 Qualification to Bid | .1 | Invitations to bid are extended to all pre-qualified general contractors in accordance with the pre-qualification evaluation process #26052. |
| | .2 | Contractors intending to bid are expected to extend similar minimum standards of qualification to all sub-trades they intend to use. |
| | .3 | General Contractors, Mechanical, Electrical, Roofing, Data Cabling and Millwork sub-contractors submitting a bid must be prequalified to do so. |
| 1.3 Bid Depository | .1 | The Niagara Construction Associations Bid Depository System of bid collection for sub-contractors will not be entertained on this project. |
| 1.4 Examination and Pre-Bid Site Meeting | .1 | Before submitting their bid, each bidder shall examine the Contract Documents, visit the site, take note of all conditions that exist and difficulties that may arise; and shall include in their Tender a fixed price to cover the cost of all Work required to complete this contract. No provision will be made during the Work for failure to comply with this requirement. |
| 1.5 Form of Specification | .1 | These specifications generally follow the Canadian National Master Specification 2004. |
| 1.6 Document Availability | .1 | The District School Board of Niagara (DSBN) or "Owner" is not distributing hard copies of the construction documents. |
| | .2 | The tender, drawing and specifications are made available by DSBN to pre-qualified contractors only by downloading and printing as electronic documents through the online bidding platform bids&tenders. Contractors, sub-contractors and suppliers interested in tendering on this project are responsible for obtaining the documents themselves. |
| | .3 | Addenda and supplementary information distribution will also be online through bids&tenders. |

End of Section 00010



**Purchasing and
Central Services**

191 Carlton Street,
St. Catharines, ON
L2R 7P4
(905) 641-1550

REQUEST FOR TENDER # 26051

New Dain City (Welland South) Elementary School

Bid Solicitation Issue Date:	April 22, 2026
Site Visit:	Refer to Section 4.0 & 5.0
Question Deadline:	May 12, 2026 at 4:00 PM.
Closing Date and Time:	May 21, 2026 at 2:00:00 p.m. Local Time
Bid submission Method:	Electronic bid submission only Refer to Section 2.0

The following pages comprise Tender 26051 and form the contract documents.

**Contract Documents: Identified as “New Dain City (Welland South) Elementary School”
” as prepared by Whiteline Architects, 83 Ontario Street, St. Catharines, ON”**

- * Invitation to Bid – (Section 00010)
- * Instructions to Bidders – (Section 00100)
- * Appendix A – Policies regarding Bid Irregularities
- * DSBN Supplementary Conditions to the CCDC 2 – 2008 dated March 9, 2020, CCDC 2 - 2008
- * Specifications – See Specification Index
- * Drawings – See Drawing Index, which is part of the Drawing Package
- * Addenda issued prior to closing

Bids and Tenders Forms

Schedule of Prices:

- * Pricing Form
- * Contingency and Allowances

Specifications:

- * Mandatory Requirements
- * Mandatory Alternates

Subcontractors:

- * Subcontractors – Prequalified by DSBN
- * Proposed Subcontractors

Bids and Tenders uploads

- Bid Bond
- Agreement to Bond

Andrew McCaffery,
Coordinator
Andrew.McCaffery@dsbn.org

DEFINITIONS

Addendum/Addenda	a written addition/alteration/change made to an Invitation to Bid subsequent to its printing or publication
Award	notification to a Bidder/Proponent of acceptance of a tender that brings a contract into existence
Bid /Bids/Submission/Tender	the Bidder's/Proponent's response to the Invitation to Bid
Bidder/Proponent	a legal entity, being a person, partnership or corporation that submits a bid in response to a formal Invitation to Bid
Compliance – Compliant Bid	a Bidder/Proponent who responds to this solicitation and is compliant with the mandatory requirements and whose bid indicates performance without material deviation from the terms and conditions of the proposed contract, and who is fully capable of performing the contract. This includes but is not limited to, a bid that complies with all the Invitation to Bid instructions, requirements, and one that submits all required documentation, as stated in Invitation to Bid, or other materials requested and/or required within the time and date specified in this Invitation to Bid.
Compliance – Non-Compliant Bid	a non-responsive bid is one that does not meet the bid mandatory requirements, as stated in the Invitation to Bid or fails to provide all required documents/attachments. Any noncompliant bid received will be rejected.
Conflict of Interest	<p>Material conflict of interest means there is the potential to:</p> <ul style="list-style-type: none"> (i) influence a person's financial decisions or conduct or (ii) have a non-trivial impact on the financial situation of a person or an entity in which that person or an immediate family member has a significant financial interest. <p>Immaterial Conflict of Interest means there is no potential to:</p> <ul style="list-style-type: none"> (i) influence a person's financial decisions or conduct or (ii) have no impact on the financial situation of a person or an entity in which that person or an immediate family member has a significant financial interest.
Contract	any written contract between the DSBN and a Vendor or any purchase order issued by the DSBN to the Vendor with respect to the Goods/Services contemplated by this Invitation to Bid, deemed to include the terms and conditions for the provision of the Goods/Services as set out in this Bid document. The DSBN has accepted the Vendor's Offer.
Contractor/ Supplier / Vendor	the person or corporation whose Bid Submission has been accepted and awarded by the DSBN, and who is deemed to have entered into the Contract with the DSBN
Deliverables/ Work	quantifiable goods or services, either tangible or intangible, submitted within the scope of a project
DSBN	District School Board of Niagara
ESA	<p>Electrical Safety Authority of Ontario, responsible for administering specific regulations related to the Ontario Electrical Safety Code (OESC), licensing Electrical Contractors and Master Electricians, electricity distribution system safety, and electrical products safety.</p> <p>The DSBN requires that all electrical products offered in bid submissions be compliant and labeled accordingly with recognized certification marks. http://www.esasafe.com</p>
HST	Harmonized Sales Tax
Irregularity – Major	a deviation which relates to information that is material to the Contract. If the deviation is permitted, the Bidder could gain an unfair advantage over competitors. The DSBN will reject any bid submission which contains a major irregularity.

Irregularity - Minor	a deviation which affects form rather than substance. The effect is not material to the Contract or causes an ambiguity that can be categorized as a clerical error where information was inadvertently not included in the submission. If the deviation is permitted or corrected the Bidder would not gain an unfair advantage over competitors. The DSBN may / may not accept or waive, at the discretion of the Purchasing Manager or Supervisor, a minor irregularity or permit the Bidder/Proponent to correct minor irregularity items of noncompliance which do not strictly comply, or are incomplete or ambiguous with the provisions and requirements of this Contract. All Bidders/Proponents agree to provide all such additional information as, and when requested, within 48 hours, at their own expense, provided no Bidder/Proponent in supplying such information will be allowed, in any way materially, to alter or add to the submission originally submitted.
ITB	Invitation to Bid, consisting of all documents prepared and distributed by the DSBN, in order to obtain goods and/or services, including Request for Quote, Request for Tender, Request for Tender, Request for Supplier Qualifications, Expression of Interest and Request for Information opportunities.
Mandatory Requirement	minimum requirement – where the words “Mandatory”, “Must”, “Required”, “Shall” and/or “Will” are referenced in this ITB document. Failure to comply with mandatory requirements will deem the submission noncompliant and the bid will be disqualified.
Request for Tender	A Request for Tender (RFT) document is used to request Bidder responses to supply goods and/or services based on stated delivery requirements, performance specifications, terms and conditions, where the focus for award is predominantly on price and delivery requirements.
Subcontractor	a Subcontractor is a person, partnership or corporation having a direct contract with the Contractor to perform a part or parts of the Work, or to supply products worked to a special design according to the Contract Documents, but does not include one who merely supplies products not so worked.
Submission Deadline	date and time by which the Bid Submission must be received, failing which such Bid Submission will not be accepted or considered.

1.0 PROJECT INVITATION AND INTENT

- 1.1 The intent of this Tender is to obtain offers to perform all works to construct the entire scope of work referred to as "Dain City Elementary School" (the **Project**) for District School Board of Niagara (the "**Owner**"), located at 415 Eastbridge Avenue, Welland ON. (the "**Site**") and as described in the drawings in the Tender Documents for a stipulated sum remuneration, in accordance with the contract documents.

1.1.1 The Work is to include a new 3 storey elementary school including a daycare and community space having an area of approximately 6200m² (66,736 sq. ft) all in accordance with the Contract Documents.

- 1.2 Construction start date: June 1, 2026
Site Ready: July 15, 2026
City Approved Occupancy with all finishing complete in building except daycare, library and community center - November 1, 2027
Substantial completion, all areas in building with city approved occupancy and all finishing including all exterior plantings/sod - December 3, 2027
Project Complete - January 7, 2028

The commencement of any work under this Agreement is contingent upon the DSBN receiving all required approvals. As such, the anticipated start date is subject to change. The Contractor acknowledges that delays resulting from pending or incomplete Ministry approval shall not constitute a breach of this Agreement, and no additional compensation shall be owed for such delays.

The completion schedule is such that the Owner requires the Contractor achieve Substantial Performance of the Work no later than December 3 2027 and to achieve Total Completion no later than January 7, 2028. Take over procedures are to follow the process outlined in OGCA 100 – OAA/OGCA Takeover Procedures (2007).

- 1.3 The following General Contractors have been pre-qualified by the Owner through RFSQ #26052 to submit a Tender for this Project. Only those General Contractors which have been prequalified may provide bids on this project

General Contractors - for Three (3) New Elementary Schools RFSQ 26052

General Contractor's Name	Phone #	Facsimile #	Email
Aquicon Construction	905-458-1313		purchasing@aquicon.com
Brouwer Construction Ltd.	905-984-3060	905-984-3063	shawn@brouwerconstruction.com
Collaborative Structures Ltd.	519-658-2750		jblackler@collaborativestructures.com
DeFaveri Group Contracting Inc.	905-664-7046	905-560-1306	jdefaveri@defaveri.ca
Duomax Developments Ltd.	905-563-7488	905-563-7485	edpoort@duomax.ca office@duomax.ca
Everstrong Construction Ltd.	416-930-8952		bryan@everstrong.ca
Garritano Bros Ltd.	905-576-8642		steve@garritano-bros.com
Merit Contractors Niagara Ltd.	905-641-2374	905-641-2988	estimating@meritcontractors.com
Norlon Builders	519-672-7590		mpilecki@norlon.ca
Percon Construction Inc	416-744-9967		massimo@perconconstruction.com
Pre-Eng Contracting Ltd.	905-738-6866		info@pre-eng.com
Tambro Construction Ltd.	519-766-1234		ntami@tambro.com
TRP Construction General Contractors	905-336-1041	905-336-9564	carriep@trpconstruction.ca

- 1.4 The following Electrical sub-contractors have been pre-qualified by the Owner through RFSQ# 25144 to submit a Tender for this Project. Only those sub-contractors which have been pre-qualified may provide bids on this project.

Electrical Contractors – Category B – Over \$1,000,000

Electrical Contractor's Name	Phone #	Email
BCR Electric Ltd.	905-935-0154	bcr.electric92@gmail.com
Cahill Electric Inc.	905-388-0515	estimating@cahillelectric.ca
Clairmont Electric Inc	905-296-6012	kclairmont@clairmontelectric.com
Ecco Electric Ltd.	905-984-8544	mail@eccoelectric.com
Kraun Electric Inc	844-667-6937	estimating@kraun.ca
L.J. Barton Mechanical Inc.	905-304-1976	estimating@ljbarton.com
Mario's Electric Ltd.	905-735-1294	lorenzo@marioselectric.com
T. Lloyd Electric Ltd.	905-388-8916	mark@tlloydelectric.ca
Verhoef Electric Inc.	905-562-5977	office@verhoefelectric.com
Visca Electric	905-354-0184	sandro@viscaelectric.ca

- 1.5 The following Mechanical sub-contractors have been pre-qualified by the Owner through RFSQ# 25143 to submit a Tender for this Project. Only those sub-contractors which have been pre-qualified may provide bids on this project.

Mechanical Contractors – Category B – Over \$1,000,000

Mechanical Contractor's Name	Phone #	Email
Carmichael Engineering Ltd.	905-625-4701	jsutcliffe@carmichael-eng.ca
Group 92 Mechanical Contractors	905-984-3282	stephen@group92.com
Keith's Plumbing & Heating Inc.	905-544-8118	morgan@keithsph.com
Kelson Mechanical Inc.	905-898-3400	josh.kelson@kelson.on.ca
Kirk Mechanical Ltd.	905-681-0140	kirkmech@bellnet.ca
LJ Barton Mechanical Inc.	905-304-1976	estimating@ljbarton.com
Mattina Mechanical Ltd.	905-544-6380	dmattina@mattina.ca
Nutemp Mechanical Systems Ltd.	905-338-5603	dmcmichael@nutemp.ca
Regional Mechanical (Niagara) Inc.	905-684-6555	mmirabella@rmni.ca
Superior Boiler Works & Welding Ltd.	905-643-6628	dsettimi@sbww.com bfoley@sbww.com
VanAm Mechanical Ltd.	289-897-0346	abe@vanammechanical.ca

		dave@vanammechanical.ca
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- 1.6 The following Roofing sub-contractors have been pre-qualified by the Owner through RFSQ# 24039 to submit a Tender for this Project. Only those sub-contractors which have been pre-qualified may provide bids on this project.

Roofing Contractors – Category B – Over \$600,000

Roofing Contractor's Name	Phone #	Facsimile #	Email
Atlantic Roofers	905-573-6202	905-573-1138	Info@atlanticroofers.ca
Atlas-Apex Roofing	519-894-4422	519-894-4487	inquiries@atlas-apex.com
B & G Roofing	905-545-4493	905-524-1173	info@bg-roofing.ca
Cordeiro Roofing	416-234-9901	416-234-9581	estimating@cordeiroofing.com
Crawford Roofing	416-787-0649	416-787-0640	Nelson.rites@crawfordroofing.ca
Eileen Roofing	416-762-1819	416-762-7013	eileen@eileenroofing.com
Flynn Canada	905-643-9515	905-643-6499	Joseph.raposo@flynncompanies.com
GRRC Canada	905-393-7989	905-393-7751	George@grrc.ca
Maxim Roofing	416-245-4949		info@maximroofing.ca
Nortex Roofing	416-236-6090	416-236-6091	info@nortexroofing.com
Pollard Roofing	905-332-6660	905-332-6662	reception@pollardroofing.ca
Proteck Roofing	416-630-2300	416-630-2310	info@proteckroofing.com
RCJ Roofing	416-679-8911	416-675-0893	info@rcjroofingsheetmetal.com
Roque Roofing	905-525-9689	905-525-7844	sarah@roqueroofing.com
Semple Gooder	416-743-5370	416-743-4257	bmccandless@semplegooder.com
Trio Roofing	905-456-1688	905-456-3440	paulo@trioroofing.ca

- 1.7 The following Millwork sub-contractors have been pre-qualified by the Owner through RFSQ# 23130 to submit a Tender for this Project. Only those sub-contractors which have been pre-qualified may provide bids on this project.

Millwork Contractors – Category C – Over \$300,000

Millwork Contractor's Name	Phone #	Facsimile #	Email
Baywood Interiors Ltd.	519-748-9577	519-748-6563	info@baywoodinteriors.com
Harris Corporate Interior Inc.	905-563-6111	905-563-6122	dan@hciinc.ca
REA Construction	905-264-6481	905-264-1805	vitojr@reaconstruction.org
Wood Design Custom Millwork	905-595-1281	905-595-1283	wooddesign.ltd@gmail.com

- 1.8 The following Data Cabling sub-contractors have been pre-qualified by the Owner through RFSQ# 23136 to submit a Tender for this Project. Only those sub-contractors which have been pre-qualified may provide bids on this project.

Data Cabling Contractors – Category B – Over \$100,000

Data Cabling Contractor's Name	Phone #	Facsimile #	Email
BCR Electric	905-935-0154	905-935-0158	bcr.electric92@gmail.com
Procon Constructors Inc.	905-732-0322	905-732-3778	bids@procon.ca
Systemmacs Voice/Data Solutions	905-468-9559	905-468-7762	jmerza@systemmacs.com

- 1.9 The following Paint sub-contractors have been pre-qualified by the Owner through RFSQ# 25006 to submit a Tender for this Project. Only those sub-contractors which have been pre-qualified may provide bids on this project.

Painting Contractors – Category A – Over \$25,000

Painting Contractor's Name	Phone #	Facsimile #	Email
Connco Group Ltd o/a Northern Painters	905-388-8881	905-388-8884	northpaint@conncogroup.com
Contour Architectural Coatings Inc.	905-680-9888	905-680-1516	contourpainting@gmail.com

2.0 TENDER SUBMISSION

- 2.1 The Bid Document shall only be available to prospective Bidders for viewing, downloading and printing as electronic documents through the online bidding platform bids&tenders. Only registered Suppliers may submit a Bid.
- 2.2 The onus is on all Bidders to have a Bidding System Account and be registered as a Plan Taker for this Bid opportunity, which in doing so will allow the Bidder to download the Bid document and other supplementary documents and receive Addenda email notifications.
- 2.3 Questions related to this Bid opportunity are to be submitted to the DSNB's Purchasing Contact through the Bidding System only by clicking on the "Submit a Question" button for this specific Bid opportunity. The DSNB is not responsible for responding to or any responses to any questions related to this Bid opportunity not submitted through the Bidding System.
Bidders and their representatives are not permitted to contact any employees, officers, agents, elected or appointed officials or other representatives of the DSNB concerning matters regarding this RFT other than the DSNB Purchasing Contact, through the "Submit a Question" process.
- 2.4 It is the responsibility of the Bidder to seek clarification of any matter that they consider unclear before submitting a Tender. Bidders must promptly notify the DSNB through the "Submit a Question" process of any error, inconsistency or omission discovered during the review of the Contract Documents prior to the Submission Deadline or deadline for questions, if applicable, whichever date and time occurs first.

INSTRUCTIONS TO BIDDERS**Tender #26051 *Dain City Elementary School*****Section 00100****Page 5**

- 2.5 The DSBN will not entertain requests for gratuitous payments arising from error alleged to have been made in the Contract which the DSBN has accepted.
- 2.6 All submissions must be in English.
- 2.7 It is the Bidder's sole responsibility to ensure that their Submission document(s):
 - i. do not have a security password
 - ii. are not defective corrupted or blank, and
 - iii. can be viewed and opened by the DSBN

- 2.8 Submissions are to be sent ONLY through the Bidding System. Hard copy or other electronic means submissions are not permitted and will be rejected.
- 2.9 Tenders must be received prior to the Submission Deadline, received by the Bidding System. It is the sole responsibility of each Bidder to ensure that its submission is received by the Bidding System no later than the Submission Deadline for the RFT.
- 2.10 Late bids will not be considered and are not permitted by the Bidding System.
- 2.11 Bidders are cautioned that the timing of their Bid Submission is based on when the Bid is RECEIVED by the Bidding System, not when a Bid is submitted, as Bid transmission can be delayed due to file transfer size, transmission speed, etc.
- 2.12 For the above reasons, it is recommended to allow sufficient time to complete your Bid Submission and to resolve any issues that may arise. The closing time and date shall be determined by the Bidding System's web clock.
- 2.13 Bidders should contact bids&tenders support listed below, at least twenty-four (24) hours prior to the closing time and date, if they encounter any problems. The Bidding System will send a confirmation email to the Bidder advising that their bid was submitted successfully. If you do not receive a confirmation email, contact bids&tenders support at support@bidsandtenders.ca.
- 2.14 Please be advised that 500MB document size is the bids&tenders limitation for electronic submissions.
- 2.15 Bidders may edit or withdraw their Bid Submission prior to the Submission Deadline. However, the Bidder is solely responsible to ensure the re-submitted bid is received by the Bidding System no later than the stated closing time and date.
- 2.16 If a Bidder submits their bid prior to the Submission Deadline and any Addenda have been issued, the Bidding System shall WITHDRAW the Bid submission and the bid status will change to an INCOMPLETE STATUS and Withdraw the Bid. The Bidder can view this status change in the "MY BIDS" section of the Bidding System.
The Bidder is solely responsible to:
- make any required adjustments to their Bid; and
 - acknowledge the Addenda; and
 - ensure the re-submitted Bid is RECEIVED by the Bidding System no later than the stated Submission Deadline.
- 2.17 Bidders shall acknowledge receipt of any addenda through the Bidding System by checking a box for each addenda and any applicable attachment.
It is the responsibility of the Bidder to have received all Addenda that are issued. Bidders should check the specific Bid opportunity online at [DSBN url](#) prior to submitting their Bid and up until Bid closing time and date in the event additional Addenda are issued.
- 2.18 A blackout period shall exist between the bid posting date (not deadline for questions) and the date of award. During this period there shall be no communication between the Bidders, the DSBN or any DSBN consultants or employees, unless initiated by the DSBN's Purchasing Contact.

Post-award, any discussions related to the bidding, evaluation and award process must be directed only to the DSBN's Purchasing Contact.

- 2.19 Tender submissions should provide straightforward, concise proof of the capabilities to satisfy RFT requirements.
- 2.20 So far as practical, all material included with a Bid must be included in your submission. The Bidder bears the risk of loss where the requirement is not followed.
- 2.21 All submissions and associated enclosures become the property of the DSBN.
- 2.22 All costs associated with the preparation of the bid submission will be solely the responsibility of the Bidder.
- 2.23 The DSBN is committed to providing equal treatment to people with disabilities with respect to the use and benefit of educational services in a manner that respects their dignity and that is equitable in relation to the broader public in accordance with the *Ontario Human Rights Code*, ODA and the AODA, the DSBN will accommodate for a disability, ensuring full and equitable participation throughout the Tender process.
- 2.24 The DSBN will consider the Accessibility for Ontarians with Disabilities Act (AODA) requirements when developing competitive bids and will provide open competitive bidding on the acquisition of all goods, services, and construction where feasible, practical, and cost effective, consistent with the educational goals of the DSBN and fair business principles. Responsible environmental criteria in procurement practices will be incorporated where feasible.
- 2.25 If a Bidder requires this Tender in a different format to accommodate a disability, the Proponent must contact the DSBN Contact as soon as possible through the Submit a Question process and in any event prior to the Submission Deadline. The Tender in the different format will be issued only to the requesting Bidder and all Addenda will be issued in such different format only to the requesting Bidder.
- 2.26 The DSBN is committed to providing equal treatment to people with disabilities with respect to the use and benefit of educational services in a manner that respects their dignity and that is equitable in relation to the broader public in accordance with the *Ontario Human Rights Code*, ODA and the AODA, the DSBN will accommodate for a disability, ensuring full and equitable participation throughout the Tender process.
- 2.27 There will not be a public opening for this RFT.

3.0 TENDER DOCUMENTS

- 3.1 Tender documents may also be viewed at the office of the Niagara and Hamilton Construction Associations. Contractors or suppliers are responsible to ensure all tender documents are complete.
- 3.2 Tender Documents are the property of the Owner and are delivered only for the purpose of enabling each bidder to prepare and submit a tender. The information contained or referred to in the Tender Documents is not to be disclosed or released for

any other use or purpose.

- 3.3 Tender Documents are made available only for the purpose of obtaining offers for this project. Their issue does not confer a license or grant for other purposes.

4.0 EXAMINATION OF TENDER DOCUMENTS AND PROJECT SITE

- 4.1 Before submitting Tenders, bidders shall carefully examine the Tender Documents and the Project Site and shall fully inform themselves of existing site conditions and ascertain the extent and nature of all conditions affecting the performance of the Work, including locations of all concealed services which may have to be protected, removed or relocated and shall include in their Tender price all costs to complete Work described in the Tender Documents.
- 4.2 As per Section 2.1.3 the bidder shall submit questions through the bidding system regarding all discrepancies, errors, omissions, departures from building code and/or by-laws and good building practice (i.e. items considered to be of a dubious nature), which the bidder discovers during the tender period and prior to the Tender Closing.
- 4.3 The Tender shall be based on the products, materials or articles, methods, designs or specifications designated for the Project in the Specifications. When more than one product, material or article, method, design or specification is designated for the Project, the bidder may use in the Tender any of the designated products, materials or articles, methods, designs or specifications without notice unless specifically noted to only bid the first item named. Proposals for substitutions after award of Contract are governed by Division 1 of the Specifications.
- 4.4 The Contractor shall accept sole responsibility for any error or neglect on his part in respect to this Article.

5.0 PRE-TENDER MEETING AND PROJECT WALKTHROUGH

- 5.1 **Prequalified General Contractors, Mechanical, Electrical, Roofing, Data Cabling, and Millwork subcontractors may visit the site at their convenience, located at 415 Eastbridge Avenue, Welland, Ontario**
- 5.2 Bidders intending to submit Bids are strongly encouraged to attend the site meeting and obtain for themselves all information pertaining to existing conditions affecting the proper execution and completion of the Work. Claims for additional compensation will not be considered for any items of labour or material required to complete the work that could have been reasonably ascertained by a site examination.
- 5.3 This site meeting is to facilitate the Bidders in familiarizing themselves with the actual site conditions. The written document will always govern the bid process. Bidders must send questions (if any) and seek clarifications in writing from the Purchasing Contact through the Bidding System's "Submit a Question". RFT document(s)/addenda prevail over what is explained and discussed during the pre-bid meeting.

- 5.4 It is the Bidder's responsibility to visit the job site and to examine all existing conditions to determine the amount and character of the work involved and to take their own measurements and make their own calculations prior to submitting a Bid. No allowance will subsequently be made for any errors or omissions on the part of any Bidder.
- 5.5 Any person sent on behalf of the Bidder is an acceptable representative.
- 5.6 A Bidder who does not attend or who is late to an optional site visit will still be eligible to bid.
- 5.7 Any new information discussed at the Site Visit will be forwarded to all Bidders in the form of an Addendum. Neither the Owner nor the Consultant will be responsible for any verbal instructions given at the pre-bid meeting unless the instructions are contained in an Addendum.

6.0 NO ADJUSTMENT

- 6.1 No adjustment to the schedule for completion of the Project or to the Contract Price will be made for conditions and features of the Project Site including, but not limited to, means of access and egress, obstacles, surrounding or adjacent public and private properties or requirements or authorities having jurisdiction which are evident at the pre-tender meeting or at any time during the tender period.
- 6.2 Under no circumstances shall the owner be responsible for any costs incurred or damages suffered by any bidders resulting from the Tender, including in relation to the preparation, review or evaluation of the Tender.

7.0 BIDDING SYSTEM FORMS

- 7.1 Any mandatory forms will be indicated in the bidding system and must be completed for your Submission to be accepted by the bidding system.
- 7.2 Bidders will have access to begin working on forms for their response upon posting of the bid opportunity. Forms may be completed in any order and saved throughout the process then submitted prior to Submission deadline.
- 7.3 The DSBN hereby consents to the use of an Electronic Signature for the signing of the Form of Tender. Acceptable forms of signature include, but are not limited to, the typing of the Bidder's authorized signing Officer's name or the inclusion of an image of the Bidder's authorized Officer's signature, so long as the electronic signature is sufficient to identify the Bidder's authorized signing Officer. The Bidder's authorized signing Officer agrees that whatever form of electronic signature is provided constitutes a signature for the purpose of executing the Form of Tender document. (all documents requested hereunder.)

8.0 PRICING

- 8.1 The total stipulated price submitted on the Pricing Form on the bids&tenders procurement platform intended to cover the cost of the complete work at the school (inclusive of all applicable duties, customs, freight, exchange and taxes except for Harmonized Sales Tax (HST). For greater certainty, HST will be extra and **must not** be included in Bid prices.

9.0 ALTERNATIVES

Voluntary Alternatives: N/A

- 9.1 Should the bidder want to propose products, materials or articles, methods, designs or specifications alternate to those designated for the Project, then such bidder may suggest an alternative by completing the appropriate bids&tenders form for valuation and consideration by the DSBN. The Tender price however shall be based on the specified products, material or articles, methods, designs or specifications. Such alternate submissions shall describe the designated product, material or article, method, design or specification, a description of the alternative and the total revision to the Tender price that would result if the alternative were accepted.

Mandatory Alternatives:

- 9.2
- Remove all new sod and replace with hydroseed.
 - Replace kindergarten storage building with an 8'x8' precast bunker to match daycare.
 - Delete all work to naturalization area including walkway plantings and furniture and replace with hydroseed.
 - Remove all floor finishes including gymnasium to Tarkett VCT II full colour range.
 - Delete all window coverings

Should the Owner require separate prices for products, materials or articles, methods, designs or specifications alternate to those designated for the Project, then such Bidder must complete the appropriate bids&tenders form. The Tender price however shall be based on the specified products, material or articles, methods, designs or specifications. Such alternate submissions shall describe the designated product, material or article, method, design or specification, a description of the alternative and the total revision to the Tender price that would result if the alternative were accepted.

10.0 INTERPRETATION, CLARIFICATION AND ADDENDA

- 10.1 The DSBN reserves the right at any time prior to the Submission Deadline, to withdraw or cancel the RFT, extend the Submission Deadline or modify these Instructions, the Form(s), the Specifications, or the Description of the Project, Work or Supply, by the publication of an Addendum or other notice, and the DSBN will not be liable for any expense, cost, loss or damage incurred or suffered by any Bidder (or any other person) as a result of its so doing. Such addenda may contain important information, including significant changes to the RFT. Bidders are solely responsible for obtaining all addenda issued by the DSBN.

- 10.2 All addenda will be posted on the DSBN bids&tenders website. It is the responsibility of the Bidder to check the website often for Addenda at DSBN url.
- 10.3 If a Bidder submits their bid prior to the Bid closing time and date and any Addenda have been issued, the Bidding System shall WITHDRAW the Bid submission and the bid status will change to an INCOMPLETE STATUS and Withdraw the Bid. The Bidder can view this status change in the "MY BIDS" section of the Bidding System. The Bidder is solely responsible to:
- make any required adjustments to their Bid; and
 - acknowledge the Addenda; and
 - ensure the re-submitted Bid is RECEIVED by the Bidding System no later than the stated Submission Deadline.
- 10.4 The DSBN reserves the right to:
- distribute the responses to all questions that have been submitted (but will not attribute the questions to any person or Bidder)
 - edit questions for clarity and applicability to all Bidders generally
 - decline to distribute an answer to a question if the DSBN deems, in its sole opinion and discretion, that the answer is irrelevant to other Bidders or has already been addressed in the bid document.
- 10.5 If the DSBN determines that it is necessary to issue an addendum in proximity to the Submission Deadline, the DSBN may extend the Submission Deadline for a reasonable period of time, in its sole discretion.
- 10.6 All addenda issued will become part of the Contract Documents and will be considered in determining the bid prices.
- 10.7 No employee or agent of the DSBN is authorized to verbally amend or waive the requirements of this bid document in any way. Under no circumstances shall the Bidder rely upon any information or instructions from the DSBN, its employees, or its agents unless the information or instructions are provided in writing in the form of an official Addendum.
- 10.8 It is vital to the DSBN that the process leading to the recommendation of a Vendor and the conclusion of an agreement be seen to be open and fair and that each of the Bidders is treated equally. No Bidder can be seen to be deriving, intentionally or otherwise, an advantage of information which is not equally available to all other Bidders.

11.0 SCHEDULE

- 11.1 The Owner requires that the Work under this Contract be completed as quickly as possible. Where the lowest compliant bid does not meet the time to completion required by the Owner, the Owner reserves the right to select the next lowest bidder whose time to completion meets the owner's requirements. The selection of the next lowest compliant bid to meet the time to completion requirement will be subject to the consideration of the additional cost to the Owner.
- 11.2 It is the expectation of the District School Board of Niagara (DSBN) that the Contractor will order the necessary materials upon award of the Contract.

- 11.3 If the Contractor is delayed in the performance of the Work by:
any cause beyond the Contractors control other than one resulting from a default or breach of Contract by the Contractor, then the Contract Time shall be extended for such reasonable time as the Consultant or DSBN representative may recommend in consultation with the Contractor. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the Contractor agrees to a shorter extension. The Contractor shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the Owner, Consultant or anyone employed or engaged by them directly or indirectly.

12.0 SUB CONTRACTORS

- 12.1 DSBN Prequalified Subcontractors
Subcontractors required for this project are listed on the bidding system form. Select one prequalified contractor for each category.
- 12.2 Proposed Subcontractors
Subcontractors required for this category are listed on the bidding system form. For each category list the Subcontractors proper legal designation. The phrase "own forces" may be used in those categories which are generally accepted as being done by the General Contractor and providing the capability exists within the General Contractor's organization

The phrase "own forces" will only be accepted if the Contractor has his own qualified staff for the trade involved.

13.0 SECURITY DOCUMENTS

BID BOND

- 13.1 Submit a Bid Bond (CCDC Form 220-2024) with the Owner named as Obligee, issued by a bonding/surety company authorized to issue surety bonds in the Province of Ontario in an amount of not less than \$2,000,000 Canadian.
- 13.2 The Bid Bond shall be effective for a period of Ninety (90) days after the Tender Closing and will be retained by the Owner until a Tender has been accepted by the Owner and the required Performance Bond and Labour and Material Payment Bond and other documents required herein have been provided to the Owner and a written construction contract has been executed by the Owner and the successful bidder.
- 13.3 If after a Tender has been accepted and the successful bidder has failed or refused to execute the written construction Contract and/or furnish the required Performance Bond and Labour and Material Payment Bond or any of the other documents required herein within the time prescribed herein, the Bid Bond of the successful bidder shall be forfeited, without recourse, to the use of the Owner.
- 13.4 Include the cost of the bonds in the Tender price.

AGREEMENT TO BOND

- 13.5 Submit an "Agreement to Bond" or a "Consent of Surety" valid for 90 days from the date of tender closing, stating that the bonding/surety company providing the Bid Bond will supply the Performance Bond and Labour and Material Payment Bond stipulated in the Contract Documents
- 13.6 A labour and material bond in the amount of 50% of the total contract value including taxes, and a Performance Bond in the amount of 50% of the total contract value including taxes.
- 13.7 Include the cost of the bonds in the Tender price

14.0 PERMITS/FEES

- 14.1 The bidders are not to include the cost of the Municipal Building Permit in the Tender price. The Owner will be responsible for purchasing the Municipal Building Permit.
- 14.2 Permits pertaining to particular Subcontractors shall be paid by the particular Subcontractor concerned.

15.0 CONFLICT OF INTEREST

15.1 Conflict of Interest and Prohibited Conduct

1. Conflict of Interest

The DSBN may disqualify a Bidder for any conduct, situation or circumstances, determined by the DSBN, in its sole and absolute discretion, to constitute a Conflict of Interest.

For the purposes of this RFT, the term "Conflict of Interest" includes, but is not limited to, any situation or circumstance where:

- (a) in relation to the RFT process, the Bidder has an unfair advantage or engages in conduct, directly or indirectly, that may give it an unfair advantage, including but not limited to (i) having, or having access to, confidential information of the DSBN in the preparation of its Bid that is not available to other Bidders, (ii) communicating with any person with a view to influencing preferred treatment in the RFT process (including but not limited to the lobbying of decision makers involved in the RFT process), or (iii) engaging in conduct that compromises, or could be seen to compromise, the integrity of the RFT process; or
- (b) in relation to the performance of its contractual obligations contemplated in the Contract that is the subject of this procurement, the Bidder's other commitments, relationships or financial interests (i) could, or could be seen to, exercise an improper influence over the objective, unbiased and impartial exercise of its independent judgement, or (ii) could, or could be seen to, compromise, impair or be incompatible with the effective performance of its contractual obligations.

For the purposes of section (a) (i) above, Bidders should specifically consider whether there were any individuals (employees, advisers, or individuals acting in any other capacity) who (a) participated in the preparation of the bid; **AND** (b) were employees of the DSBN within twelve (12) months prior to the Submission Deadline.

In addition to any other situation that may constitute a Conflict of Interest, Bidders will not be permitted to submit a Bid if the Bidder participated in the preparation of the RFT, and any such bid submitted will be disqualified.

2. Disqualification for Prohibited Conduct

The DSBN may disqualify a Bidder or terminate the Contract (in compliance with the applicable Terms and Conditions) if, in the sole and absolute determination of the DSBN, the Bidder has engaged in any conduct prohibited by this RFT.

3. Prohibited Bidder Communications

A Bidder shall not engage in any communications that could constitute a Conflict of Interest and should take note of the Conflict of Interest declaration on the Bidding System site when completing a Submission.

4. Bidder Not to Communicate with Media

A Bidder may not at any time directly or indirectly communicate with the media in relation to this RFT or any Contract entered into pursuant to this RFT without first obtaining the written permission of the DSBN Contact.

5. No Lobbying

A Bidder, including any agent or representative of a Bidder, may not, in relation to this RFT or the evaluation and selection process, engage directly or indirectly in any form of political or other lobbying whatsoever to advocate for any interest that may be affected by the RFT process or to influence the outcome of the RFT process.

For the purpose of this RFT:

- (a) "Lobbying" means the advocacy of an interest that is affected, actually or potentially by the procurement process or individuals involved in the procurement process including seeking to influence the outcome of the procurement process or subsequent award of a contract.
- (b) Bidders, their staff members, or anyone involved in preparing a bid, shall not engage in any form of political or other lobbying whatsoever or seek to influence the outcome of the procurement process or subsequent award. This restriction extends to all of the DSBN's staff and anyone involved in preparing the RFT or participating in the bid evaluation process, and members of the Board of Trustees.
- (c) The DSBN may reject any Bid by a Bidder that engages in lobbying, without further consideration, and may terminate that Bidder's right to continue in the procurement process.
- (d) During a procurement process, all communications shall be made through the DSBN Contact. No Bidder or person acting on behalf of a Bidder or group of Bidders, shall contact any elected official, consultant or any employee of the DSBN to attempt to seek information or to influence the outcome of the procurement process.
- (e) Elected officials shall refer any inquiries about a procurement process to the Director of Education.

6. Illegal or Unethical Conduct

Bidders shall not engage in any illegal business practices, including activities such as bid-rigging, price-fixing, bribery, fraud, coercion or collusion. Bidders shall not engage in any unethical conduct, including lobbying, as described above, or other inappropriate communications, offering gifts to any employees, officers, agents, elected or appointed officials or other representatives of the DSBN, deceitfulness, submitting bids containing misrepresentations or other misleading or inaccurate information, or any other conduct that compromises or may be seen to compromise the competitive process provided for in this RFT.

7. Past Performance or Past Conduct

The DSBN may prohibit a supplier from participating in a procurement process based on past performance or based on inappropriate conduct in a prior procurement process. Such inappropriate conduct shall include but not be limited to the following: (a) illegal or unethical conduct as described above; (b) the refusal of the supplier to honour its pricing or other commitments made in its bid; (c) failure to disclose a conflict of interest or (d) any other conduct, situation or circumstance as outlined in the Policies and Procedures of the DSBN related to the Purchasing of Goods and Services.

16.0 TENDERS OPEN FOR ACCEPTANCE

- 18.1 A Tender will be irrevocable (i.e. open for acceptance by the DSBN) for a period of 90 days following the Submission Deadline for the RFT.

17.0 RESERVED RIGHTS OF THE DSBN

- 17.1 Tenders that contain costs that appear to be unbalanced or unreasonable as likely to adversely affect the interests of the DSBN may be rejected.
For the purpose of this provision “unbalanced” means the price submitted, whether in whole or in part, does not reflect reasonable, anticipated costs for the required labour, equipment and/or materials plus a reasonable proportionate share of the Bidder’s anticipated overhead and profit.
- 17.2 If the DSBN receives a Submission where the price is substantially lower than the pricing in other Submissions, or is otherwise determined to be unbalanced, the DSBN may confirm with the Bidder that the Bidder satisfies the requirements for participation and is capable of fulfilling the terms of the Contract. If the DSBN determines that they are not capable of fulfilling the terms of the Contract, the DSBN will deem the Submission noncompliant and reject it.
- 17.3 The submission of Tenders does not obligate the DSBN to accept any Tender or to proceed further with the Project. The DSBN may, in its sole discretion, elect not to proceed with the Project in whole or in part and may elect not to accept any or all Tenders for any reason and cancel the Project. Alternatively, should the DSBN not receive any satisfactory Tenders, it may, in its sole and absolute discretion, negotiate a contract for the whole or any part of the Project with the lowest compliant bidder.
- 17.4 By submitting a Tender, the bidder acknowledges the Owner’s rights as stated herein and absolutely waives any right of action against the Owner and the Consultant for the

Owner's failure to accept the bidder's Tender whether such right of action arises in contract, negligence, or any other cause of action.

- 17.5 The DSBN may award a contract on the basis of initial offers received, without negotiation. Therefore, each initial offer should contain the Bidder's best terms. Clarification discussions and negotiations may be conducted with the Bidder(s) whose submission is deemed best qualified, after which the DSBN, in its absolute discretion, may select that Tender and a contract may be awarded to that Bidder. If those discussions/negotiations do not satisfy the DSBN requirements, as determined by the DSBN, the DSBN will proceed to discussions with the next best qualified Tender.
- 17.6 Regardless if a Tender otherwise satisfies the requirements of the submission, the DSBN reserves the right to reject any Tender received from a person or agency that:
- i. is or has been involved in litigation with the DSBN, within the five-year period preceding the date of the submission;
 - ii. the DSBN has made a claim under a bid bond, a performance bond or a warranty bond within the five-year period preceding the date of the submission;
 - iii. in the opinion of the DSBN or its legal advisors, does not possess the experience, or financial, technical, personnel or other resources that may reasonably be expected to be necessary in order to carry out the obligations that the Bidder proposes to assume under the terms of its Tender.
- 17.7 The DSBN reserves the right to
- (a) make public the names of any or all Bidders;
 - (b) request written clarification or the submission of supplementary written information in relation to the clarification request from any Bidder and incorporate a Bidder's response to that request for clarification into the Bidder's Submission;
 - (c) request written clarification from any Bidder in respect to the Submission without contacting any other Bidders;
- with the understanding that any clarification sought shall not be an opportunity for the Bidder to either correct errors or change its Submission in any substantive manner. The DSBN shall not be obliged to seek clarification of any aspect of any Submission.
- (d) assess a Bidder's Submission on the basis of
 - (i) a financial analysis determining the actual cost of the Submission when considering factors including quality, service, price and transition costs arising from the replacement of existing goods, services, practices, methodologies and infrastructure (howsoever originally established);
 - (ii) information provided by references;
 - (iii) the Bidder's past performance under previous contracts with the DSBN;

- (iv) the information provided by a Bidder pursuant to the DSBN exercising its clarification rights under this RFT process; or
- (v) other relevant information that arises during this RFT process;
- (e) waive formalities and accept tenders that substantially comply with the requirements of this RFT at the DSBN's sole discretion;
- (f) verify with any Bidder or with a third party any information set out in a Submission;
- (g) check references other than those provided by any Bidder;
- (h) disqualify any Bidder whose Submission contains misrepresentations or any other inaccurate or misleading information;
- (i) disqualify any Bidder who has engaged in conduct prohibited by this RFT;
- (j) make changes, including substantial changes, to this RFT provided that those changes are issued by way of addenda in the manner set out in this RFT;
- (k) select a Bidder other than the Bidder whose Submission reflects the lowest cost to the DSBN;
- (l) reject any tender that contains pricing which appears to be unbalanced or unreasonable;
- (m) cancel this RFT process at any stage;
- (n) cancel this RFT process at any stage and issue a new RFT for deliverables the same as or similar to the Deliverables;
- (o) accept any tender in whole or in part; or
- (p) reject any or all tenders;

and these reserved rights are in addition to any other express rights or any other rights that may be implied in the circumstances.

18.0 AWARD OF CONTRACT

- 18.1 The award will be based on Total Price as shown on the bidding system Pricing Form. Where the contract is awarded to the lowest Bidder, the DSBN may negotiate amendments to the contract or to the work or services to be done or materials to be supplied under the contract and no other Bidder shall have any right to object that its Bid would have been lower had the negotiated amendments been included in the original Request to Tender or Tender Notice.
- 18.2 Award of the Contract will be subject to the requirements and approval of the Ministry of Education and Training, and the DSBN.

- 18.3 The price of alternates shall be separately stated on the appropriate bids&tenders for evaluation and consideration by DSBN. DSBN may at its discretion elect to purchase all, some or none of the alternates offered when accepting a bid.
- 18.4 The Owner will not consider requests for changes to a price in the Tender or number of weeks required to achieve Substantial Performance of the Work or Total Completion Date for errors alleged to have been made by a bidder in a Tender that the Owner has accepted in accordance with the procedures described in the Tender Documents.
- 18.5 No employee of the DSBN shall personally sell goods or services to the DSBN, nor have a direct or indirect interest in a company that sells goods or services to the DSBN. The DSBN may reject any tender submitted, or cancel any contract awarded in contravention of this requirement.
- 18.6 The issue of a Purchase Order by the DSBN gives rise to a Contract between the DSBN and the successful Bidder in accordance with the terms and conditions set out in these Instructions, the Specifications, the Drawings, any applicable Addenda and any other related documents.
- 18.7 The successful bidder shall execute the written construction Contract identified in the in the Tender Documents and shall deliver same to the Owner, in duplicate within ten (10) business days of notification to the bidder of the acceptance of its Tender, together with duly executed originals of the following documents:
- Insurance Certificates required by the Contract
 - WSIB Clearance Certificate
 - A performance Bond and Labour and Material Payment Bond as required in the Contract Documents.
- 18.8 It is understood and agreed that if the successful bidder fails to execute the written construction Contract, the DSBN will be entitled to all remedies available at law and in equity, including, but not limited to, damages amounting to the difference between the accepted Tender and the price of the Contract that is subsequently and consequently signed. Further the DSBN will be entitled to seek its damages from the Bid Bond delivered by the Bidder.
- 18.9 This Contract is non-exclusive. The DSBN may, at its sole discretion, purchase the same or similar equipment from other sources, subject to budget, specifications and requirements.
- 18.10 Where tie Tenders are received by two competing Bidders and the Tenders are low bid and compliant, the tie will be settled by the flip of a coin in the presence of the two Bidders. The Bidder whose bid has the earliest email time of submission may call the coin toss. The winner of the coin toss will be considered the awarded Tender. Where tie Tenders are received by three or more competing Bidders and the Tenders are high scored and compliant, the tie will be settled by drawing of names in the presence of the Bidders. The Bidder whose name is drawn will be considered the awarded Tender.
- 18.11 It is DSBN practice to publish unofficial bid results with the name and tender price of the low bidder. All pricing information must be regarded as unofficial.

Accordingly, bidders are warned not to make any business decision based upon the information disclosed on the unofficial bid results.

An announcement in regard to the successful bidder will be posted once DSNB staff has had the opportunity to review each bid and confirm that all bids comply with the requirements of the Tender.

- 18.12 It is DSNB practice to publish the name(s) of the successful Bidder(s) and the total tender price. The DSNB shall make every effort to safeguard the confidentiality of other information included in each submission, however, all submissions are subject to the provisions of the MFIPPA and the *Personal Information Protection and Electronic Documents Act (PIPEDA)*.

19.0 LIABILITY – DOCUMENTATION

WSIB DOCUMENTATION:

- 19.1 The successful Bidder will provide an eClearance Certificate for the DSNB through the WSIB on-line eServices website. This form must be furnished prior to commencement of any work or service. The successful Bidder further agrees to maintain their WSIB account in good standing throughout the Contract period.

20.0 CERTIFICATES OF INSURANCE

- 20.1 The successful Bidder must maintain individual positions in regard to requirements and provisions of law and no liability will attach to the Owner due to any act or omission on the part of the General Contractor, Subcontractor(s) or any of their agents or employees. The successful Bidder must maintain and pay for insurance as follows for the protection against claims directly arising as a result of the successful Bidder's operations under this Contract:
- 20.2 The successful Bidder must **provide and maintain**, during the term of the Contract, Commercial General Liability and Automobile Liability as per the DSNB Supplementary Conditions dated March 9, 2020 to the Canadian Construction Document Committee, CCDC 2-2008. The DSNB will require the successful Bidder to update certificates of insurance from time to time to ensure valid coverage.
- 20.3 Builders Risk Comprehensive naming both the successful Bidder and District School Board of Niagara in an amount adequate, reflecting the scope of work and the value of the contract.
- 20.4 Where cranes or hoists are used, Hook Insurance acceptable to the DSNB will be required.
- 20.5 Where asbestos abatement is involved pollution liability insurance will be required.

APPENDIX A - POLICIES REGARDING BID IRREGULARITIES

Major Irregularity: A deviation which relates to information that is material to the Contract. If the deviation is permitted, the Bidder could gain an unfair advantage over competitors. The DSBN may reject any bid submission which contains a major irregularity.

Minor Irregularity: A deviation which affects form rather than substance. The effect is not material to the Contract or causes an ambiguity that can be categorized as a clerical error where information was inadvertently not included in the submission. If the deviation is permitted or corrected the Bidder would not gain an unfair advantage over competitors. The DSBN may / may not accept or waive, at the discretion of the Purchasing Manager or Administrator, a minor irregularity or permit the Bidder to correct minor irregularity items of noncompliance which do not strictly comply or are incomplete or ambiguous with the provisions and requirements of this Contract. All Bidders agree to provide all such additional information as, and when requested, within 24 hours, at their own expense, provided no Bidder in supplying such information shall be allowed, in any way materially, to alter or add to the submission originally submitted.

Late bids	Major irregularity – Bid rejected by Bidding System
Proposals received on documents other than those provided by DSBN when permitted, and mandatory requirements have not been addressed	Major irregularity – Bid rejected by Bidding System
Proposals that are not completed in full, or are not typewritten, printed or in legible writing (in ink)	Minor or Major irregularity depending on extent
Insufficient financial security (no bid deposit or insufficient bid deposit) where mandatory	Major irregularity – Bid rejected by Bidding System
Failure to provide a letter of Agreement to Bond (Surety letter) where required	Major irregularity – Bid rejected by Bidding System
Proposals received by method stated as unacceptable i.e. faxed when statement that no faxed Proposals will be accepted.	Major irregularity
Partial Proposals (i.e. for less than all of the items required to be included in a bid) except where the document permits partial Proposals.	Minor or Major irregularity depending on extent

Preview of On-Line Bidding System Schedules

Please find below a preview only of certain schedules that will need to be completed online only through the Bidding System by the Bidder as part of your bid submission.

The Bidder acknowledges that the preview below is provided as a courtesy only (to assist the Bidder in determining the size and scope of the project, etc.) and shall not be relied upon in any way.

Please note that the schedules shown below are subject to change by addenda issued by the Owner. Following the issuance of addenda, such changes may be reflected in the electronic schedules to be completed but will not be reflected in this document. It is the Bidder's responsibility to review all addenda and ensure that the bid is submitted based on the current requirements.

For greater certainty, the Bidder shall submit their bid by completing all the schedules and fields on the online Bidding System. Any bid submitted on the basis of the preview schedules below may, in the Owner's sole discretion, be disqualified and rejected on the basis of being incomplete.

26051 - New Dain City (South Welland) Elementary School

Vendor Details

Company Name: TEST VENDOR
232 Sienna Cres
Address: Kitchener, On n2r1t4
Contact: TEST VENDOR
Email: testvendor@esolutionsgroup.ca
Phone: 111-111-1111
HST#:

Submission Details

Created On: Friday April 10, 2026 15:51:45
Submitted On:
Submitted By: TEST VENDOR
Email: testvendor@esolutionsgroup.ca
Transaction #:
Submitter's IP Address:

Schedule of Prices

HST will be extra and **must not** be included in Bid prices.

All prices are to be firm for the contract period with the exception of a legislated tax increase.

Prices quoted must be expressed in accordance with our specified unit of measure.

The DSBN reserves the right to correct a patent computational or other mathematical error evident on the face of the bid, however, unit prices will not be adjusted. For greater certainty, any failure by a Bidder to insert a unit price where required, or insertion of n/c or no charge in that field, will be deemed to be a "\$0" value.

* denotes a mandatory field.

Price Form

The Stipulated Price submitted on the Bids and Tenders Price Form is intended to cover the complete work at the School, which includes all other charges such as; Excise Taxes, custom duties, freight, exchange, where applicable, and all fees for permits for building and inspections by government and municipal authorities as in effect on this date.

Not included in the Stipulated Price is the Harmonized Sales Tax (H.S.T.)

Not Included in the Stipulated Price are Contingencies and Allowances as listed below(see Contingency and Allowances Form):

Contingency - \$300,000

Cash Allowance - \$700,000

Description	Quantity	Stipulated Price (HST Extra) *	Subtotal
New Dain City (South Welland) Elementary School	1		
Subtotal:			\$ 0.00

Contingency and Allowances

Description	Amount
Contingency	\$300,000.0000
Cash Allowance (As per section 01020)	\$700,000.0000
Subtotal:	\$ 1,000,000.00

Summary Table

Bid Form	Amount
Price Form	\$ 0.00
Contingency and Allowances	\$ 1,000,000.00
Subtotal Contract Amount:	\$ 1,000,000.00

Mandatory Requirements

MANDATORY REQUIREMENTS

Bidders/Proponents must complete this checklist. **Inability to provide the mandatory requirement will result in bid disqualification.**

A check in the "YES" space provided indicates the Bidder/Proponent understands and will comply with the item. Where a successful Bidder/Proponent answers "YES" to any item and defaults on that item, the DSBN may cancel the contract without penalty. A check in the "NO" space provided indicates the Bidder/Proponent understands and will not comply with the item.

Mandatory Requirement	Yes-No *
The Bidder agrees to indemnify and save harmless the DSBN, and its elected officials, officers, employees, agents, successors and assigns from and against all claims, demands, losses, actions, damages, suits, proceedings, expenses, costs, including all legal fees and disbursements, of every nature and kind whatsoever, which the DSBN and its elected officials, officers, employees, agents, successors and assigns may suffer, arising out of, or attributable to the acts or omissions of the Bidder, its directors, officers, servants, employees, agents, successors, assigns and anyone to for whom at law the Bidder is responsible, related to or arising out of programs or other matters to which an awarded Contract pertains and which may include, (a) on account of injury to persons, including death, or damage to property in any way caused by the negligence of the Bidder, its directors, officers, servants, employees, agents or employees in its actions, omissions, or failure to exercise reasonable care, skill or diligence, or (b) its wilful misconduct, or (c) failure to comply with applicable laws. All representations, indemnifications and warranties will continue in force indefinitely after the expiration or termination of this Contract.	<input type="radio"/> Yes <input type="radio"/> No
The Supplier shall comply with, and ensure that any subcontractors comply with, applicable accessibility laws, regulations and by-laws, including but not limited to the Ontarians with Disabilities Act, 2001 (ODA), the Accessibility for Ontarians with Disabilities Act, 2005 (AODA), Ontario Regulation 429/07 (Accessibility Standards for Customer Service) and Ontario Regulation 191/11 (Integrated Accessibility Standards), and the DSBN's accessibility policies and guidelines (for further information visit http://www.dsbno.org) during the term of the Contract.	<input type="radio"/> Yes <input type="radio"/> No
The DSBN will make every effort to safeguard the confidentiality of other information included in each submission, however Bidders acknowledge that all submissions are subject to the provisions of the Municipal Freedom of Information and Privacy Act and the Personal Information Protection and Electronic Documents Act.	<input type="radio"/> Yes <input type="radio"/> No
The Bidder declares that they have examined the Instruction to Bidders, the General Conditions of the Standard Construction Documents, CCDC 2 - 2008 Stipulated Price Contract, and as amended by the DSBN supplementary conditions dated March 9, 2020 for this project, and having visited, investigated and examined the site for all Conditions of the Contract affecting the Work, we agree to furnish all labour, material, plant, and equipment necessary for full completion of all the Work in accordance with the Drawing and Specifications, the Instructions to Bidders, together with Addenda.	<input type="radio"/> Yes <input type="radio"/> No
The successful Proponent agrees if notified of award of a Contract, to immediately commence work actively and to complete work as per schedule indicated in Section 1.2 of General Instructions to Bidders and to pay all extra wages and premiums necessary for overtime work, daily and on weekends for all trades required to complete the work as scheduled without extra compensation, barring strikes and Acts of God for which extra time may be allowed.	<input type="radio"/> Yes <input type="radio"/> No
The successful Proponent agrees to furnish an analysis of the Contract sum for the purpose of segmenting the project into costs within ten (10) days after the tender closing for the General Contractors.	<input type="radio"/> Yes <input type="radio"/> No
The successful Proponent will also furnish an analysis of the Contract Sum within ten (10) days of Contract award, the total aggregating amount of the tender.	<input type="radio"/> Yes <input type="radio"/> No
The successful Proponent to fully execute the form of Contract (CCDC 2 – 2008 as amended by the DSBN supplementary conditions (dated March 9, 2020) and the Contract will incorporate all of the documents listed in Article A-3 of the CCDC 2 – 2008 Stipulated Price Contract.	<input type="radio"/> Yes <input type="radio"/> No
The successful Proponent will furnish a 50% Performance Bond and a 50% Labour and Materials Bond as required by the Specifications and maintain this security in force for a period of at least one year after the date of the Architect's final Certificate. HST is not to be included in the cost of bonding.	<input type="radio"/> Yes <input type="radio"/> No
Upon award of tender the following WSIB and Liability insurance certificates will be required for this tender: - WSIB - Commercial Liability \$10,000,000 - Automobile Liability \$5,000,000 - Non-owned Automobile \$5,000,000 - Builder's Risk - Value of Project	<input type="radio"/> Yes <input type="radio"/> No
Any other mandatory requirements where "Will", "Must" or "Shall" are noted in the bid document.	<input type="radio"/> Yes <input type="radio"/> No

Mandatory Alternates

As requested and described in the Instructions to Bidders, we further shall supply all materials, labour, and services necessary for these separate prices which shall be broken out separately.

Mandatory Separate Prices shall describe the designated product, material or article, method, design or specification, and the total revision to the Tender price that would result if the Separate Item were accepted. Each particular item is to be broken out as a separate price.

Separate prices are **NOT TO BE INCLUDED** in the stipulated price bid on the tender form.

Separate Prices shall not include H.S.T.

Mandatory Alternate Description	Add *	Deduct *
Remove all new sod and replace with hydroseed.		
Replace kindergarten storage building with an 8' x 8' precast bunker to match daycare.		
Delete all work to naturalization area including walkway plantings and furniture and replace with hydroseed.		
Replace all floor finishes including gymnasium to Tarkett VCT II full colour range.		
Delete all window coverings.		

Subcontractors

Subcontractors - Prequalified by DSBN

PROPOSED DSBN PRE-QUALIFIED SUBCONTRACTORS

(a) The following are the Pre-qualified Subcontractors whose quotations we have employed in the preparations of this Tender and whose services we propose to use should this Tender be accepted. We agree not to change Subcontractors without the expressed and written approval of the DSBN.

(b) The Vendor hereby agrees that in proposing the undermentioned Pre-qualified Subcontractors they have consulted each Subcontractor and have ascertained to their complete satisfaction that those named are fully acquainted with the extent and nature of the work involved and of the proposed construction and that they will execute the work to conform to the requirements of the Contract Documents.

Scope of Work	Proposed Subcontractor *
Electrical (Must be prequalified and listed in Section 1.4)	
Mechanical (Must be prequalified and listed in Section 1.5)	
Roofing (Must be prequalified and listed in Section 1.6)	
Millwork (Must be prequalified and listed in Section 1.7)	
Cabling (Must be prequalified and listed in Section 1.8)	
Painting (Must be prequalified and listed in Section 1.9)	

Subcontractors

PROPOSED SUBCONTRACTORS

(a) The following are the Subcontractors whose quotations we have employed in the preparations of this Tender and whose services we propose to use should this Tender be accepted. We agree not to change Subcontractors without the expressed and written approval of the DSBN.

(b) List each Subcontractor by the firm's proper legal designation.

(c) The Vendor hereby agrees that in proposing the undermentioned Subcontractors they have consulted each Subcontractor and have ascertained to their complete satisfaction that those named are fully acquainted with the extent and nature of the work involved and of the proposed construction and that they will execute the work to conform to the requirements of the Contract Documents.

(d) The phrase "own forces", which may appear, will be used in those categories which are generally accepted as being done by the General Contractor and providing the capability exists within the General Contractor's organization.

(e) The phrase "own forces" will only be accepted if the Contractor has his own qualified staff for the trade involved.

Scope of Work	Proposed Subcontractor *
Fencing	
Excavation, Backfilling, and Compaction	
Site Services	
Landscaping	
Cast-in-place Concrete	
Precast Concrete Floor and Roof Slabs	
Masonry	
Rough Carpentry	
Thermal Insulants	
Metal Siding	
Steel Doors and Frames	
Aluminum Windows and Doors	
Finish Hardware	
Glass and Glazing	
Drywall and Acoustics	
Flooring	
Gym Wood Flooring	
White Boards and Tack Boards	
Solid Plastic Toilet Partitions	
Lockers	
Washrooms Accessories	
Athletic Equipment	
Elevator	
Structural Steel (Including Steel Joists)	
Structural Metal Deck	
Metal Fabrication	
BAS Controls	
Paving & Asphalt	

Documents

It is your responsibility to make sure the uploaded file(s) is/are not defective or corrupted and are able to be opened and viewed by the DSBN. If the attached file(s) cannot be opened or viewed, your Submission may be rejected.

Agreement to Bond:

Submit an "Agreement to Bond" or a "Consent of Surety", valid for 90 days from the date of Tender closing, stating that the bonding/surety company will supply the Performance Bond and Labour and Material Payment Bond stipulated in the Contract Documents. A labour and material bond in the amount of 50% of the total contract value including taxes, and a Performance Bond in the amount of 50% of the total contract value including taxes. Include the cost of the bonds in the Tender price.

Bid Bond:

Submit a Bid Bond (CCDC Form 220-2024) with the Owner named as Obligee, issued by a bonding/surety company authorized to issue surety bonds in the Province of Ontario in an amount of not less than \$2,000,000.00 Canadian. The Bid Bond shall be effective for a period of Ninety (90) days after the Tender Closing and will be retained by the Owner until a Tender has been accepted by the Owner and the required Performance Bond and Labour and Material Payment Bond and other documents required herein have been provided to the Owner and a written construction contract has been executed by the Owner and the successful bidder. If after a Tender has been accepted and the successful bidder has failed or refused to execute the written construction Contract and/or furnish the required Performance Bond and Labour and Material Payment Bond or any of the other documents required herein within the time prescribed herein, the Bid Bond of the successful bidder shall be forfeited, without recourse, to the use of the Owner.

Include the cost of the bonds in the Tender price.

- Agreement to Bond * (mandatory)
- Bid Bond * (mandatory)

Addenda, Terms and Conditions



I/We agree to be bound by the terms and conditions and have authority to bind the Corporation and submit this Bid on behalf of the Bidder.

-

The Bidder shall declare any potential Conflict of Interest that could arise from bidding on this opportunity. A Conflict of Interest could arise where the owner(s) of this company and/or an individual(s) employed by this company in a decision-making role work for or are related to someone who works for the District School Board of Niagara.

Do you have a Conflict of Interest?

☒ Yes ☐ No

The Bidder acknowledges and agrees that the Addendum/Addenda below form part of the Contract. Please check the box in the column "**I have received this Addendum**" below to acknowledge each of the Addenda.

File Name	I have reviewed the below addendum and attachments (if applicable)	Pages
There have not been any addenda issued for this bid.		

The Standard Construction Document CCDC 2 2008 for a Stipulated Price Contract, English version, consisting of the Agreement Between *Owner* and *Contractor*, Definitions and General Conditions of the Stipulated Price Contract, Parts 1 to 12 inclusive, governing same is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications:

AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE A-3 – CONTRACT DOCUMENTS

3.1 Add the following to the list of *Contract Documents* in paragraph 3.1:

- Amendments to CCDC 2 – 2008
- *Drawings*
- *Specifications*
- Performance Bond
- Labour and Material Payment Bond

ARTICLE A-5 – PAYMENT

5.3.1 Delete paragraph 5.3.1 in its entirety and replace it with the following:

Interest

.1 Should either party fail to make payments as they become due under the terms of the Contract or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at 0% above the prime rate. Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by the Bank of Canada for prime business loans, as it may change from time to time.

ARTICLE A-9 – CONFLICT OF INTEREST

Add new Article A-9 – Conflict of Interest:

- 9.1 The *Contractor*, all of the *Subcontractors* and *Suppliers* and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest, as described in this Article A-9, includes, but is not limited to, the use of *Confidential Information* where the *Owner* has not specifically authorized such use.
- 9.2 The *Contractor* shall disclose to the *Owner*, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*.
- 9.3 The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the *Owner* where to do so constitutes a breach by such employee or previous employee of the *Owner's* conflict of interest policy, as it may be amended from time to time, until after completion of the *Work* under the *Contract*.
- 9.4 It is of the essence of the *Contract* that the *Owner* shall not have direct or indirect liability to any *Subcontractor* or *Supplier*, and that the *Owner* relies on the maintenance of an arm's-length relationship between the *Contractor* and its *Subcontractors* and *Suppliers*. Consistent with this fundamental term of the *Contract*, the *Contractor* will not enter into any agreement or understanding with any *Subcontractor* or *Supplier*, whether as part of any contract or any written or oral collateral agreement, pursuant to which the parties thereto agree to cooperate in the presentation of a claim for payment against the *Owner*, directly or through the *Contractor*, where such claim is, in whole or in part, in respect of a disputed claim by the *Subcontractor* or *Supplier* against the *Contractor*, where the payment to the *Subcontractor* or *Supplier* by the *Contractor* is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the *Owner*, failing which the *Contractor* shall be saved harmless from all or a portion of those claims. The *Contractor* acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of interest. For greater certainty, the *Contractor* shall only be entitled to advance claims against the *Owner* for amounts pertaining to *Subcontractor* or *Supplier* claims where the *Contractor* has actually paid or unconditionally acknowledged

liability for those claims or where those claims are the subject of litigation or binding arbitration between the *Subcontractor* or *Supplier* and the *Contractor* has been found liable for those claims.

- 9.5 Notwithstanding 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, SUSPEND THE WORK OR TERMINATE THE CONTRACT, a breach of this Article by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity.

DEFINITIONS

Add the following new definitions:

27. Confidential Information

Confidential Information means all the information or material of the *Owner* that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not, including but not limited to information and material of every kind and description (such as drawings and move-lists) which is communicated to or comes into the possession or control of the *Contractor* at any time, but *Confidential Information* shall not include information that:

- 1) is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public;
- 2) the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence;
- 3) the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or
- 4) is independently developed by the *Contractor* without use of any *Confidential Information*.

28. Construction Schedule

Construction Schedule means the schedule for the performance of the *Work* provided by the *Contractor* pursuant to GC 3.5, including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*.

29. Force Majeure

Force Majeure means any cause, beyond the *Contractor's* control, other than bankruptcy or insolvency, which prevents the performance by the *Contractor* of any of its obligations under the *Contract* and the event of *Force Majeure* was not caused by the *Contractor's* default or active commission or omission and could not be avoided or mitigated by the exercise of reasonable effort or foresight by the *Contractor*. *Force Majeure* includes *Labour Disputes*, fire, unusual delay by common carriers or unavoidable casualties, civil disturbance, acts, orders, legislation, regulations or directives of any government or other public authority, acts of a public enemy, war, riot, sabotage, blockage, embargo, lightning, earthquake, or acts of God.

30. Install

Install means install and connect. *Install* has this meaning whether or not the first letter is capitalized.

31. Labour Dispute

Labour Dispute means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, job action, slow down, lock-outs, picketing, refusal to work or continue to work, refusal to supply materials, cessation or work or other labour controversy which does, or might, affect the *Work*.

32. Overhead

Overhead means all site and head office operations and facilities, all site and head office administration and supervision; all duties and taxes for permits and licenses required by the authorities having jurisdiction at the *Place of the Work*; all requirements of Division 1, including but not limited to submittals, warranty, quality control, calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs.

33. Request for Information/RFI

Request for Information or *RFI* means written documentation sent by the *Contractor* to the *Owner* or to the *Owner's* representative or the *Consultant* requesting written clarification(s) and/or interpretation(s) of the *Drawings* and/or *Specifications*, *Contract* requirements and/or other pertinent information required to complete the *Work* of the *Contract* without applying for a change or changes to the *Work*.

34. Direct Costs

Direct Costs are the reasonable costs of performing the contract or subcontract including costs related to the additional supply of services or materials (including equipment rentals), insurance and surety bond premiums, and costs resulting from seasonal conditions, that would not have been incurred, but do not include indirect damages suffered as a result, such as loss of profit, productivity or opportunity, or any head office overhead costs.

35. Proper Invoice

Proper Invoice means an invoice of application for payment of the *Contract Price* that complies with the requirements for a “proper invoice” under the *Construction Act*, and includes or attaches the documents and information required under paragraph 5.2.2 of GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT or, in the case of the final payment, the documents and information required under paragraph 5.7.1 of GC 5.7 – FINAL PAYMENT.

16. Amend Definition 16 by adding the following to the end of the Definition:

Provide has this meaning whether or not the first letter is capitalized.

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

- 1.0 Where a General Condition or paragraph of the General Conditions of the *Contract* is deleted by these amendments, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, unless stated otherwise herein, and the numbering of the deleted item will be retained, unused.

GC 1.1 CONTRACT DOCUMENTS

- 1.1.6 Add the following to the end of paragraph 1.1.6:

The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Owner* or the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* with respect to such divisions. The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangements and sizes of fixtures, equipment and outlets. The *Contractor* shall obtain more accurate information about the locations, arrangements and sizes from study and coordination of the *Drawings*, including *Shop Drawings* and shall become familiar with conditions and spaces affecting those matters before proceedings with the *Work*. Where site conditions require reasonable minor changes where the change requires only the additional labour of one half hour or less, the *Contractor* shall make such changes at no additional cost to the *Owner*. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor* shall include such relocation in the *Work*. The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The schedules are those portions of the *Contract Documents*, wherever located and whenever issued, which compile information of similar content and may consist of drawings, tables and/or lists.

- 1.1.7 Amend paragraph 1.1.7.1 by adding “Supplementary Conditions to CCDC 2 – 2008” before “the Agreement between the Owner and the Contractor” and deleting the reference to “Supplementary Conditions”.

Add new paragraphs 1.1.7.5, 1.1.7.6, 1.1.7.7 and 1.1.7.8 as follows:

- .5 noted materials and annotations on the *Drawings* shall govern over the graphic representation of the *Drawings*.
- .6 finishes in the room finish schedules shall govern over those shown on the *Drawings*.
- .7 architectural drawings shall have precedence over structural, plumbing, mechanical, electrical and landscape drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts and architectural elements of construction, it being understood that the integrity and installation of the systems designed by the *Consultant* or its sub-*Consultants* are to remain with each of the applicable drawing disciplines.
- .8 should reference standards contained in the *Specifications* conflict with the *Specifications*, the *Specifications* shall govern. Should reference standards and *Specifications* conflict with each other or if certain requirements of the *Specifications* conflict with other requirements of the *Specifications*, the more stringent requirements shall govern.

- 1.1.8 Delete paragraph 1.1.8 in its entirety and substitute as follows:

The *Consultant*, on behalf of the *Owner* shall provide the *Contractor* without charge, one (1) electronic copy of the *Contract Documents*, exclusive of those required by jurisdictional authorities and the executed *Contract Documents*. Additional copies can be purchased by the *Contractor* at the *Consultant's* cost of reproduction, handling and sales tax.

- 1.2.2 The Owner and the Contractor acknowledge and agree that:

- .1 this Agreement was entered into, or resulted from a procurement process (within the meaning set out in Section 87.3 of the Construction Act) that was commenced, on or after October 1, 2019, and, accordingly, amendments to the Construction Act that were proclaimed and came into force on July 1, 2018 and on October 1, 2019 are applicable to this Agreement; and
- .2 the Contractor will incorporate into its procurement documents and contracts with Subcontractors and Suppliers, and ensure that all Subcontractors and Suppliers are made aware of, these acknowledgements and agreements.

GC 1.3 RIGHTS AND REMEDIES

- 1.3.2 Delete the word “No” from the beginning of paragraph 1.3.2 and substitute the words:

“Except with respect to the requirements set out in paragraphs 2.2.13, 6.4.1, 6.5.4, 6.6.1 and 8.2.2, no...”

GC 1.4 ASSIGNMENT

Delete paragraph 1.4.1 in its entirety and replace with the following:

- 1.4.1 The *Contractor* shall not assign the *Contract*, or any portion thereof, without the prior written consent of the *Owner*. The *Owner* shall be entitled to assign the *Contract* to a corporation, partnership or other entity (the “Assignee”). Upon the assumption by the Assignee of the *Owner's* obligations under the *Contract*, the *Owner* shall be released from its obligations under the *Contract*.

GC 1.5 EXAMINATION OF DOCUMENTS AND SITE

Add new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows:

- 1.5.1 The *Contractor* declares and represents that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work*, it has investigated for itself the character of the *Work* to be done, based on information generally available from a site visit. The *Contractor* has assumed and does hereby assume all risk of conditions now

existing or arising in the course of the *Work* which might or could make the *Work*, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the tender was made or the *Contract* signed.

- 1.5.2 The *Contractor* also declares that in tendering for the *Work* and in entering into this *Contract*, the *Contractor* did not and does not rely upon information furnished by the *Owner* or any of its agents or servants respecting the nature or confirmation of the ground at the site of the *Work*, or the location, character, quality or quantity of the materials to be removed or to be employed in the construction of *Work*, or the character of the construction machinery and equipment or facilities needed to perform the *Work*, or the general and local performance of the work under the *Contract* and expressly waives and releases the *Owner* from all claims with respect to the said information with respect to the *Work*.

GC 1.6 TIME IS OF THE ESSENCE OF THE CONTRACT

Add new GC 1.6 - TIME IS OF THE ESSENCE OF THE CONTRACT as follows:

- 1.6.1 All time limits stated in the *Contract Documents* are of the essence of the *Contract*.

GC 2.2 ROLE OF THE CONSULTANT

- 2.2.7 Delete the words “Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER” .

- 2.2.13 Amend paragraph 2.2.13 by the addition of the following to the end of that paragraph:

If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or in the *Contract Time*, it shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* with a notice in writing to that effect. Failure to provide written notification within the time stipulated in this paragraph 2.2.13 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor*, without any adjustment in the *Contract Price* or *Contract Time*.

- 2.2.19 Add new paragraph 2.2.1.9 as follows:

The *Consultant* or the *Owner*, acting reasonably, may from time to time require the *Contractor* to remove from the *Project* any personnel of the *Contractor*, including project managers, superintendents, *Subcontractors* or *Subcontractor's* personnel. Such persons shall be replaced by the *Contractor* in a timely fashion to the satisfaction of the *Consultant* or the *Owner*, as the case may be, at no cost to the *Owner*.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

- 2.3.2 Amend paragraph 2.3.2 by adding the words “and *Owner*” after the words “*Consultant*” in the second and third lines.

- 2.3.3 Delete paragraph 2.3.3 in its entirety and replace it with the following:

The *Contractor* shall furnish promptly two copies to the *Consultant* and one copy to the *Owner* of all certificates and inspection reports relating to the *Work*.

- 2.3.4 Insert the word “review” after the word “inspections” in the first line of paragraph 2.3.4.

- 2.3.5 In the first line after “*Consultant*”, add “or the *Owner*”.

- 2.3.8 Add a new paragraph 2.3.8 as follows:

The *Consultant* will conduct periodic reviews of the *Work* in progress, to determine general conformance with the requirements of the *Contract Documents*. Such reviews, or lack thereof, shall not give rise to any claims by the *Contractor* in connection with construction means, methods, techniques, sequences and procedures, nor in connection with construction safety at the *Place of Work*, responsibility for which belongs exclusively to the *Contractor*.

- 2.3.9 Add a new paragraph 2.3.9 as follows:

The *Owner* shall have the right during and for up to seven (7) years after the term of the *Contract*, to audit, examine, and make copies of all invoices, books, records, documents, correspondence, contracts, electronic files, and other evidence relating to the performance of the *Work* or amounts claimed under the *Contract* in the possession or control of the *Contractor* and any *Subcontractor* (the “Records”). Such Records shall be made available directly by the *Contractor* or directly by the *Subcontractor* within ten (10) business days of the *Owner*’s written request. The *Contractor* shall authorize and direct all *Subcontractors* who have contracted with the *Contractor* to provide all Records requested under this paragraph 2.3.9 of the *Subcontractor* and the *Contractor* shall provide to the *Owner* an executed authorization and direction addressed to the *Subcontractors* for all Records requested in a form acceptable to the *Owner* within five (5) business days from the *Owner*’s request. The *Contractor* agrees to waive any requirements as to confidentiality between the *Contractor* and its *Subcontractors* in order to give effect to this provision. The *Contractor*’s and *Subcontractors*’ obligations under this paragraph 2.3.9 shall survive any termination or expiration of the *Contract*.

GC 2.4 DEFECTIVE WORK

2.4.1 Amend GC 2.4.1 by inserting “, the *Owner* and/or its agent” in the first sentence following “rejected by the *Consultant*”.

Add new paragraphs 2.4.1.1 and 2.4.1.2:

2.4.1.1 The *Contractor* shall rectify, in a manner acceptable to the *Consultant* and to the *Owner through 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 any defective work, which, in the sole discretion of the *Owner through the Consultant*, adversely affects the day to day operations of the *Owner* or which, in the sole discretion of the *Consultant*, adversely affects the progress of the *Work*.

2.4.2 Delete paragraph 2.4.2 in its entirety and replace it with the following:

The *Contractor* shall promptly pay the *Owner* for costs incurred by the *Owner*, the *Owner*’s own forces or the *Owner*’s other contractors, for work destroyed or damaged or any alterations necessitated by the *Contractor*’s removal, replacement or re-execution of defective work.

Add new paragraph 2.4.4 as follows:

2.4.4 Neither acceptance of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the sole responsibility for rectifying such defect or deficiency at the *Contractor*’s sole cost, even where such failure to identify, observe or warn is negligent.

GC 3.1 CONTROL OF THE WORK

3.1.3 Add a new paragraph 3.1.3 as follows:

Prior to commencing individual procurement, fabrication and construction activities, 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, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceedings with any part of the affected *Work*.

3.1.4 Add a new paragraph 3.1.4 as follows:

Notwithstanding the provisions of paragraphs 3.1.1 and 3.1.2, the *Owner* shall have access to the site at all times to monitor all aspects of construction. Such access shall in no circumstances affect the obligations of the *Contractor* to fulfill its contractual obligations.

GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

3.2.2.1 Delete paragraph 3.2.2.1 in its entirety.

3.2.2.2 Delete paragraph 3.2.2.2 in its entirety.

3.2.2.3 Delete paragraph 3.2.2.3 in its entirety.

3.2.2.4 Delete paragraph 3.2.2.4 in its entirety.

3.2.3.2 Delete paragraph 3.2.3.2 and replace it with the following:

Co-ordinate and schedule the activities and work of other contractors and *Owner's* own forces with the *Work* of the *Contractor* and connect as specified or shown in the *Contract Documents*.

3.2.3.4 Add new paragraph 3.2.3.4 as follows:

Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* own forces and for other contractors, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in force at the *Place of the Work*, including all of the responsibilities of the "constructor", pursuant to the *Occupational Health and Safety Act* (Ontario)..

GC 3.3 TEMPORARY WORK

3.3.2 In paragraph 3.3.2, in the second line after the words "where required by law", insert "or the *Consultant*".

GC 3.4 DOCUMENT REVIEW

3.4.1 Delete paragraph 3.4.1 in its entirety and substitute new paragraph 3.4.1:

The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be undertaken with the standard of care described in paragraph 3.14.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in this paragraph 3.4.1, the *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of the required standard of care.

3.4.2 Add new paragraph 3.4.2. as follows:

If, at any time, the *Contractor* finds errors, inconsistencies, or omissions in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, including laying out of the *Work*, the *Contractor* shall immediately notify the *Consultant*, and request instructions, a *Supplemental Instruction*, *Change Order*, or *Change Directive*, as the case may require, and the *Contractor* shall not proceed with the work affected until the *Contractor* has received such instructions, a *Supplemental Instruction*, *Change Order* or *Change Directive*. Neither the *Owner* nor the *Consultant* will be responsible for the consequences of any action of the *Contractor* based on oral instructions.

3.4.3 Add new paragraphs 3.4.3 as follows:

Errors, inconsistencies and/or omissions in the *Drawings* and/or *Specifications* which do not allow completion of the *Work* of the *Contract* shall be brought to the *Consultant's* attention prior to the execution of the *Contract* by means of an *RFI*.

GC 3.5 CONSTRUCTION SCHEDULE

3.5.1 Delete paragraph 3.5.1 in its entirety and replace with the following:

The *Contractor* shall:

.1 within five (5) calendar days of receiving written confirmation of the award of the *Contract*, prepare and submit to the *Owner* and the *Consultant* for their review and acceptance, a construction schedule in the format indicated below that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the

Contract Documents. Such schedule is to include a delivery schedule for *Products* whose delivery is critical to the schedule for the *Work* or are required by the *Contract* to be included in a *Products* delivery schedule. The *Contractor* shall employ construction scheduling software, that permits the progress of the *Work* to be monitored in relation to the critical path established in the schedule. The *Contractor* shall provide the schedule and any successor or revised schedules in both electronic format and hard copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline construction schedule; and,

.2 provide the expertise and resources, such resources including manpower and equipment, as are necessary to maintain progress under the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE; and,

.3 monitor the progress of the *Work* on a weekly basis relative to the baseline construction schedule, or any revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, update and submit to the *Consultant* and *Owner* the electronic and hard copy schedule on a monthly basis, at a minimum, or as required by the *Consultant* and advise the *Consultant* and the *Owner* weekly in writing of any variation from the baseline or slippage in the schedule; and,

.4 provide overtime work without change to the *Contract Price* if such work is deemed necessary to meet the schedule; and,

.5 ensure that the *Contract Price* shall include all costs required to phase or stage the *Work*.

3.5.2 Add new paragraph 3.5.2 as follows:

If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.5.1.3, the *Contractor* shall, either at the request of the *Owner* or the *Consultant*, or following giving notice pursuant to subparagraph 3.5.1.3, take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay. Within five (5) calendar days of the request by the *Owner* or the *Consultant* or the notice being given pursuant to subparagraph 3.5.1.3, the *Contractor* shall produce and present to the *Owner* and the *Consultant* a plan demonstrating how the *Contractor* will achieve the recovery of the last accepted schedule.

3.5.3 The *Contractor* is responsible for performing the *Work* within the *Contract Time*. Any schedule submissions revised from the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, during construction are not deemed to be approved extensions to the *Contract Time*. All extensions to the *Contract Time* must be made in accordance with the *Contract Documents*.

GC 3.6 SUPERVISION

Delete paragraph 3.6.1 in its entirety and replace with the following:

3.6.1 The *Contractor* shall employ a competent full-time superintendent, acceptable to the *Owner* and *Consultant*, who shall be in full time attendance at the *Place of Work* while the *Work* is being performed. The superintendent shall not be changed by the *Contractor* without valid reason which shall be provided in writing and shall not be changed without prior consultation with and agreement by the *Owner* and the *Consultant*. The *Contractor* shall replace the superintendent within 7 *Working Days* of the *Owner's* written notification, if the superintendent's performance is not acceptable to the *Owner*. The *Contractor* shall provide the *Owner* and the *Consultant* with the names, addresses and telephone numbers of the superintendent referred to in this paragraph 3.6.1 and other responsible persons who may be contacted for emergency and other reasons during non-working hours.

Delete paragraph 3.6.2 in its entirety and replace with the following:

3.6.2 The superintendent, and any project manager appointed by the *Contractor*, shall represent the *Contractor* at the *Place of Work* and shall have full authority to act on written instructions given by the *Consultant* and/or the *Owner*. Instructions given to the superintendent or the project manager shall be deemed to have been given to the *Contractor* and both the superintendent and any project manager shall have full authority to act on behalf of the *Contractor* and bind the *Contractor* in matters related to the *Contract*.

3.6.3 Add new paragraph 3.6.3 , 3.6.4, 3.6.5 and 3.6.6 as follows:

The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s). Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement, which is approved by the *Owner*.

- 3.6.4 The supervisory staff assigned to the *Project* shall also be fully competent to implement efficiently all requirements for scheduling, coordination, field engineering, reviews, inspections and submittals defined in the *Specifications*, and have minimum 5 years documented “Superintendent/Project Management” experience.
- 3.6.5 The *Consultant and Owner* shall reserve the right to review the record of experience and credentials of supervisory staff assigned to the *Project* prior to commencement of the *Work*.
- 3.6.6 A superintendent assigned to the *Work* shall be “Gold Seal Certified” as per the Canadian Construction Association; or a superintendent that can demonstrate the requisite experience and success related to the *Project* to the sole satisfaction of the *Owner*.

GC 3.7 SUBCONTRACTORS AND SUPPLIERS

- 3.7.1.1 In paragraph 3.7.1.1 add to the end of the second line “including any warranties and service agreements which extend beyond the term of the *Contract*.”
- 3.7.1.2 In subparagraph 3.7.1.2 after the words “the *Contract Documents*” insert the words “including any required surety bonding”.

Delete paragraph 3.7.2. in its entirety and replace with the following:

- 3.7.2 Substitution of any *Subcontractor* and/or *Suppliers* after submission of the *Contractor’s* bid will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be arbitrarily withheld. The reason for substitution must be provided to the *Owner* and to the original *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given the opportunity to reply to the *Contractor* and *Owner*. The *Contractor* shall be fully aware of the capability of each *Subcontractor* and/or *Supplier* included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule.

Add new paragraphs 3.7.7 and 3.7.8 as follows:

- 3.7.7 Where provided in the *Contract*, the *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any contract procured by the *Owner* for *Work* or services required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*, and upon such assignment, the *Owner* shall have no further liability to any party for such contract.
- 3.7.8 The *Contractor* covenants that each subcontract or supply contract which the *Contractor* enters into for the purpose of performing the *Work* shall expressly provide for the assignment thereof to the *Owner* (at the option of the *Owner*) and the assumption by the *Owner* of the obligations of the *Contractor* thereunder, upon the termination of the *Contract* and upon written notice by the *Owner* to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the *Owner* has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the *Owner* for the performance of obligations under such subcontracts or supply contracts and the *Contractor* shall be fully responsible for all of its obligations and liabilities (if any) under such subcontracts and supply contracts.

GC 3.8 LABOUR AND PRODUCTS

- 3.8.2 Delete paragraph 3.8.2 and substitute with the following:

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, provincial and municipal building codes, fire safety standards, and all governmental authorities and regulatory agencies 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. The said *Products* shall be at the sole risk of the *Contractor*.

Workmanship shall be, in every respect, first class and the *Work* shall be performed in accordance with the best modern industry practice.

- 3.8.3 Amend paragraph 3.8.3 by adding the words, “..., agents, *Subcontractors* and *Suppliers*...” after the word “employees” in the first line.

Add new paragraphs 3.8.4, 3.8.5, 3.8.6, 3.8.7, 3.8.8 and 3.8.9 as follows:

- 3.8.4 Upon receipt of a written notice from the *Owner*, the *Contractor* shall immediately remove from the *Place of the Work*, tradesmen and labourers whose conduct jeopardizes the safety of the *Owner's* operations. Immediately upon receipt of the request, the **Contractor** shall make arrangements to appoint an acceptable replacement.
- 3.8.5 Upon receipt of written notice from the *Consultant*, the *Contractor* shall remove from the *Place of Work*, tradesmen and labourers whose *Work* is unsatisfactory to the *Consultant* or who are considered by the *Consultant* to be unskilled or otherwise objectionable.
- 3.8.6 The *Contractor* shall cooperate with the *Owner* and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the *Work* at the *Place of the Work*, including cooperation to attempt to avoid *Work* stoppages, trade union jurisdictional disputes and other *Labour Disputes*. Any costs arising from labour disputes shall be at the sole expense of the *Contractor*.
- 3.8.7 The cost for overtime required beyond the normal *Working Day* to complete individual construction operations of a continuous nature, such as pouring or finishing of concrete or similar work, or *Work* that the *Contractor* elects to perform at overtime rates without the *Owner* requesting it, shall not be chargeable to the *Owner*.
- 3.8.8 All manufactured *Products* which are identified by their proprietary names or by part or catalogue number in the *Specifications* shall be used by the *Contractor*. No substitutes for such specified *Products* shall be used without the written approval of the *Owner* and the *Consultant*. Substitutes will only be considered by the *Consultant* when submitted in sufficient time to permit proper review and investigation. When requesting approval for the use of substitutes, the *Contractor* shall include in its submission any proposed change in the *Contract Price*. The *Contractor* shall use all proprietary *Products* in strict accordance with the manufacturer's directions. Where there is a choice of proprietary *Products* specified for one use, the *Contractor* may select any one of the *Products* so specified for this use.
- 3.8.9 Materials, appliances, equipment and other *Products* are sometimes specified by reference to brand names, proprietary names, trademarks or symbols. In such cases, the name of a manufacturer, distributor, *Supplier* or dealer is sometimes given to assist the *Contractor* to find a source *Supplier*. This shall not relieve the *Contractor* from its responsibility from finding its own source of supply even if the source names no longer supplies the *Product* specified. If the *Contractor* is unable to obtain the specified *Product*, the *Contractor* shall supply a substitute product equal to or better than the specified *Product*, as approved by the *Consultant* with no extra compensation. Should the *Contractor* be unable to obtain a substitute *Product* equal to or superior to the specified *Product* and the *Owner* accepts a different *Product*, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*.

GC 3.9 DOCUMENTS AT THE SITE

- 3.9.1 Delete paragraph 3.9.1 in its entirety and substitute the following:

The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, contemplated *Change Orders*, *Change Orders*, *Change Directives*, cash allowance disbursement authorizations, reviewed *Shop Drawings*, submittals, reports and records of meeting at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*.

GC 3.10 SHOP DRAWINGS

- 3.10.1 Delete paragraph 3.10.1 in its entirety and replace with the following:

The *Contractor* shall provide shop drawings as described in the *Contract Documents* and as the *Consultant* may reasonably request.

- 3.10.9 Delete paragraph 3.10.9 in its entirety and substitute the following:

At the time of providing *Shop Drawings*, the *Contractor* shall advise the *Consultant* in writing of any deviations in *Shop Drawings* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance of such deviation expressly in writing. Where manufacturers' literature is submitted in lieu of scaled drawings, it shall be clearly marked in ink, to indicate the specific items for which review is requested.

Add new paragraphs 3.10.13, 3.10.14, 3.10.15, 3.10.16, 3.10.17 and 3.10.18 as follows:

- 3.10.13 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* and/or the *Contract Time*.
- 3.10.14 The *Contractor* shall prepare a *Shop Drawings* schedule acceptable to the *Owner* and the *Consultant* prior to the first application for payment. A draft of the proposed *Shop Drawings* schedule shall be submitted by the *Contractor* to the *Consultant* and the *Owner* for approval. The draft *Shop Drawings* schedule shall clearly indicate the phasing of *Shop Drawings* submissions. The *Contractor* shall periodically re-submit the *Shop Drawings* schedule to correspond to changes in the construction schedule.
- 3.10.15 Except where the parties have agreed to a different *Shop Drawings* schedule pursuant to paragraph 3.10.3, the *Contractor* shall comply with the requirements for *Shop Drawings* submissions stated in the *Specifications*.
- 3.10.16 The *Contractor* shall not use the term "by others" on *Shop Drawings* or other submittals. The related trade, *Subcontractor* or *Supplier* shall be stated.
- 3.10.17 Certain *Specifications* sections require the *Shop Drawings* to bear the seal and signature of a professional engineer. Such professional engineer must 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*.
- 3.10.18 The *Consultant* will review and return *Shop Drawings* and submittals in accordance with the schedule agreed upon in paragraph 3.10.3, The *Contractor* shall allow the *Consultant* a minimum of 10 *Working Days* to review *Shop Drawings* from the date of receipt. If resubmission of *Shop Drawings* is required, a further 10 *Working Day* period is required for the *Consultant's* review.

GC 3.11 USE OF THE WORK

- 3.11.1 In the second line between the words "permits" and "or" add, by direction of the *Owner* or *Consultant*.
- 3.11.3 Add new paragraph 3.11.3 as follows:

The *Owner* shall have the right to enter or occupy the *Work* in whole or in part for the purpose of placing fittings and equipment, or for other use before *Substantial Performance of the Work*, if, in the opinion of the *Consultant*, such entry and occupation does not prevent or substantially interfere with the *Contractor* in the performance of the *Contract* within the *Contract Time*. Such entry or occupation shall neither be considered as acceptance of the *Work*, nor in any way relieve the *Contractor* from its responsibility to complete the *Contract*.

GC 3.12 CUTTING AND REMEDIAL WORK

Add new paragraphs 3.12.5 and 3.12.6 as follows:

- 3.12.5 Unless specifically stated otherwise in the *Specifications*, the *Contractor* shall do all cutting and making good necessary for the proper installation and performance of the *Work*.
- 3.12.6 To avoid unnecessary cutting, the *Contractor* shall lay out its work and advise the *Subcontractors*, when necessary, where to leave holes for installation of pipes and other work.

GC 3.13 CLEAN UP

- 3.13.1 At the end of the paragraph 3.13.1, add the following:

Remove accumulated waste and debris at least once a week as a minimum or as required by the nature of the *Work*.

3.13.2 In paragraph 3.13.2, in the fourth line add the word “materials” between the word “tools” and the words “*Construction Equipment*”.

3.13.3 In paragraph 3.13.3, in the first and second lines add the word “materials” between the word “tools” and the words “*Construction Equipment*”.

Add new paragraphs 3.13.4, 3.13.5 and 3.13.6 as follows:

3.13.4 The *Contractor* shall clean up garbage during and after construction, and maintain the site in a neat and orderly condition on a daily basis. Prior to leaving the site at the end of construction, the *Contractor* shall make good all damage to the building and its components caused by the performance of the *Work* or by any *Subcontractor* or *Supplier*. The *Contractor* shall leave the site in a clean and finished state; remove all equipment and materials; remove all paint, stains, labels, dirt, etc. from the *Work*; and touch up all damaged painted areas.

3.13.5 Without limitation to or waiver of the *Owner’s* other rights and remedies, the *Owner* shall have the right to back charge to the *Contractor* the cost of damage to the site caused by transportation in and out of the site by the *Contractor*, *Subcontractors* or *Suppliers*, if not repaired before final payment.

3.13.6 The *Contractor* shall dispose of debris at location and in a manner acceptable to the *Owner*, and authorities having jurisdiction in the area of the *Work* and the disposal area, and cover containers with tarpaulins tied in place to prevent scattering of debris on site and during transport.

GC 3.14 CONTRACTOR STANDARD OF CARE

Add a new General Condition 3.14 – CONTRACTOR STANDARD OF CARE as follows:

3.14.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise the standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract*, the performance of the *Contractor’s* obligations, duties and responsibilities shall be judged against this standard. The *Contractor* shall exercise the same standard of care, skill and diligence in respect of any *Products*, personnel or procedures which it may recommend to the *Owner*.

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

- .1 the personnel it assigns to the *Project* are appropriately experienced;
- .2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the *Owner’s* approval, in the event of death, incapacity, removal or resignation; and
- .3 there are no pending, threatened or anticipated claims, liabilities or contingent liabilities that would have a material effect on the financial ability of the *Contractor* to perform its work under the *Contract*.

GC 3.15 OCCUPANCY OF THE WORK

3.15.1 The *Owner* reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the *Project* even though the *Work* may not be substantially performed, provided that such taking possession and use will not interfere, in any material way, with the progress of the *Work*. The 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 the *Project*, nor shall it relieve the *Contractor* of any of its obligations under the *Contract*.

3.15.2 Whether the *Project* contemplates *Work* by way of renovations in buildings which will be in use or be occupied during the course of the *Work* or where the *Project* involves *Work* that is adjacent to a structure which is in use or is occupied, the *Contractor*, without in any way limiting its responsibilities under the *Contract*, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, the operation of HVAC systems, to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such

structures or adjacent structures.

GC 4.1 CASH ALLOWANCES

4.1.1 Delete the second sentence in paragraph 4.1.1

4.1.4 Delete paragraph 4.1.4 in its entirety and substitute the following:

Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances 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. 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*.

4.1.5 Delete paragraph 4.1.5 in its entirety and substitute the following:

The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount.

Add new paragraphs 4.1.8 and 4.1.9 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*, which are to be paid for from cash allowances.

4.1.9 Cash allowances cover the net cost to the *Contractor* of services, *Products*, *Construction Equipment*, freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any *Work* stipulated under the cash allowances but does not include any *Value Added Taxes* payable by the *Owner* and the *Contractor*.

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

5.1.1 Delete paragraph 5.1.1 in its entirety.

5.1.2 Delete paragraph 5.1.2 in its entirety.

GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

Delete paragraph 5.2.2 in its entirety and substitute the following:

5.2.2 Applications for payment shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties. The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of work performed and *Products* delivered and incorporated into the *Work* at that date. Materials may also be deemed to be supplied to an improvement, for payment purposes, when, in the *Owner's* opinion, they are placed and properly secured on the land on which the improvement is made, or placed upon land designated by the *Owner* or agent of the *Owner*, but placing the materials on the land so designated does not, of itself, make that land subject to a lien. No amount claimed shall include products delivered and incorporated into the work, unless the products are free and clear of all security interests, liens and other claims of third parties.

Each application for payment, except the first, shall include a statutory declaration, in the current CCDC 9A form, up to the date of the application for payment. Each application for payment (including the first, the holdback upon Substantial Performance, and final payments), shall be a Proper Invoice and include:

.1 the *Contractor's* name and address.

.2 the date of the *Proper Invoice* and the period during which the services or materials were supplied.

- .3 information identifying the authority, whether in the *Contract* or otherwise, under which the services or materials were supplied.
- .4 a description, including quantity where appropriate, of the services or materials 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 certificate, issued by an agency or firm providing workers' compensation insurance to the *Contractor*, verifying that coverage is in force at the time of making the application for payment, and that coverage will remain in force for at least sixty (60) days thereafter;
- .8 a declaration by the *Contractor* verifying that the performance of the *Work* is in compliance with all applicable regulatory requirements respecting environmental protection, first safety, public safety and occupational health and safety;
- .9 a pre-approved schedule of values, supplied by the *Contractor*, for Architectural Specification Divisions of the *Work*, aggregating the total amount of the *Contract Price*;
- .10 a separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of the Mechanical and Electrical Divisions of the *Work*, aggregating the total amount of the *Contract Price*;
- .11 invoices to support all claims against the cash allowance; and
- .12 a construction schedule pursuant to GC 3.5 reasonably acceptable to the Owner;

5.2.3 Amend paragraph 5.2.3 by adding the following to the end of that paragraph:

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.

Add new paragraphs 5.2.8, and 5.2.9 as follows:

5.2.8 The *Contractor* shall prepare and maintain current as-built drawings which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current as-built drawings shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant* shall retain a reasonable amount for the value of the as-built drawings not presented for review.

5.2.9 Prior to each application for payment, the *Contractor* and the *Consultant* shall jointly review the progress of the *Work*.

GC 5.3 PROGRESS PAYMENT

5.3.1.2 In the first sentence amend as follows: After the words "issue to the *Owner*" delete "and copy to the *Contractor*". After the words "no later than" add "7 calendar days after the receipt of the applicable Proper Invoices".

5.3.1.3 Delete subparagraph 5.3.1.3 in its entirety and substitute as follows:

the *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT no later than 28 calendar days after the receipt by the *Owner* of the complete applicable *Proper Invoice*, subject to the delivery by the *Owner* of a notice of non-payment under the *Construction Act*, and subject to the receipt by the *Owner* of a complete certificate of payment issued by the *Consultant*.

Add new paragraphs 5.3.2 and 5.3.3 as follows:

5.3.2 If the *Contractor* fails to provide all documentation as required by GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT, the *Contractor* or *Owner* shall be entitled to return the application for progress payment to the *Contractor* for

completion. The 7 day review period by the *Consultant* and 21 day payment period by the *Owner* will commence upon receipt of a proper and complete application for progress payment.

- 5.3.3 Payment will be direct deposited to the *Contractor's* bank account. The payment date shall be the date the payment is transferred to the *Contractor's* bank account. At the request of the *Owner*, the *Contractor* will provide evidence that the *Owner's* payments are held by the *Contractor* in an account in the *Contractor's* name, and that the *Contractor* is complying with its trust fund obligations under the *Construction Act*.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

- 5.4.2 Delete paragraph 5.4.2 in its entirety and substitute the following:

The *Consultant* will review the *Work* to verify the validity of the application and shall promptly, and in any event, no later than 30 calendar days after receipt of the *Contractor's* complete deficiency list and application, the *Consultant* shall:

.1 prepare a final deficiency list incorporating all items to be completed or corrected. Each item is to have an indicated value for correction or completion. Determination of the value is defined in GC 5.10 – DEFICIENCY HOLDBACK. The final deficiency list complete with values is to be included with the *Consultant's* draft verification and shall be reviewed with the *Owner* prior to 5.4.2.2.

.2 having completed 5.4.2.1, the *Consultant* shall:

- .1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or
.2 state the date of *Substantial Performance of the Work* in a certificate and issue a copy of that certificate to each the *Owner* and the *Contractor*.

- 5.4.3 Delete paragraph 5.4.3 in its entirety and substitute the following:

Following the issuance of the certificate of *Substantial Performance of the Work*, the following shall apply to completing the *Work*:

- .1 *Contractor* is to complete the *Work* within sixty (60) calendar days.
.2 No payments will be processed between *Substantial Performance of the Work* and the completion of the *Work*.
.3 The *Owner* reserves the right to contract out any or all unfinished *Work* if it has not been completed within sixty (60) days of *Substantial Performance of the Work* without prejudice to any other right or remedy and without affecting the warranty period. The cost of completing the *Work* including *Owner* and *Consultant* wages and materials shall be deducted from the *Contract Price*.

Add new paragraphs 5.4.4, 5.4.5 and 5.4.6:

- 5.4.4 Within the time prescribed by the *Construction Act*, the *Contractor* shall take whatever steps are required to publish or post a signed copy of the certificate, as is required by such legislation. If the *Contractor* fails to comply with this provision, the *Owner* may take the required steps pursuant to the legislation and charge the *Contractor* for any costs so incurred.

- 5.4.5 Prior to submitting its written application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* all:

- .1 guarantees;
.2 warranties;
.3 certificates;
.4 final testing and balancing reports;
.5 distribution system diagrams;
.6 spare parts;
.7 maintenance manuals;
.8 samples;
.9 reports and correspondence from authorities having jurisdiction in the *Place of the Work*;
.10 shop drawings;

- .11 inspection certificates;
- .12 one full size paper copy and one PDF electronic scanned copy red-lined record drawings.

and other materials or documentation required to be submitted under the *Contract*, together with written proof acceptable to the *Owner* and the *Consultant* that the *Work* has been substantially performed in conformance with the requirements of municipal, governmental, and utility authorities having jurisdiction in the *Place of the Work*. The *Consultant* shall refuse to certify *Substantial Performance of the Work* if the submittals referred to in this paragraph 5.4.5 are not provided by the *Contractor*.

- 5.4.6 The *Owner* shall withhold, from amounts otherwise payable to the *Contractor*, an amount not to exceed one (1) percent of the *Contract Price* as security for the obligation of the *Contractor* to deliver copies of the red-lined record drawings.

GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

Add new subparagraph 5.5.1.3 as follows

- 5.5.1.3 submit a statement that no written notices of liens have been received by it

- 5.5.2 Amend paragraph 5.5.2 by adding the following sentence to the end of that paragraph:

A reserve fund may be retained by the *Owner* to secure the correction of deficiencies and/or warranty claims. Included in the reserve fund would be all *Consultant* and *Owner* costs including any and all staff and material costs, design, tendering and contractor and supplier costs related to the correction of deficiencies and/or warranty claims.

- 5.5.3 Delete paragraph 5.5.3 in its entirety.

- 5.5.5 Delete paragraph 5.5.5 in its entirety.

GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

Delete GC 5.6 in its entirety.

GC 5.7 FINAL PAYMENT

- 5.7.1 Delete paragraph 5.7.1 in its entirety and substitute as follows:

When the *Contractor* considers that the *Work* is completed, as defined in the *Construction Act*, the *Contractor* shall submit an application for final payment. The *Contractor's* application for final payment shall be a *Proper Invoice* and accompanied by any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings and:

- .1 the *Contractor's* written request for release of the first installment of the deficiency holdback, including a statement that no written notices of lien have been received by it;
- .2 a Statutory Declaration CCDC 9A-2018; and
- .3 the *Contractor's* written certification that there are no outstanding claims, pending claims or future claims from the *Contractor* or their subcontractors or suppliers.
- .4 The *Work* shall be deemed not to be completed, nor a *Proper Invoice* delivered, until all of the aforementioned documents have been delivered, and the *Owner* may withhold payment in respect of the delivery of any documents in an amount determined by the *Consultant* in accordance with the provisions of GC 5.8 - WITHHOLDING OF PAYMENT.

- 5.7.2 Delete from the first line of paragraph 5.7.2 the words, “10 calendar days” and substitute the words “14 calendar days”.

- 5.7.4 Delete from the second line of paragraph 5.7.4 the words, “5 calendar days after the issuance of” and substitute the words “28 calendar days after receipt of a *Proper Invoice* for the final payment, subject to the delivery by the *Owner* of a notice of non-payment under the *Construction Act* and subject to the receipt of”.

GC 5.8 WITHHOLDING OF PAYMENT

Delete paragraph 5.8.1 and replace with the following:

- 5.8.1 If because of conditions reasonably beyond the control of the *Contractor*, there are items of work that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such remaining work. The remaining work shall be valued as deficient work as defined in GC 5.10.1.

GC 5.10 DEFICIENCY HOLDBACK

Add a new General Condition 5.10 as follows:

- 5.10.1 Notwithstanding any provisions contained in the *Contract Documents* concerning certification and release of monies to the *Contractor*, the *Owner* reserves the right to establish a deficiency holdback, at the time of the review for *Substantial Performance*, based on a 2% dollar value of the Contract Price. The *Owner* shall release seven-eighths of the deficiency holdback amount, being 1.75% of the Contract Price, upon completion of all of the deficiencies listed by the *Consultant* to the satisfaction of the *Consultant*. The remaining one-eighth of the deficiency holdback amount, being 0.25% of the *Contract Price*, shall be released upon the expiration of the last to expire of the warranty periods set out in the *Contract Documents*.

GC 6.1 OWNER’S RIGHT TO MAKE CHANGES

Add new paragraphs 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7 and 6.1.8 as follows:

- 6.1.3 The *Contractor* agrees that changes resulting from construction coordination, including but not limited to, site surface conditions, site coordination, and *Subcontractor and Supplier* coordination are included in the *Contract Price* and the *Contractor* shall be precluded from making any claim for a change in the *Contract Price* as a result of such changes.
- 6.1.4 Labour costs shall be actual, prevailing rates at the *Place of the Work* paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The *Contractor* shall provide these rates, when requested by the *Consultant*, for review and/or agreement.
- 6.1.5 Quotations for changes to the *Work* shall only include *Direct Costs* and be accompanied by itemized breakdowns together with detailed, substantiating quotations or cost vouchers from *Subcontractors* and *Suppliers*, submitted in a format acceptable to the *Consultant* and shall include any *Direct Costs* associated with extensions in *Contract Time*.
- 6.1.6 When both additions and deletions covering related *Work* or substitutions are involved in a change to the *Work*, payment, including *Overhead* and profit, shall be calculated on the basis of the net difference, if any, with respect to that change in the *Work*.
- 6.1.7 No extension to the *Contract Time* shall be granted for changes in the *Work* unless the *Contractor* can clearly demonstrate that such changes significantly alter the overall construction schedule submitted at the commencement of the *Work*. Extensions of *Contract Time* and all associated costs, if approved pursuant to GC 3.4.2, shall be included in the relevant *Change Order*.
- 6.1.8 When a change in the *Work* is proposed or required, the *Contractor* shall within 10 calendar days submit to the *Consultant* for review a claim for a change in *Contract Price* and/or *Contract Time*. Should 10 calendar days be insufficient to prepare the submission, the *Contractor* shall within 5 calendar days, advise the *Consultant* in writing of the proposed date of submission of the claim. Claims submitted after the dates prescribed herein will not be considered.

GC 6.2 CHANGE ORDER

6.2.1 Add after the last sentence in the paragraph:

The adjustment in the *Contract Time* and the *Contract Price* shall include an adjustment, if any, for delay or for the impact that the change in the *Work* has on the *Work* of the *Contractor*, and once such adjustment is made, the *Contractor* shall be precluded from making any further claims for delay or impact with respect to the change in the *Work*.

Add new paragraph 6.2.3 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 *Consultant*.

- .1 by estimate and acceptance of a lump sum;
- .2 by negotiated unit prices which include the *Contractor's Overhead* and profit, or;
- .3 by the actual cost to the *Owner*, such costs to be the actual cost after all credits included in the change have been deducted, plus the following ranges of mark-up on such costs:
 - .1 for *Change Orders* with a value of \$0 to \$15,000 the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 10% and the total *Contractor* mark-up including overhead and profit shall be 5%. Only sub-contractors performing actual work on the change are entitled to 10%. If a sub-contractor is subcontracting the work to another subcontractor, they are only entitled to 5% mark up for overhead and profit.
 - .2 For *Change Orders* in excess of \$15,000, the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 5% and the total *Contractor* mark-up including *Overhead* and profit shall be 3%. Only sub-contractors performing actual work on the change are entitled to 5%. If a sub-contractor is subcontracting the work to another subcontractor, they are only entitled to 3% mark up for overhead and profit.

Add new paragraph 6.2.4 as follows:

6.2.4 All quotations will be submitted in a complete manner listing:

- .1 quantity of each material,
- .2 unit cost of each material,
- .3 man hours involved,
- .4 cost per hour,
- .5 *Subcontractor* quotations submitted listing items 1 to 4 above and item 6 below.
- .6 mark-up

Add new paragraph 6.2.5 as follows:

6.2.5 The *Owner* and the *Consultant* will not be responsible for delays to the *Work* resulting from late, incomplete or inadequately broken down valuations submitted by the *Contractor*.

GC 6.3 CHANGE DIRECTIVE

6.3.6.1 Amend paragraph 6.3.6.1 by deleting the final period and adding as follows:

- .1 Ten percent (10%) for profit plus five percent (5%) for overhead on work by the *Contractor's* own forces up to the value of \$15,000 and five percent (5%) for profit plus three percent (3%) for *Overhead* on work by the *Contractor's* own forces in excess of \$15,000 and,
- .2 Ten percent (10%) fee on amounts paid to *Subcontractors* or *Suppliers* under subparagraph 6.3.7.9 for changes up to the value of \$15,000 and five percent (5%) on changes over \$15,000.

Unless a *Subcontractor's* or *Supplier's* price has been approved by the *Owner*, the *Subcontractor* or *Supplier* shall be entitled to its actual net cost as determined in accordance with paragraph 6.3.7, plus ten percent (10%) for profit and five percent (5%) for *Overhead* on such actual net cost for changes in the *Work*, up to the value of \$15,000 and five percent (5%) for profit and three percent (3%) for overhead on such actual net cost changes in the *Work* in excess of \$15,000.

6.3.6.2 Delete paragraph 6.3.6.2 and replace it with the following:

If a change in the *Work* results in a net decrease in the *Contract Price* in excess of \$15,000 the amount of the credit shall be the net cost, with deduction for *Overhead* and profit. If a change in the *Work* results in a net decrease in the *Contract Price* of \$15,000 or less, the amount of the credit shall be the net cost, without deduction for *Overhead* or profit.

6.3.7.1 In subparagraph 6.3.7.1 insert “while directly engaged in the work attributable to the change” after the words “in the direct employ of the *Contractor*”.

6.3.7 At the end of paragraph 6.3.7 add the following:

All other costs attributable to the change in the *Work* including the costs of all administrative or supervisory personnel are included in *Overhead* and profit calculated in accordance with the provisions of paragraph 6.1.5 of GC6.1 – OWNER'S RIGHT TO MAKE CHANGES.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

6.4.1 Delete paragraph 6.4.1 and replace with the following:

6.4.1.1 Prior to the submission of the bid on which the *Contract* was awarded, the *Contractor* confirms that it carefully investigated the *Place of the Work* and carried out such tests as it deemed appropriate and, in doing so, applied to that investigation the degree of care and skill required by paragraph 3.14.1.

6.4.1.2 No claim by the *Contractor* will be considered by the *Owner* or the *Consultant* in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*.

6.4.2 Amend paragraph 6.4.2 by adding a new first sentence as follows:

Having regard to paragraph 6.4.1, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those reasonably anticipated, differ materially from those indicated in the *Contract Documents* or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall provide the *Owner* and the *Consultant* with *Notice in Writing* no later than five (5) *Working Days* after the first observation of such conditions.

Amend the existing second sentence of paragraph 6.4.2 in the second line, following the word “materially” by adding the words “or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1,”

6.4.3 Delete paragraph 6.4.3 in its entirety and substitute the following:

If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*.

Add new paragraph 6.4.5 as follows:

6.4.5 No claims for additional compensation or for an extension of *Contract Time* shall be allowed if the *Contractor* fails to give *Notice in Writing* to the *Owner* or *Consultant*, as required by paragraph 6.4.2.

GC 6.5 DELAYS

6.5.1 Delete the words after the word “for” in the fourth line of paragraph 6.5.1, and add the words “...reasonable direct costs directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity).”

6.5.2 Delete the words after the word “for” in the fourth line of paragraph 6.5.2, and add the words “...reasonable direct costs directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity).”

6.5.3 Delete paragraph 6.5.3 in its entirety and replace with the following:

If the *Contractor* is delayed in the performance of the *Work* by *Force Majeure*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from the actions of the *Owner*.

Delete paragraph 6.5.4 in its entirety and replace with the following:

6.5.4 No extension or compensation shall be made for delay or impact on the *Work* unless notice in writing of a claim is given to the *Consultant* not later than ten (10) *Working Days* after the commencement of the delays or impact on the *Work*, provided however, that, in the case of a continuing cause of delay or impact on the *Work*, only one notice of claim shall be necessary.

Add new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows:

6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone directly or indirectly employed or engaged by the *Contractor*, or by any cause within the *Contractor's* control, then the *Contract Time* may be extended for such reasonable time as the *Owner* may decide in consultation with the *Consultant* and the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including, but not limited to, the cost of all additional services required by the *Owner* from the *Consultant* or any sub-consultants, project managers, or others employed or engaged by the *Owner*, and in particular, the costs of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of *Substantial Performance of the Work* achieved by the *Contractor*.

6.5.7 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS or GC 9.4 – CONSTRUCTION SAFETY, the *Owner* or *Consultant* may, by notice in writing, direct the *Contractor* to stop the *Work* where the *Owner* or *Consultant* determines that there is an imminent risk to the safety of persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contact Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.

6.5.8 No claim for delay shall be made and the *Contract Time* shall not be extended due to climatic conditions or arising from the *Contractor's* efforts to maintain the *Contract* schedule.

GC 6.6 CLAIMS FOR A CHANGE IN THE CONTRACT PRICE

Delete GC 6.6 in its entirety.

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

Revise the heading to read “**OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT**”

Add a new subparagraph 7.1.3.4 as follows:

7.1.3.4 An “acceptable schedule” as referred to in subparagraph 7.1.3.2. means a schedule approved by the *Consultant* and the *Owner* wherein the default can be corrected within the balance of the *Contract Time* and shall not cause delay to any other

aspect of the *Work* or the work of other contractors, and in no event shall it be deemed to give a right to extend the *Contract Time*.

7.1.4.1 Delete sentence and replace with the following:

Correct such default and deduct the cost, including *Owner's* expenses, thereof from any payment then or thereafter due the *Contractor*.

7.1.5.3 In subparagraph 7.1.5.3 delete the words: "however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference;"

Delete paragraph 7.1.6 in its entirety and add new paragraphs 7.1.6, 7.1.7, 7.1.8, 7.1.9 and 7.1.10 as follows:

7.1.6 In addition to its right to terminate the Contract set out herein, the *Owner* may terminate this *Contract* at any time for any other reason and without cause upon giving the *Contractor* fifteen (15) *Working Days Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*, but in no event shall the *Contractor* be entitled to be compensated for any loss of profit on unperformed portions of the *Work*, or indirect, special, or consequential damages incurred.

7.1.7 The *Owner* may suspend *Work* under this *Contract* at any time for any reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of suspension and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the suspension of the *Work*, but in no event shall the *Contractor* be entitled to be compensated for any indirect, special, or consequential damages incurred. In the event that the suspension continues for more than thirty (30) calendar days, the *Contract* shall be deemed to be terminated and the provisions of paragraph 7.1.6 shall apply.

7.1.8 In the case of either a termination of the *Contract* or a suspension of the *Work* under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall use its best commercial efforts to mitigate the financial consequences to the *Owner* arising out of the termination or suspension, as the case may be.

7.1.9 Upon the resumption of the *Work* following a suspension under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* will endeavour to minimize the delay and financial consequences arising out of the suspension.

7.1.10 The *Contractor's* obligations under the *Contract* as to quality, correction, and warranty of the *Work* performed by the *Contractor* up to the time of termination or suspension shall continue after such termination of the *Contract* or suspension of the *Work*.

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

7.2.3.1 Delete subparagraph 7.2.3.1 in its entirety.

7.2.3.4 In subparagraph 7.2.3.4, delete the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".

Renumber paragraph 7.2.5 as paragraph 7.2.6. Add a new paragraph 7.2.5 as follows:

7.2.5 If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it:

- .1 commences correction of the default within the specified time;
- .2 provides the *Contractor* with an acceptable schedule for such correction; and,
- .3 completes the correction in accordance with such schedule.

Delete paragraph 7.2.6 entirely and replace with the following:

- 7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in GC 7.2 – CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination, as determined by the *Consultant*. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit.

Add new paragraphs 7.2.7, 7.2.8 and 7.2.9 as follows

- 7.2.7 The *Contractor* shall not be entitled to give notice of the *Owner’s* default or terminate the *Contract* in the event the *Owner* withholds certificates or payment or both in accordance with the *Contract* because of:
- (a) the *Contractor’s* failure to pay all legitimate claims promptly, or
 - (b) the failure of the *Contractor* to discharge construction liens which are registered against the title to the *Place of the Work*.
- 7.2.8 The *Contractor’s* obligations under the *Contract* as to quality, correction and warranty of the *Work* performed by the *Contractor* up to the effective date of termination shall continue in force and shall survive termination by the *Contractor* in accordance with paragraph 7.2.4.
- 7.2.9 If the *Contractor* suspends the *Work* or terminates the *Contract* as provided for in GC 7.2 – CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall ensure the site and the *Work* are left in a safe, secure condition as required by authorities having jurisdiction at the *Place of the Work* and the *Contract Documents*.

GC 8.1 AUTHORITY OF THE CONSULTANT

Delete 8.1.3 in its entirety and replace with the following:

- 8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instructions as in the *Consultant’s* opinion are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim the party may have.

Add new paragraph 8.1.4 as follows:

- 8.1.4 In addition to disputes that may be resolved by way of interim binding adjudication under the *Construction Act*, the parties may agree to resolve any other matter by interim binding adjudication under the same adjudication procedures as set out in the *Construction Act*. Subject to any further agreement or a decision by a court or arbitrator, a determination by an adjudicator will be binding on the parties in accordance with the *Construction Act*, and any instructions by the *Consultant* under this GC 8.1 will be amended accordingly as necessary. Nothing in this *Contract* or the *Construction Act* is intended to limit the rights and remedies of the parties under this Part 8.

GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION

- 8.2.1 Amend paragraph 8.2.1 by changing part of the second line from “shall appoint a *Project Mediator*” to “may appoint a *Project Mediator*, except that such an appointment shall only be made if both the *Owner* and the *Contractor* agree.”

- 8.2.4 Amend paragraph 8.2.4 by changing part of the second line from “the parties shall request the *Project Mediator*” to “and subject to paragraph 8.2.1 the parties may request the *Project Mediator*”.

Delete paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.

Add new paragraph 8.2.6 as follows:

- 8.2.6 The dispute may be finally resolved by arbitration under the Rules for Arbitration of Construction Disputes as provided in CCDC 40 in effect at the time of bid closing, provided that both the *Contractor* and the *Owner* agree. If the *Contractor* and the *Owner* agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the *Place of the Work*.

GC 9.1 PROTECTION OF WORK AND PROPERTY

Delete subparagraph 9.1.1.1 in its entirety and substitute the following:

- 9.1.1.1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in paragraph 3.14.1;

Delete paragraph 9.1.2 in its entirety and substitute as follows:

- 9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground or hidden utilities and structures indicated in or inferable from the *Contract Documents*, or that are inferable from an inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1.

Add new paragraph 9.1.5 as follows:

- 9.1.5 With respect to any damage to which paragraphs 9.1.3 or 9.1.4 apply, the *Contractor* shall neither undertake to repair or replace any damage whatsoever to the work of other contractors, or to adjoining property, nor acknowledge that the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. Where, however, there is danger to life, the environment, or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger.

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

Add a new subparagraph 9.2.5.5 as follows:

- 9.2.5.5 in addition to the steps described in subparagraph 9.2.5.3, take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials.

- 9.2.6 Add the following to paragraph 9.2.6, after the word “responsible” in the second line:

...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 damages to the property of the *Owner* or others,...

- 9.2.8 Add the following to paragraph 9.2.8, after the word “responsible” in the second line:

...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 damages to the property of the *Owner* or others,...

Add new paragraph 9.2.10 as follows:

- 9.2.10 The *Contractor*, *Subcontractors* and *Suppliers* shall not bring on to the *Place of the Work* any toxic or hazardous substances and materials except as required in order to perform the *Work*. If such toxic or hazardous substances or materials are required, storage in quantities sufficient to allow work to proceed to the end of any current work week only shall be permitted. All such toxic and hazardous materials and substances shall be handled and disposed of only in accordance with all laws and regulations that are applicable at the *Place of the Work*.

GC 9.4 CONSTRUCTION SAFETY

Delete paragraph 9.4.1 in its entirety and substitute as follows:

- 9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations, and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*.

Add new paragraphs 9.4.2 to 9.4.10 as follows:

- 9.4.2 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:
- .1 the evidence of workers' compensation compliance required by GC 10.4.1;
 - .2 copies of the *Contractor's* insurance policies having application to the *Project* or certificates of insurance, at the option of the *Owner*;
 - .3 documentation setting out the *Contractor's* in-house safety programs;
 - .4 copies of any documentation or notices to be filed or delivered to the authorities having jurisdiction for the regulation of occupational health and safety at the *Place of the Work*.
- 9.4.3 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, trustees, officers, directors, employees, consultants, successors, appointees, and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under the occupational health and safety legislation in force at the *Place of the Work* including the payment of legal fees and disbursements on a substantial indemnity basis.
- 9.4.4 The *Owner* undertakes to include in its contracts with other contractors and in its instructions to its own forces the requirement that the other contractor or its own forces, as the case may be, comply with the policies and procedures of and the directions and instructions from the *Contractor* with respect to occupational health and safety and related matters.
- 9.4.5 If the *Owner* is of the reasonable opinion that the *Contractor* has not taken such precautions as are necessary to ensure compliance with the requirements of paragraph 9.4.1, the *Owner* may take any remedial measures which it deems necessary, including stopping the performance of all or any portion of the *Work*, and the *Owner* may use its employees, the *Contractor*, any *Subcontractor* or any other contractors to perform such remedial measures.
- 9.4.6 The *Contractor* shall file any notices or any similar document required pursuant to the *Contract* or the safety regulations in force at the *Place of the Work*. This duty of the *Contractor* will be considered to be included in the *Work* and no separate payment therefore will be made to the *Contractor*.
- 9.4.7 Unless otherwise provided in the *Contract Documents*, the *Contractor* shall develop, maintain and supervise for the duration of the *Work* a comprehensive safety program that will effectively incorporate and implement all required safety precautions. The program shall, at a minimum, respond fully to the applicable safety regulations and general construction practices for the safety of persons or property, including, without limitation, any general safety rules and regulations of the *Owner* and any workers' compensation or occupational health and safety statutes or regulations in force at the *Place of the Work*.
- 9.4.8 The *Contractor* shall provide a copy of the safety program described in paragraph 9.4.7 hereof to the *Consultant* for delivery to the *Owner* prior to the commencement of the *Work*, and shall, ensure, as far as it is reasonably practical to do so, that every employer and worker performing work in respect of the *Project* complies with such program.

- 9.4.9 The *Contractor* shall arrange regular safety meetings, and shall supply and maintain, at its own expense, at its office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the authorities having jurisdiction at the *Place of the Work*, including, without limitation, articles necessary for administering first-aid to any person and an emergency procedure for the immediate removal of any injured person to a hospital or a doctor's care.
- 9.4.10 The *Contractor* shall promptly report in writing to the *Owner* and the *Consultant* all accidents of any sort arising out of or in connection with the performance of the *Work*, whether on or adjacent to the job site, giving full details and statement of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the *Contractor* to the *Owner* and the *Consultant* by telephone or messenger in addition to any reporting required under the applicable safety regulations.

GC 10.1 TAXES AND DUTIES

- 10.1.2 Amend paragraph 10.1.2 by adding the following sentence to the end of the paragraph:

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. The *Contractor* shall provide a detailed breakdown of additional taxes if requested by the *Owner* in a form satisfactory to the *Owner*.

Add new paragraph 10.1.3 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 the 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.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

- 10.2.5 Amend paragraph 10.2.5 by addition the words "Subject to paragraph 3.4" at the beginning of the paragraph. Add the following to the end of the second sentence:

...and no further *Work* on the affected components of the *Contract* shall proceed until these directives have been obtained by the *Contractor* from the *Consultant*.

- 10.2.6 Amend paragraph 10.2.6 by adding the following sentence to the end of the paragraph:

In the event the *Owner* suffers loss or damage as a result of the *Contractor's* failure to comply with paragraph 10.2.5 and notwithstanding any limitations described in paragraph 12.1.1, the *Contractor* agrees to indemnify and to hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions suits or proceedings resulting from such failure by the *Contractor*.

Add new paragraph 10.2.8 as follows:

- 10.2.8 The *Contractor* shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental authorities furnish such certificates.

GC 10.4 WORKERS' COMPENSATION

- 10.4.1 Delete paragraph 10.4.1 and replace with the following:

Prior to commencing the *Work*, and with each and every application for payment thereafter, including the *Contractor's* application for payment of the holdback amount following *Substantial Performance of the Work* and again with the

Contractor's application for final payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation in force at the *Place of the Work*, including payments due thereunder.

GC 11.1 INSURANCE

Delete entirety of general condition and CCDC 41 and replace with the following:

11.1 Without restricting the generality of GC 12 – INDEMNIFICATION, the *Contractor* shall provide, maintain, and pay for the insurance coverages specified in GC 11.1 – INSURANCE. Unless otherwise stipulated, the duration of each insurance policy shall be from the date of commencement of the *Work* until the expiration of the warranty periods set out in the *Contract Documents*. Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements.

.1 General Liability Insurance

General liability insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as additional insureds, with limits of not less than \$5,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property, including loss of use thereof, for itself and each of its employees, *Subcontractors* and/or agents. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, provided that IBC Form 2100 shall contain the latest edition of the relevant CCDC endorsement form. To achieve the desired limit, umbrella, or excess liability insurance may be used. All liability coverage shall be maintained for completed operations hazards from the date of *Substantial Performance of the Work*, as set out in the certificate of *Substantial Performance of the Work*, on an ongoing basis for a period of 6 years following *Substantial Performance of the Work*. Where the *Contractor* maintains a single, blanket policy, the addition of the *Owner* and the *Consultant* is limited to liability arising out of the *Project* and all operations necessary or incidental thereto. The policy shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation and of change or amendment restricting coverage.

.2 Automobile Liability Insurance

Automobile liability insurance in respect of licensed vehicles shall have limits of not less than \$2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, covering all licensed vehicles *owned* or leased by the *Contractor*, and endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation, change or amendment restricting coverage. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

.3 Aircraft and Watercraft Liability Insurance

Where determined necessary by the *Contractor*, acting reasonably, aircraft and watercraft liability insurance will be obtained in accordance with the provisions of paragraph 11.1.3. Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft if used directly or indirectly in the performance of the *Work*, including use of additional premises, shall be subject to limits of not less than \$2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, including loss of use thereof and limits of not less than \$2,000,000.00 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage.

.4 Property and Boiler and Machinery Insurance

(1) Builder's Risk property insurance shall be in the name of the *Contractor* with the *Owner* and the *Consultant* named as additional insureds. The policy shall insure against all risks of direct physical loss or damage to the property insured which shall include all property included in the *Work*, whether owned by the *Contractor* or the owner or owned by others, so long as the property forms part of the *Work*. The property insured also includes all materials and supplies necessary to complete the work, whether installed in the work temporarily or permanently, in storage on the project site, or in transit to the project site, as well as temporary buildings, scaffolding, falsework forms, hoardings, excavation, site preparation and similar work. The insurance shall be for not less than the sum of the amount of the contract price and the full value of products that are specified to be provided by the owner for incorporation into the work, if applicable, with the deductible of \$10,000.00 payable by the contractor. The insurance shall include the foregoing and, otherwise, shall not be

less than the insurance required by IBC Form 4042 or its equivalent replacement provided that the IBC Form 4042 shall include the latest addition of the relevant CCDC endorsement form. The coverage shall be based on a completed value form and shall be maintained continuously until ten (10) days after the date of the final certificate of payment.

(2) Boiler and machinery insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as additional insureds, for not less than the replacement value of the boilers, pressure vessels and other insurable objects forming part of the *Work*. The insurance provided shall not be less than the insurance provided by the “Comprehensive Boiler and Machinery Form” and shall be maintained continuously from commencement of use or operation of the property insured and until 10 days after the date of the final certificate for payment.

(3) The policies shall allow for partial or total use or occupancy of the *Work*.

(4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. The *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of the *Contract Time*, relative to the extent of the loss or damage, as determined by the *Owner*, in its sole discretion.

(5) The *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount at which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. In addition, the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work*.

(6) In the case of loss or damage to the *Work* arising from the work of other contractors, or the *Owner's* own forces, the *Owner*, in accordance with the *Owner's* obligations under paragraph 3.2.2.4 of GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT.

.5 Contractors' Equipment Insurance

“All risks” contractors' equipment insurance covering construction machinery and equipment used by the *Contractor* for the performance of the *Work*, excluding boiler insurance, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance of his equipment, the *Owner* agrees to waive the equipment insurance requirement.

11.1.2 The *Contractor* shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the *Contractor's* responsibility by the terms of GC 9.1 - PROTECTION OF WORK AND PROPERTY and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY.

11.1.3 Where the full insurable value of the *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required to waive the course of construction insurance requirement.

11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and provide evidence of same to the *Contractor*. The *Contractor* shall pay the costs thereof to the *Owner* on demand, or the *Owner* may deduct the amount that is due or may become due to the *Contractor*.

11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.

GC 11.2 CONTRACT SECURITY

- 11.2.1 Amend paragraph 11.2.1 by adding the following at the end of that paragraph:

or as required under the *Construction Act*.

- 11.2.2 Delete paragraph after the word “provided” and replace with the following:

Such bonds shall be issued by a duly licensed surety company, which has been approved by the *Owner* and is permitted under the *Construction Act*, authorized to transact a business of suretyship in the Province of Ontario and shall be maintained in good standing until the fulfillment of the *Contract*, including all warranty and maintenance periods set out in the *Contract Documents*. The form of the labour and material bond, and the performance bond, if required under this *Contract* or under the *Construction Act*, shall be in accordance with, and in the form set out in, the *Construction Act*.

Add new paragraph 11.2.3 as follows:

- 11.2.3 It is the intention of the parties that the performance bond shall be applicable to all of the *Contractor's* obligations in the *Contract Document* and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply. The *Contractor* represents and warrants to the *Owner* that it has provided its surety with a copy of the *Contract Documents* prior to the issuance of such bonds.

GC 12.1 INDEMNIFICATION

Delete General Condition 12.1 – INDEMNIFICATION in its entirety and substitute as follows:

- 12.1.1 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, their respective partners, trustees, officers, directors, agents and employees and the *Consultant* from and against any and all claims, liabilities, expenses, demands, losses, damages, actions, costs, suits, or proceedings (hereinafter called “claims”), whether in respect of claims suffered by the *Owner* or in respect of claims by third parties, that directly or indirectly arise out of, or are attributable to, the acts or omissions of the *Contractor*, its employees, agents, *Subcontractors*, *Suppliers* or any other persons for whom it is in law responsible (including, without limitation, claims that directly or indirectly arise out of, or are attributable to, loss of use or damage to the *Work*, the *Owner's* property or equipment, the *Contractor's* property or equipment or equipment or property adjacent to the *Place of the Work* or death or injury to the *Contractor's* personnel).
- 12.1.2 The provisions of GC 12.1 - INDEMNIFICATION shall survive the termination of the *Contract*, howsoever caused and no payment or partial payment, no issuance of a final certificate of payment and no occupancy in whole or in part of the *Work* shall constitute a waiver or release of any of the provisions of GC 12.1.

GC 12.2 WAIVER OF CLAIMS

- 12.2.1 In the fourth line, add the words “claims for delay pursuant to GC 6.5 DELAYS” after the word “limitation”. Add the words “(collectively “Claims”)” after “*Substantial Performance of the Work*” in the sixth line.
- 12.2.1.1 Change the word “claims” to “Claims” and change the word “claim” to “Claim”.
- 12.2.1.2 Change the word “claims” to “Claims”.
- 12.2.1.3 Delete paragraph in its entirety.
- 12.2.1.4 Change the word “claims” to “Claims”.
- 12.2.2 Change the words “in paragraphs 12.2.1.2 and 12.2.1.3” to “in paragraph 12.2.1.2”. Change the word “claims” to “Claims” in both instances and change the word “claim” to “Claim”.
- 12.2.3 Delete paragraph in its entirety.

- 12.2.4 Delete paragraph in its entirety.
- 12.2.5 Delete paragraph in its entirety.
- 12.2.6 Change the word “claim” to “Claim” in all instances in the paragraph.
- 12.2.7 Change “The party” to “The *Contractor*”. Change the word “claim” to “Claim” in all instances in the paragraph.
- 12.2.8 Change “under paragraphs 12.2.1 or 12.2.3” to “under paragraph 12.2.1”. Change both instances of the words “the party” to “the *Contractor*”. Change the word “claim” to “Claim” in all instances in the paragraph.
- 12.2.9 Delete paragraph 12.2.9 in its entirety.
- 12.2.10 Delete paragraph 12.2.10 in its entirety.

GC 12.3 WARRANTY

- 12.3.2 Delete from the first line of paragraph 12.3.2 the word, “The” and substitute the words “Subject to paragraph 3.4.1, the...”
Add new paragraphs 12.3.7 to 12.3.12 as follows:
 - 12.3.7 Where required by the *Contract Documents*, the *Contractor* shall provide a maintenance bond as security for the performance of the *Contractor’s* obligations as set out in GC 12.3 WARRANTY.
 - 12.3.8 The *Contractor* shall provide fully and properly completed and signed copies of all warranties and guarantees required by the *Contract Documents*, containing:
 - .1 the proper name of the *Owner*;
 - .2 the proper name and address of the *Project*;
 - .3 the date the warranty commences, which shall be at the “date of *Substantial Performance of the Work*” unless otherwise agreed upon by the *Consultant* in writing.
 - .4 a clear definition of what is being warranted and/or guaranteed as required by the *Contract Documents*; and
 - .5 the signature and seal (if required by the governing law of the *Contract*) of the company issuing the warranty, countersigned by the *Contractor*.
 - 12.3.9 Should any *Work* be repaired or replaced during the time period for which it is covered by the specified warranty, a new warranty shall be provided under the same conditions and for the same period as specified herein before. The new warranty shall commence at the completion of the repair or replacement.
 - 12.3.10 The *Contractor* shall ensure that its *Subcontractors* are bound to the requirements of GC 12.3 – WARRANTY for the *Subcontractor’s* portion of the *Work*.
 - 12.3.11 The *Contractor* shall ensure that all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor*, *Supplier* or other person in connection with the *Work* are obtained and available for the direct benefit of the *Owner*. In the alternative, the *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor*, *Supplier* or other person in connection with the *Work* and such assignment shall be with the consent of the assigning party, where required by law, or by the terms of that party’s contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the *Owner* under the *Contract Documents*.
 - 12.3.12 The *Contractor* shall commence or correct any deficiency within 2 Working Days after receiving a notice from the *Owner* or the *Consultant*, and shall complete the *Work* as expeditiously as possible, except in the case where the deficiency prevents maintaining security or where basic systems essential to the ongoing business of the *Owner* and/or its tenants cannot be maintained operational as designed. In those circumstances all necessary corrections and/or installations of temporary replacements shall be carried out immediately as an emergency service. Should the *Contractor* fail to provide this emergency service within 8 hours of a request being made during the normal business hours of the *Contractor*, the

Owner is authorized, notwithstanding GC 3.1, to carry out all necessary repairs or replacements at the *Contractor's* expense.

PART 13 OTHER PROVISIONS

Add new Part 13 OTHER PROVISIONS as follows:

GC 13.1 OWNERSHIP OF MATERIALS

- 13.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.

GC 13.2 CONSTRUCTION LIENS

- 13.2.1 In the event that a claim for lien is registered against the *Project* by a *Subcontractor*, *Sub-subcontractor* or *Supplier*, and provided the *Owner* has paid all amounts properly owing under the *Contract*, the *Contractor* shall, at its own expense:
- .1 within 10 calendar days, ensure that any and all claims for lien and certificates of action are discharged, released, or vacated by the posting of security or otherwise; and
 - .2 in the case of written notices of lien, ensure that such notices are withdrawn, in writing.
- 13.2.2 In the event that the *Contractor* fails to conform with the requirements of paragraph 13.2.1, the *Owner* may fulfil those requirements without *Notice in Writing* to the *Contractor* and set off and deduct from any amount owing to the *Contractor*, all costs and associated expenses, including the costs of posting security and all legal fees and disbursements associated with discharging or vacating the claim for lien or certificate of action and defending the action. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said costs and associated expenses.
- 13.2.3 Notwithstanding any other provision in the *Contract*, the *Consultant* shall not be obligated to issue a certificate and the *Owner* shall not be obligated to make payment to the *Contractor* if, at the time such certificate or payment was otherwise due:
- .1 a claim for lien has been registered against the *Project* lands, or
 - .2 if the *Owner* or mortgagee of the *Project* lands has received written notice of a lien, or
 - .3 the *Owner* or *Consultant* reasonably believe that any party has purported to retain title to *Products* or materials in respect of which an application for payment has been made.
- 13.2.4 Without limiting the foregoing, the *Contractor* shall, if requested by the *Owner*, defend, indemnify and save the *Owner* harmless from the amount of all such claims and the costs of defending any and all actions commenced against the *Owner* pursuant to the construction/builder's lien legislation in force at the *Place of the Work*, including the legal costs of the *Owner*, unless the lien was a direct result of a breach of the *Contract* by the *Owner* or the non-payment by the *Owner* of a valid charge or claim under the *Contract*.
- 13.2.5 GC 13.2 – CONSTRUCTION LIENS does not apply to construction/builder's liens claimed by the *Contractor*.

END OF AMENDMENTS TO CCDC 2 - 2008

The items outlined herein comprise “PART 1/Division One” General Instructions/General Requirements for the project and apply to all subsequent Specification sections as if repeated therein.

1.1 General Description of Work

- .1 Work under this Contract generally includes (without strict limitation to) the items noted below:

New elementary school at 415 Eastbridge Avenue, Welland ON for the District School Board of Niagara including building and all site services.

The work shall be as outlined in all project drawings, specifications and supplementary reports (by outside Consultants) provided herein, all comprising the Tender Documents/Contract Documents.

Final Occupancy (which includes system integration testing, fire alarm, sprinkler system, elevator, Building Department sign off, etc..) no later than August 14, 2027.

Areas that can continue to be worked on after this deadline include the Daycare, Gymnasium and Community Centre. Occupancy of these remaining spaces shall be no later than November 1, 2027.

1.2 Completeness of Bid Submissions

*All items and/or requirements shown, indicated, illustrated, outlined and/or noted within the Contract Documents are to be included in the Tender Submission Cost. Contractors bidding this project are to verify that all such items are included in their submission at the time of Tender. Extra or additional costs during construction shall **be neither permitted nor approved** for any items shown and/or otherwise included within the Contract Documents.*

*The onus is upon the Contractor to ensure that **ALL items** within the Contract Documents are fully and completely included in their Tender Submission cost, ensuring also that their sub-trades have carefully reviewed the entirety of the Contract Documents package and have priced the work accordingly.*

*Items contained within the Contract Documents either ‘not noticed’ or not included by the Contractor in his Tender Submission [for any reason] **will not be paid for** in addition to the Tender Value/Tender Cost **after Tender Award**.*

1.3 Project Documents

- .1 Maintain at the job site, one copy each of following:
- a) Contract Drawings (architectural, engineering and all related consulting drawings)
 - b) Specifications
 - c) Addenda
 - d) Reviewed shop drawings
 - e) Change Orders, Contemplated Change Orders and Change Directives/Notices
 - f) Site/Field Instructions
 - g) Other modifications to contract
 - h) Field test reports
 - i) Copy of approved Construction Schedule
 - j) Manufacturers' installation and application instructions.
 - k) List of Sub-contractors
 - l) Progress photographs
 - m) Record Set of Drawings (being progressively updated)
 - n) Minutes of Site Meetings

1.4 Specifications

- .1 Portions of Specifications are written in short form. Therefore, it shall be understood that where item of Work is stated in heading followed by material, equipment, component, or operation, words "shall be", "shall consist of" or similar words or phrases are implied which denote supply, fabricate and supply, install, provide or commission of such materials, equipment or operations for component of Work designated by heading.
- .2 Whenever used in Specifications following definitions shall apply:
- a) SUPPLY - Procurement or fabrication of standard components not to special design of materials, equipment, or components, or performance of services to extent indicated. Where used with respect to materials, equipment, or components, term shall include delivery to Site but is not intended to include installation of item, either temporary or final.
 - b) FABRICATE AND SUPPLY - Fabrication of materials, equipment or component, to special customized design to extent indicated including delivery to Site, assisting in form of supervision to those Section(s) installing materials, equipment or component. Term does not include installation of item either temporary or final.
 - c) INSTALL - Placement of materials, equipment, or

components, including receiving, unloading, transporting, storage, uncrating and installing, and performance of such testing and finish work as is compatible with degree of installation specified complete ready for use.

- d) PROVIDE - To Supply and Install, compete and in place, including accessories, finishes, tests and services as required to render item so specified complete ready for use.
- e) COMMISSION - Startup and initial operation of equipment as required and/or as specified in respective Sections, to demonstrate satisfactory operation of components and entire system including calibration of any control instrumentation as required to maintain operations.

.3 Drawings, Lists or Schedules of Items are intended to show scope and arrangement of work. For location of item described refer to such Drawings, Lists or Schedules unless location stipulated in Specifications.

.4 Wherever words "acceptable", "approved", "reviewed", "satisfactory", "selected", "directed", "designated", "permitted", "inspected", "instructed", "clarification", "required", "report", "submit", "obtain", "consult", "advise", or similar words or phrases are used in Standards or in Contract Documents, it shall be understood that, unless context provides otherwise words "by/to/with/from the Architect shall follow them as applicable.

.5 'Related Work', 'Related Divisions', 'Related Sections' etc.: Specifications sections provided herein may note and/or itemize specific sections or divisions of related work. This information if provided for general reference only. In all circumstances, the actual scope of related work is to be as shown/required by the full scope of work outlined in all of the Contract Documents (including the drawings) and in **no way** is to be limited to any information, provided, not provided and/or referenced only in the Specification documents.

1.5 Construction Schedule .1 Provide within 14 working days after Contract award, a Schedule showing anticipated progress stages and final completion of work within time periods and phases stated in the Tender Form.

.2 In accordance with the established project schedule, provide a detailed Construction Schedule showing dates for:

- a) Submission of material sample submittals (along with an itemized list of samples to be submitted)

- b) Submission of shop drawings (along with an itemized list of shop drawings to be submitted)
- c) Supply and installation of:
 - i) Precast Concrete Floor Slabs
 - ii) Structural Steel
 - iii) Steel Joists
 - iv) Structural Metal Deck
 - v) Metal Fabrication
 - vi) Architectural Woodwork
 - vii) Roofing Materials
 - viii) Metal Flashing and Sheet Metal
 - ix) Steel Doors and Frames
 - x) Aluminum Windows, Frames, Sills, and Doors
 - xi) Counter Shutters
 - xii) Finish Hardware
 - xiii) Barrier Free Door Operators
 - xiv) Glass and Glazing
 - xv) Gym Wood Flooring
 - xvi) White Boards and Tack Boards
 - xvii) Toilet Partitions
 - xviii) Lockers
 - xix) Gymnasium Curtain Divider
 - xx) Flag Poles
 - xxi) Washroom Accessories
 - xxii) Athletic Equipment
 - xxiii) Elevator
 - xxiv) Mechanical Section 200000-250000
 - xxv) Electrical Section 260000-290000
 - xxvi) Structural Section

- .3 Interim reviews of actual progress related to the Construction Schedule prepared by the Contractor will be conducted as by the Architect. Progressive updating and distribution of the Schedule (in conjunction with the input of the Architect and building Owner) will be the responsibility of the Contractor throughout the duration of the project.

1.6 Contractor's Use of Site

- .1 Limit to those areas of the site designated by the City, the Owner and the Architect (as applicable). Operators' activities should allow for the ongoing needs of parking, deliveries, exits, fire safety access etc. on site throughout the course of construction including ongoing operation of existing school.
- .2 Do not unreasonably encumber ongoing use or access of site with materials or equipment. Stage, receive and store

construction materials on site only as and where permitted by Owner or as directed by the Architect.

- .3 Obtain and pay for use of additional storage facilities or work areas as needed throughout the course of construction.
- 1.7 Partial Occupancy of Use**
 - .1 Contractor to coordinate the Work with the continuing use of the remainder site.
- 1.8 Standards**
 - .1 Where reference is made to specification standards produced or enforced by various organizations, conform to most current edition of standards specified or, if not specified, to latest edition as amended and revised to date of Contract.
 - .2 If requested provide copy on Site of such standard(s).
 - .3 Where standard designated authorities such as "Engineer", "Designer", "Purchaser" or some other such designation, these designations shall be taken to mean "Architect".
- 1.9 Building Codes**
 - .1 Comply with most recent and applicable versions of: The Building Code Act, as amended; the Ontario Building Code, as amended; Regulations and By-Laws of other authorities having jurisdiction including latest amendments thereto, all hereafter referred to as 'Code'. Where Code or Contract Documents do not cover a particular requirement which is covered by National Building Code, conform to requirements of NBC including its related supplements. Where Drawings and/or Specifications exceed Code requirements, satisfy such additional requirements.
 - .2 Where material is designated in Contract Documents for certain applications, unless otherwise specified, that material shall conform to minimum standards designated in appropriate divisions of the Code. In the absence of more restrictive requirements, comply with Division B Part 3 of the Ontario Building Code as a minimum standard. Similarly, unless otherwise specified and/or not required otherwise by Code, minimum installation methods and standards of workmanship shall conform to standards of Part 9 in the Ontario Building Code.
- 1.10 Project Meetings**
 - .1 Hold project meetings at times, locations and frequencies requested by the Architect, but generally occurring at least once every two weeks.
 - .2 Notify all parties concerned (identified at the project outset by

the Architect and Owner) of meeting times and dates.

- .3 Record Minutes of meetings, and distribute to all parties within **three** calendar days of meetings.

1.11 Setting Out of Work

- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as ladders, measuring tapes, straight edges and templates required to facilitate Architect's inspection of work.
- .4 Supply stakes and other survey markers required for laying out work.
- .5 Any deviation from line and level shall be corrected without additional cost, to the Architect's satisfaction.

1.12 Location of Equipment and Fixtures

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate. Do not scale drawing for locating of position. Obtain Architect's direction.
- .2 Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access, and maintenance.
- .3 Inform Architect of impending installation and obtain his approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Architect.

1.13 Concealment

- .1 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.14 Cutting, Fitting, Patching

- .1 Execute cutting including excavation, fitting, and patching required to make work fit properly together.
- .2 Obtain Engineer's approval before cutting, boring or sleeving load-bearing members.
- .3 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .4 Fit work airtight to pipes, sleeves, ducts, and conduits.

- .5 Cutting and patching to be by tradesmen qualified in the respective sections of the work.
- 1.15 Existing Services**
 - .1 Before commencing Work, establish location and extent of existing services in area of Work and notify Architect.
 - .2 Whenever it is necessary to cut, interfere with, or connect to existing services or facility do so at hours and times recommended by governing authorities and approved by Architect; and with minimum disturbance to occupants, pedestrian and vehicular traffic and public and private property.
 - .3 Submit schedule to and obtain approval from Architect for each proposed shut-down of active service or facility. Adhere to approved schedule and provide notice to affected parties.
 - .4 If unknown services are encountered, immediately notify Architect and confirm findings in writing and/or on Drawings. Obtain Architect's written direction if such services require cutting, capping or relocation to do Work.
 - .5 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Architect.
 - .6 Protect and record locations of maintained or rerouted service lines. Record locations of abandoned service lines.
- 1.16 Additional Drawings**
 - .1 Architect may furnish additional drawings to assist proper execution of work. These drawings will be issued for clarification only. Such drawings shall have same meaning and intent as if they were included with plans referred to in Contract Documents.
- 1.17 Relics and Antiquities**
 - .1 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents commemorative plaques, inscribed tablets, and similar objects found on site or in buildings to be demolished, shall remain property of Owner. Protect such articles and request directives from Architect.
- 1.18 Coordination**
 - .1 The Contractor will coordinate the work of all sub-contractors, including mechanical and electrical trades.
 - .2 Coordinate work of each Section as required for satisfactory

and expeditious completion of Work. Take field dimensions as required. Take into account existing installations to assure best arrangements of components in available space. Consult before commencing Work in critical locations. Fabricate and erect Work to suit field dimensions and field conditions.

- .3 Provide forms, templates, anchors, sleeves, inserts and accessories or other components required to be fixed to or inserted in the Work. As applicable set them in place or instruct related Sections as to their location.
- .4 Pay cost of extra work caused by, and make up time lost as result of failure to comply with these requirements within established project timelines.
- .5 Cutting and patching as specified in sub-section above.

1.19 Modular Coordination

- .1 Where work incorporates metric modular components following rules apply:
 - a) Actual opening dimensions in masonry including doors, windows, walls, louvres and actual room sizes are 10 mm (3/8") greater than nominal dimensions given on Drawings. Actual thicknesses of walls, piers and overall lengths of walls or buildings are 10 mm (3/8") less than nominal dimensions given on Drawings unless indicated otherwise.
 - b) Unless indicated otherwise Drawing details at scales of 1:10 and less indicate "actual" rather than "nominal" dimensions.

1.20 Examination

- .1 Examine work upon which your work depends. Report in writing defects in such work. Application of your work shall be deemed acceptance of work upon which your work depends.
- .2 Drawings are, in part, diagrammatic and are intended to convey scope of Work and indicate general and approximate location, arrangement and sizes of fixtures, equipment, ducts, piping, conduit and outlets and similar items. Obtain more accurate information about locations, arrangement and sizes from study and coordination of Drawings, including shop drawings and manufacturers' literature and become familiar with conditions and spaces affecting these matters before proceeding with Work.

- .3 Where job conditions require reasonable changes in indicated locations and arrangements, make such changes with approval of Architect at no additional cost to Client. Similarly, where existing conditions interfere with new installation and require relocation, such relocation is included in Work.
 - .4 Install and arrange fixtures, equipment, ducts, piping and conduit to conserve as much headroom and space as possible, and avoid interference and obstruction of access. Observe good installation practice for safety, access, maintenance and follow manufacturer's recommendations. Make changes requested to comply with these requirements at no additional cost to Client.
 - .5 If requested by Architect, and before installation, relocate equipment, services, doors, openings, furring and other work at no additional cost to Client; providing such relocation involves only reasonable minor adjustments and reasonable advance notice is given in writing.
- 1.21 Cold Weather Work**
- .1 Continue Work including winter months, if applicable, until Work is completed and accepted. Provide winter heat to maintain project timelines and to ensure completion (and Occupancy) by the date specified Tender Documents. No additional costs for cold weather heating will be entertained.
- 1.22 Materials, Plant and Equipment**
- .1 Materials, plant and equipment specified shall form basis of Bid and Contract. Where more than 1 brand or manufacturer is named in Specifications, or on Drawings, choice is Bidders/Contractors provided requirements of Drawings and Specifications are met.
 - .2 Unless explicit statement is made in Bid/Contract Documents to say no substitutions will be permitted; then works "or approved alternate" are hereby deemed to apply to material, plant and equipment specified by brand or manufacturer, subject to following conditions:
 - a) Request for substitution is made after Contract award and in accordance with provisions for substitutions set out in the General Conditions of the Contract.
 - b) Proposed substitution satisfies all other indicated or specified requirements and conditions.
 - .3 Materials, plant and equipment shall not be damaged or

defective and shall be of quality compatible with Specifications for purpose intended. If requested provide evidence as to type, source and quality. Remove and replace defective products, at own expense, regardless of previous inspections, and be responsible for delays and expenses caused thereby.

- .4 Replace factory finished equipment, or parts thereof, whose paint finish is damaged and cannot be reasonably remedied by paint touch-up.

1.23 Material Storage and Handling

- .1 Store packaged materials in original, undamaged containers with manufacturer's labels and seals intact. Handle and store materials in accordance with manufacturer's and suppliers' recommendations and in manner to prevent damage to materials during storage and handling.

1.24 Concealment of Work

- .1 Conceal pipes, ducts conduits, tubing, wiring and other items requiring concealment in floor, wall and ceiling construction of finished areas except where indicated or specified otherwise. If in doubt as to method of concealment, or intention of Contract Documents in this connection, request clarification from Architect before proceeding with work in question.
- .2 Lay out mechanical and electrical work in advance of concrete placement and furring installation to allow for its proper concealment.
- .3 Test and inspect work before applying pipe covering and before Work is concealed.

1.25 Lines, Levels and Dimensions

- .1 Have registered Ontario Land Surveyor establish 1 permanent bench marks on Site, referenced to established bench marks by survey control points. Provide and maintain control lines and level required.
- .2 Lay out work in accordance with lines, levels and dimensions indicated and/or provided on bench marks established by survey.
- .3 Verify lines, levels and dimensions. Report errors or inconsistencies in Drawings and obtain direction from Architect before commencing Work and prior to ordering of associated products and materials.
- .4 Except as provided by survey, provide lines, levels dimensions necessary to relate work to that of other Sections.

**1.26 General
Workmanship**

- .1 Complete Work in accordance with industry standards for related type of work unless Contract Documents stipulate more precise requirements.
- .2 Complete all Work in neat and careful manner to retain Work plumb, square and straight.
- .3 Ensure Work is properly related to form close joints and appropriately aligned junctions, edges and surfaces and is free of warp, twist, wind, wave or other irregularities.
- .4 When required by Specifications or by manufacturer's recommendations, have manufacturer, supplier or accredited agent, inspect work which incorporates their products.
- .5 Do not permit materials to come in contact with other materials or environmental conditions which may result in corrosion, staining, dis-colouration, degradation or any adverse impact on completed Work. Provide compatible, durable separators where such contact is unavoidable.

1.27 Fasteners

- .1 Supply appropriate fasteners, anchors, accessories and adhesives required for fabrication and erection of Work.
- .2 Unless specified otherwise use exposed metal fasteners and accessories of same texture, colour and finish as product being fastened.
- .3 Use metal fasteners of same material as metal component being fastened, or of metal which will not generate electrolytic action and cause damage to fastener or metal component under moist conditions. In general use noncorrosive or hot dip galvanized steel anchors occurring on or in exterior wall, slab or other exterior locations, unless higher standard is indicated or specified.
- .4 Fastening devices or adhesives shall be of appropriate type, used in sufficient quantity and in such manner to provide positive, permanent fastening which will not shift, work loose or fail during occupancy of building due to vibration or other causes resulting from normal use of building. Install anchors at spacing to provide required load/stress carrying capacity. Do not use wood plugs.
- .5 Lay out fasteners neatly, evenly spaced and aligned. Keep exposed fasteners to minimum.
- .6 Supply adequate instructions and templates and, if necessary supervise installation, where fasteners or accessories for your

Section are required to be built into work of other Sections.

- .7 Do not use fasteners which will cause spalling, cracking, or deformation or deterioration of material being fastened by or to.
- .8 Do not use powder actuated fastening devices, which are used in tension, without approval. Take stringent safety precautions when using powder actuated fasteners. Use only low velocity plunger-type devices.
- .9 Use adhesives specified, or if not specified, those recommended by manufacturer of materials involved, compatible with materials to be joined, and effective in forming permanent joint of adequate strength.
- .10 Use screws, nails, staples and other similar, driven fasteners suitable to materials to be joined and to conditions under which they are installed and used. Ensure that in finished work, fasteners are sized to take durable hold under stress to be encountered without damage to, or weakening of, elements secured together, and that fastenings will not corrode or cause staining of exposed surfaces.
- .11 Do brazing or soldering to form durable connections of strength adequate to resist stresses to be encountered without deformation of elements joined. Prepare base metals and use methods and materials to ensure clean joint, and to prevent staining, corrosion, discolouration, deformation or other damage to finished Work.
- .12 Do welding to CSA W59-M89 (for steel) or CSA W59.2-M91 (for aluminum) for material and methods, unless specified otherwise. Have welding performed by industry certified operatives to CSA W47.1-83 or CSA W47.2-M87.

1.28 Accessories

- .1 Provide accessory items or materials required, such as brackets, cleats, connectors, sealants, lubricants, cleaners, protection, and similar items, whether specified or not, so that Work is complete and will perform as required.

1.29 Design and Safety Requirements for Temporary Work

- .1 Be responsible for design, erection, operation, maintenance and removal of temporary structural and other temporary facilities. Engage and pay for registered Professional Engineering personnel skilled in appropriate disciplines to

perform these functions where required by law or by the Contract Documents; and in cases where such temporary facilities and their method of construction are of such nature that Professional Engineering skill is required to produce safe and satisfactory results.

- 1.30 Protection and Safety**
- .1 Comply with requirements of Acts and Regulations with respect to health and safety including Occupational Health and Safety Act, as amended, and Workplace Hazardous Materials Information System (WHIMIS) Regulation, including following:
 - a) Before commencement of Work, and throughout Contract, maintain on Site, and readily accessible to all those who may be exposed to hazardous materials, list of hazardous materials proposed for use on Site or Workplace together with current Materials Safety Data Sheet (MSDS).
 - b) Ensure hazardous materials used and/or supplied on Site are labelled in accordance with WHIMIS requirements.
 - c) Know and be aware of the procedures for safe handling, storage and use of such hazardous materials including special precautions, safe clean-up and disposal procedures. Conform to Environmental Protection Act for disposal requirements.
 - d) ensure that those who handle, and/or are exposed to, or are likely to handle or be exposed to, hazardous materials are fully instructed and trained in accordance with WHIMIS requirements.
 2. Protect excavation, trenches and building from damage from rainwater, ground water, backing up of drains or sewers and other water, frost and other weather conditions. Provide sheeting, piling, shoring, pumps, equipment, temporary drainage, protective covering and enclosures. Provide necessary pumps including spare pump for keeping project free of water throughout construction period.
 - .3 Protect, relocate and maintain existing, active services wherever they are encountered. Wherever inactive services are encountered, cap them off and remove unwanted portion, with approval of authorities having jurisdiction or public utility concerned in manner approved by them.
 - .4 Load no part of structure during construction with load greater than it is calculated to bear safely when completed. Make every temporary support as strong as permanent support. Place no load on concrete structure until it has sufficient strength to safely carry such load.

- .5 Adequately protect floors and roofs from damage. Take special measures when moving heavy loads or equipment on them.
- .6 Keep floors free of oils, grease or related contaminants likely to dis-colour them or adversely affect bond of applied surfaces including fumes generated by temporary heating devices. Take care not to spill or allow oil, grease, gasoline, diesel and fuel oil, chemicals and other substances to contaminate soil or water on or adjacent to Site. Should such contamination accidentally occur report it immediately and clean up to satisfaction of Architect.
- .7 Protect work of other Sections from damage resulting from your work.
- .8 Damaged work shall be made good wherever possible by Section whose work is damaged but at expense of those causing damage.
- .9 Protect glass and other finishes against heat, slag and weld splatter using suitable protective shields or covers.
- .10 Prior to beginning of construction, design fire safety plan in conjunction with local Fire Chief. Post fire plan throughout construction and recommended. Do not allow accumulation of waste that may constitute fire hazard.
- .11 Conform to Construction Safety Association of Ontario's manual on Propane in construction. Watch work area for minimum of 30 minutes after hot work is completed. Provide Site fire security when required by local building department and/or municipal fire department. Ensure that water supply is adequate for fire fighting.
- .12 Provide and maintain in working order, suitable Underwriters' labelled fire extinguishers and locate in suitable positions, to approval of authorities having jurisdiction.
- .13 Provide minimum of 3 safety helmets for Architect and any other authorized visitors to Site if required.
- .14 Protect public and those employed on Work from injury. Equipment (mobile) when not in use shall have keys removed and locked up in secure location.

1.31 Scaffolding

- .1 Erect scaffolding independent of walls. Use it in manner as to interfere as little as possible with other Sections. When not in use, move it as necessary to permit installation of other work.

Construct and maintain scaffolding in rigid, secure and safe manner. Remove it promptly when no longer required.

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| 1.32 Temporary Cleaning | .1 Keep Site and building, including concealed spaces, free from accumulation of dirt, debris, garbage and excess material. Remove oily rags and waste from premises at close of each day, or more often if required. |
| 1.33 Manufacturers Directions | .1 Except where specified otherwise, use each product in accordance with manufacturer's published or written instructions, specifications or recommendations regarding handling, storage, preparation, Site conditions, ancillary products or accessories, methods of installation, protection and cleaning. Submit copy of such instructions and indicate if and where there is discrepancy between them and requirements of Specifications and obtain direction. |
| 1.34 Spare Products | .1 Where specified in other Sections, provide spare materials and products for future repair and replacement.
.2 Ensure such materials are of same production run as those incorporated in Work.
.3 Deliver quantities required, in separate labelled containers, and store where directed.
.4 Labels shall state material description, colour, pattern and location of installation. |
| 1.35 Environmental Practices | .1 Take active role in implementing environmentally sound business practices and producing goods and services that lessen burden on environment in production, use and final disposition. Support implementation of reduction, reuse and recycling strategies and use of environmentally sound products. Reduce or eliminate excessive packaging and promote use of environmentally responsible packaging practices.
a) Environmentally Sound Products: Product that is made, used and disposed of in a manner that significantly reduces harm it would otherwise cause the environment. Product may be certified as environmentally sound because it is made in a way that improves energy efficiency, reduces hazardous by-products, uses recycled material, or because the product itself can be recycled or reused, or in some way is environmentally benign.
b) Packaging requirements: Implement waste reduction by reducing or eliminating excessive packaging practices. |

- c) Use, where appropriate, combination of packaging materials such as re-usable containers, blanket wrap or cushioning material provided that all reasonable requirements of materials handling, transportation and storage are observed.
- d) Packaging materials such as kraft paper and corrugated cartons shall be made from reclaimed products to facilitate recycling of secondary materials.
- e) Packaging material shall be clearly labelled to display their recycled content and recyclability.
- f) Ensure that packaging materials are removed from Site and disposed of in environmentally responsible manner.

1.36 Waste Disposal

- .1 All refuse generated by and/or related to construction shall be removed from the project site and disposed of by the Contractor at an approved sanitary landfill site, recycling depot or waste collection facility suited to the nature of items being removed. All costs related to on-site handling of debris (including rental of on-site waste handling bins, dumpsters etc.) and the subsequent shipping and drop-off of waste is the sole responsibility of the Contractor throughout the duration of the project.
- .2 Coordinate all waste handling procedures within occupied buildings with Building Owners.
- .3 Coordinate all site locations of waste handling dumpsters with Building Owners.

1.37 Polychlorinated Biphenyl (PCB's)

- .1 In event of unexpected discovery of PCB's immediately notify Architect orally and in writing and do not handle, disturb or remove items containing PCB's. Architect will authorize remedial work, if any, in writing. Do such remedial work as addition to Contract.

1.38 Spill Response Procedures

- .1 The Contractor shall have written spill response procedures and material on-site to respond to pollutants and contaminants into the natural environment in excess of levels permitted in regulations or cause or are likely to cause an adverse effect.

END OF SECTION 01005

- 1.1 Allowance Overview** .1 Expend Cash Allowances only as directed and authorized by the Architect, and confirm in writing. Supply detailed and itemized costs for all Allowances in writing for the Architect's approval prior to proceeding with work.
- .2 Unexpended amount(s) of cash allowances may be relocated to other specified cash allowances at the sole discretion of the Architect.
- .3 Unexpended amount(s) of cash allowances shall be deducted from the Contract Price at completion of the work.
- .4 Overhead and Profit for the General Contingency (held by the Owner) will be as set out in Section 00710.
- .5 Do not include overhead and profit for work to be done under Cash Allowance Items noted below.
- Overhead and Profit on cash allowances only applies when the cash allowance expenditure exceeds the sum stated for the particular allowance.
- Then the overhead and profit on the excess amount will be allowed for the allowance in question as set out in Section 00710.
- .6 General Contingency and all cash allowances do not include H.S.T. It is understood that 13% is to be added to the General Contingency and Cash Allowances.
- .7 Mechanical allowances are to be included in mechanical contractor's price. Electrical allowances are to be included in electrical contractor's price.

1.2 Cash Allowances

.1

GENERAL ALLOWANCE:

Allowance by the General Contractor

Include the sum of \$700,000.00

This fund includes an overall cash allowance for:

- Inspection & Testing (concrete, asphalt, compaction, steel, post verification topo, storm and sanitary flush and camera post construction)
- Air & Hydronic Balancing
- Controls Commissioning
- Interior Graphics
- Exterior Ground Sign and Building Mounted Name
- Creative Play Area
- Playground Line Painting
- Scoreboard
- Stage Lighting and Audio Visual Equipment
- Post Verification Topo / CCTV and flush sewers
- Appliances (Excluding Childcare)
- Intrusion Alarm Security
- Door Access Control
- CCTV
- Jump Pit

.2

GENERAL CONTINGENCY FUND:

Allowance by General Contractor

Include the sum of \$300,000.00

This Fund includes for additional scope items or unforeseen site conditions.

END OF SECTION 01020

1.1 Sample Submissions

- .1 Submit samples in sizes and quantities noted in Specifications and/or as requested by the Architect throughout the course of construction.
- .2 Where a variety of colours, patterns, textures or finish options are provided by product manufacturers (for items not previously specified by the Architect), submit the manufacturer's full range of samples/options to the Architect.
- .3 All samples of colours, materials and/or finishes are to be submitted to the Architect as actual material samples in hardcopy submission. NO virtual/electronic colour cards viewed on-line (i.e. from supplier or manufacturer websites), electronic photos etc. will be accepted as compliant submission formats.
- .4 All samples are to be submitted, forwarded and delivered to the Architect's office. It shall not be the responsibility of the Architect to pick up or order any required samples (from product suppliers) under any circumstances.
- .5 All samples shall be submitted to the Architect at least 21 days prior to product ordering. The Architect reserves the right to allow 7 days min. for sample submittal review.

Any item or samples not submitted in sufficient time for Architectural review and approval [relative to subsequent ordering, production and delivery of product to site when required] shall be the sole responsibility of the Contractor to rectify and make good to the satisfaction of the Architect. *Neither the Owner [nor the Architect and related consultants] shall be financially responsible for any additional costs associated with express shipping options, accelerated production premiums and/or substitute materials which are necessary due to delays by the Contractor [his Sub-Trades and/or related product suppliers] in submitting and receiving the necessary approvals.*

1.2 Co-ordination of
Shop Drawings

- .1 Prior to first draw for payment being processed, the complete list of all shop drawings for the project shall be submitted and approved by all Consultants. Updated shop drawing schedule to be submitted with each draw until all shop drawings have been processed.

The Contractor shall formulate all Shop Drawing submission dates into the Project Construction Schedule only after

verifying and allowing for sufficient product delivery times (product lead times) required to meet the Owner's schedule for completion of individual project phases.

- .2 Review shop drawings, product data and of samples prior to submission to ensure their conformance to project requirements.
- .3 Prior to the submission of Shop Drawings, verify and reflect in the shop drawings all related:
 - (a) Field measurements (taken from project job site)
 - (b) Field Construction Criteria (taken from project job site)
 - (c) Product requirements, complete with proper identification of related manufacturer's catalogue, model and/or product numbers
- .4 Co-ordinate each submission with requirements of work and Contract documents. Individual shop drawings will not be reviewed until all related drawings are available.
- .5 Contractor's responsibility for errors and omissions in submission is not relieved by Architect's review of submittals.
- .6 Contractor's responsibility for deviations in submission from requirements of contract documents is not relieved by Architect's review of submission, unless Architect gives written acceptance of specified deviations.
- .7 Notify Architect, in writing at time of submission, of deviation from requirements of Contract documents.
- .8 After Architect's review, distribute copies.
- .9 All shop drawings shall be submitted to the Architect *at least 45 days prior to product ordering. This submission timeline in all circumstances shall be increased to allow for all required production and lead times relative to delivery of the product when required on site (identified within the Contractor's Construction Schedule).*

The Contractor must allow (within his Submission Schedule) for the possibility that all initial Shop Drawing submissions may not be approved, and that additional time is required for their subsequent revision and resubmission.

All shop drawings identified for re-submission are to be rectified and returned to the Architect's office within 7 days

after previous review date on the Shop Drawings.

Any delays in the re-submission of rectified or approvable shop drawings are the sole responsibility of the Contractor, along with any and all related expenses to accelerate product production, shipping and delivery and (where necessary) substitution to an alternate product deemed acceptable by the Architect.

**1.3 Shop Drawing
Submission Req'ts**

- .1 Schedule submissions at least forty-five (45) days prior to time at which related product must be ordered to ensure delivery to the construction site when required by the Contractor's Construction Schedule.
- .2 Submit shop drawings electronically as a pdf format document for consultant review and distribution.
- .3 Accompany submissions with transmittal letter, containing:
 - (a) Date
 - (b) Project title and number
 - (c) Contractor's name and address
 - (d) Number of each shop drawing, product data and sample submitted.
 - (e) Other pertinent data.
- .4 Where additional copies of shop drawings or product data are required for distribution, they shall be marked by the Contractor to accord with the copies reviewed by Consultants.
- .5 Submissions shall include:
 - (a) Submission Date and revision dates
 - (b) Project title and number
 - (c) Name of:
 - (i) Contractor
 - (ii) Sub-contractor
 - (iii) Supplier
 - (iv) Manufacturer
 - (v) Separate detailer when pertinent
 - (d) Identification of product or material with manufacturer's related codes and identification numbers
 - (e) Relationship to adjacent structure or materials
 - (f) Field Dimensions, clearly identified as such
 - (g) Specification Section number
 - (h) Applicable standards, such as CSA or CGSB numbers
 - (i) Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract documents.
- .6 Send finalized copies of shop drawings to the Client for record

purposes (as/if requested).

- .7 Shop Drawings not stamped with the Contractor's "Approved" stamp will be rejected. It is required that all shop drawings be reviewed by the Contractor (for completeness and accuracy) prior to submission to the Architects and/or his Consultants.
- .8 Shop Drawings being submitted by the Contractor which are specified herein as requiring an Engineer's seal will be rejected without review if the appropriate seal is not shown or present at the time of submission to the Consultant.

- .9 Shop Drawings not stamped or otherwise marked with the Architect's acknowledgment of review shall not be used or integrated into the construction in any manner.

END OF SECTION 01340

TEMPORARY FACILITIES

Section 01500
Page 1 DCPE
PN2501

- | | |
|-------------------------------------|---|
| 1.1 Access | <ul style="list-style-type: none">.1 Provide and maintain adequate access to project site..2 General Contractor to be responsible for maintaining snow clearing of snow in winter in areas around storage containers. |
| 1.2 Contractor Office | <ul style="list-style-type: none">.1 The General Contractor and Subcontractors shall be provided their own site offices and workshops for the entire length of Construction located in <u>Custodian 118</u>..2 Maintain in clean condition. Sweep daily..3 This facility, nor existing school site to be used for material storage. |
| 1.3 Sanitary Facilities | <ul style="list-style-type: none">.1 Provide sanitary facilities or work force in accordance with governing regulations and ordinances. Washrooms within school may NOT be used during construction..2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition. |
| 1.5 Storage Sheds | <ul style="list-style-type: none">.1 Provide adequate weather tight sheds with raised floors, for storage of materials, tools, and equipment which are subject to damage by weather. |
| 1.6 Parking | <ul style="list-style-type: none">.1 Parking spaces will not be allowed off the property unless reviewed and approved by the City. Designated parking along south of main parking lot shall be used during school hours. |
| 1.7 Enclosure of Structure | <ul style="list-style-type: none">.1 Provide temporary weather tight enclosures and protection for exterior openings until permanently enclosed..2 Erect enclosures to allow access for installation of materials and working inside enclosure..3 Design enclosure to withstand wind pressure and snow loading..4 Provide and maintain dustproof and sound resistant barriers or partitions between the Work and existing occupied building. |
| 1.8 Power | <ul style="list-style-type: none">.1 The General Contractor shall pay all costs associated with the provision of Construction power to the site. |
| 1.9 Water Supply | <ul style="list-style-type: none">.1 The General Contractor shall pay all costs associated with the provision of Construction water supply to the site. |
| 1.10 Heating and Ventilating | <ul style="list-style-type: none">.1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment..2 Maintain minimum temperature of 10°C or higher where specified as soon as finishing work is commenced and maintain |

until acceptance of structure by Architect.

- .3 Ventilating:
 - (a) Prevent hazardous accumulations of dust, fumes, mists, vapours, or gases, in areas occupied during construction.
 - (b) Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - (c) Provide mechanical ventilation to accelerate drying out of building if necessary to maintain schedule.
 - (d) Ventilate storage spaces containing hazardous or volatile materials.
 - (e) Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
 - .4 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - (a) Conform with applicable codes and standards
 - (b) Enforce safe practices
 - (c) Prevent abuse of services
 - (d) Prevent damage to finishes
 - (e) Vent direct-fired combustion units to outside.
 - .5 Activate air system under direction of Engineer to provide temporary heat, after Engineer is satisfied that system will not be damaged by freezing. Product ducting system by disposable filters 50% effective NDS inspected daily and replaced as necessary. Finally, vacuum clean entire ducting system and renew filters.
 - .6 Refer to Section 01710 for replacement of filters at time of final acceptance of work.
-
- 1.11 Drainage
 - .1 Refer to Civil drawings for site drainage and pumping.
 - 1.12 Site Signs and Notices
 - .1 Only project identification and approved job sign and notices for safety or instruction are permitted on site.
 - .2 Signs and notices for safety or instructions to be in the English language, or commonly understood graphic symbols.
 - .3 Maintain sign and notices for duration of project. Remove sign and deliver to Owner off site on completion of project.
 - 1.13 Scaffolding
 - .1 Construct and maintain scaffolding in rigid, secure and safe manner.
 - .2 Erect scaffolding independent of walls. Remove promptly

TEMPORARY FACILITIES

Section 01500

Page 3 DCPE

PN2501

when no longer required. Refer to Section 01545 for safety requirements for scaffolding.

End of Section 01500

SAFETY REQUIREMENTS

Section 01545
Page 1 DCPE
2501

- | | |
|---|---|
| 1.1 Construction Safety Measures | <ul style="list-style-type: none">.1 Observe and enforce construction safety measures required by the Ontario Building Code, Provincial Government regulatory agencies, Workplace Safety Insurance Board (WSIB), municipal agencies and all prevailing statutes and authorities. Safety requirements throughout the project include both the safety of workers and the safety of building occupants present elsewhere in the facility throughout the course of construction..2 In event of conflict between any provision of the above authorities the most stringent provision will apply. |
| 1.2 Fire Safety Requirements | <ul style="list-style-type: none">.1 Provide and maintain in good working order, sufficient fire fighting equipment, tools, and extinguishers to contain an outbreak of fire..2 Comply with all requirements of the local authorities having jurisdiction in the storage and handling of flammable materials..3 Ensure all persons working at the site are conversant with action to be taken in the event of an outbreak of fire at the Work. |
| 1.3 Overloading | <ul style="list-style-type: none">.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation. |
| 1.4 Falsework | <ul style="list-style-type: none">.1 Design and construct falsework in accordance with CSA S269.1-1975. |
| 1.5 Scaffolding | <ul style="list-style-type: none">.1 Design and construct scaffolding in accordance with CSA S269.2-M1980. |
| 1.6 Hoarding | <ul style="list-style-type: none">.1 Construct temporary construction hoarding as required within and outside of the facility as required to ensure the safety of occupants within the building. Hoarding shall be 6'-0" tall minimum, Modu-lock construction fencing..2 Hoarding shall be self-supporting and not permanently tied into any building materials or finishes..3 Coordinated hoarding locations and scheduling for hoarded areas with Building Owner or operator as required to facilitate use and related access to building areas. No hoarding shall inhibit exit or egress routes in the facility unless expressly permitted by related Authorities Having Jurisdiction. |
| 1.6 Smoking | <ul style="list-style-type: none">.1 Smoking is not permitted on School Board Property. |

SAFETY REQUIREMENTS

Section 01545
Page 2 DCPE
2501

END OF SECTION 01545

1.1 General

- .1 Use new material and equipment unless otherwise specified or directed in writing by the Architect.
- .2 Within (7) days of written request by Architect, submit the following information for any or all material and products proposed for supply:
 - (a) Name and address of manufacturer
 - (b) Product name, model, and catalogue number
 - (c) Performance, descriptive and test data
 - (d) Manufacturer's installation or application instructions
 - (e) Evidence of arrangements to procure
- .3 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
- .4 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.

1.2 Manufacturer's Instructions

- .1 Unless otherwise specified, comply with all product manufacturer's latest written instructions for materials and installation methods for the intended application. Comply with and supply all prescribed installation techniques, and materials recommended by the manufacturer as required to ensure the integrity and first-rate installation of related materials.
- .2 Notify Architect in writing of any conflict between these specifications and manufacturers' instructions. Architect will designate which document is to be followed.

1.3 Fasteners - General

- .1 Provide metal fasteners and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic and all similar negative reactions between dissimilar metals using appropriate materials or techniques. Use non-corrosive fasteners, anchors and spacers for securing exterior work.
- .2 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs not acceptable.
- .3 Keep exposed fasteners to minimum, space evenly and lay out neatly.
- .4 Fasteners which cause spalling or cracking of material to which anchorage is made are not acceptable.

- .5 Obtain Owner's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166-1975.
 - .6 Use fasteners of standard commercial Equipment sizes and patterns with material and finish suitable for service.
 - .7 Use heavy hexagon heads, semi-finished unless otherwise specified. Use no. 304 stainless steel for exterior areas.
 - .8 Bolts may not project more than one diameter beyond nuts.
 - .9 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur and resilient washers with stainless steel.
- 1.4 Delivery and Storage**
- .1 Deliver, store and maintain packaged material and equipment with manufacturers' seals and labels intact.
 - .2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.
 - .3 Store material and equipment in accordance with suppliers' instructions and Section 01500.
 - .4 Touch-up damaged factory finished surfaces to Architect's satisfaction. Use primer or enamel to match original. Do not paint over name plates.
- 1.5 Product Substitutions**
- .1 **All Tenders are to be based STRICTLY UPON THE ITEMS SPECIFIED IN/ON THE CONTRACT DOCUMENTS (INCLUDING DRAWINGS AND SPECIFICATIONS.)** Tender submissions based upon Contractor-elected alternate items, products and/or materials [not approved by the Architect prior to Tender Close] will not be accepted.
- No Contractor-suggested alternate materials will be accepted following Tender if not expressly approved by the Architect in accordance with item .2 below.
- Proposals for alternate materials or products *may* be submitted after Award of Contract if required by the circumstances outlined below. Such requests must include statements relating respective costs of items originally specified against proposed substitutions.

- .2 Alternate materials may be considered by Architect post-Tender if:
 - (a) Products specified at time of Tender are no longer available OR
 - (b) Products specified at the time of Tender cannot be ordered and produced within the Owner's timeframes for project completion (including interim dates for various project phases) OR
 - (c) the proposed alternate products meet with the Architect's approval (relative to qualitative and performance standards) and it also results in a credit amount to the Contract value
 - .3 Should proposed substitution be accepted either in part or in whole, the Contactor shall assume full responsibility of additional costs when substitution affects other work on project, including the costs of design or drawing changes required as result of substitution.
 - .4 Amounts of all credits arising from approval of substitutions will be determined by Architect and Contract price will be reduced accordingly. No substitutions will be permitted without prior written approval of Architect.
 - .5 The Owners reserve the right not to allow substitutions. Products specified are in the Tender Documents reflect Owner's standards for related system and components.
- 1.6 Construction Equipment and Plant**
- .1 On request, prove to the satisfaction of Architect that the construction equipment and plant are adequate to manufacture, transport, and install items to the standards, schedule and all related requirements specified. If inadequate, replace or provide additional equipment or plant as directed.
 - .2 Maintain construction equipment and plant in good operating order.
- 1.7 Work Surfaces**
- .1 Millwork, cabinets, countertops or other similar permanent surfaces, including loose or fixed and installed furniture and equipment are not to be used as work surfaces. Contractors and Subcontractors shall provide their own temporary work surfaces as required.

- | | |
|---|---|
| 1.1 General | <ul style="list-style-type: none">.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. |
| 1.2 Materials | <ul style="list-style-type: none">.1 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer. |
| 1.3 Cleaning During Construction | <ul style="list-style-type: none">.1 On a daily basis maintain premises free from debris and waste material..2 Maintain project site and public properties free from accumulations of waste materials and rubbish..3 Provide on-site container for collection of waste materials and rubbish..4 Remove waste materials, and rubbish from site at regular intervals, or when container is full..5 Vacuum clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy..6 Schedule cleaning operations so that resulting dust and other contaminants will not fall on areas prepared for finishes and/or wet, newly painted surfaces. |
| 1.4 Final Cleaning | <ul style="list-style-type: none">.1 In preparation for substantial completion or occupancy, conduct inspection of sight-exposed interior surfaces..2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior finished surfaces including glass and other polished surfaces, resulting |

from own work.

- .3 Clean finished floors ready for sealing and waxing.
NOTE: The Contractor is responsible for initial wax and seal on any flooring as required.
- .4 Clean lighting reflectors, lenses, and other lighting surfaces.
- .5 Power wash paved surfaces; rake clean other surfaces of grounds.
- .6 Remove debris and surplus materials from accessible concealed spaces.
- .7 Replace heating, and ventilating filters if units were operated during construction.
- .8 Replace broken, damaged or scratched glass and mirrors, which are part of the Work.
- .9 Use appropriate apparatus and cleaning materials. Clean Work in accordance with applicable Sections and/or manufacturer's directions.
- .10 Upon completion of final cleaning, remove cleaning equipment, materials and debris from building and Site.

END OF SECTION 01700

1.1 Record Drawings

- .1 Contractor will provide with two sets of white prints at the outset of construction for the progressive recording of items deviating from the drawings. At the completion of construction, this set of record drawings should reflect final 'as-built' conditions.
- .2 Maintain project record drawings by accurately and progressively recording deviations from Contract documents caused by site conditions, and changes subsequent to Tender.
- .3 Mark changes in coloured (red) ink.
- .4 Record following information:
 - (a) Location and nature of mechanical and electrical building systems and related components not otherwise shown on the drawings.
 - (b) Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
 - (c) Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
 - (d) Field changes of dimension and detail.
 - (e) All changes made by Change Order.
- .5 At completion of project and prior to final inspection, neatly transfer notations from the original working set of drawings (for all structural, architectural, electrical, civil and mechanical drawings) to the second final set. Submit both sets to Architect, Civil, Mechanical and Electrical Engineers.
- .6 The General Contractor, Mechanical Contractor and Electrical Contractor, shall each note a \$5,000.00 Hold Back value (to be identified in all draws) to cover final submission and of as-built drawings and Operation and Maintenance Manuals. Hold back values will be released upon consultant review and approval of completed submittal requirements.

END OF SECTION 01720

- 1.1 Maintenance**
- .1 On completion of project submit to Architect digital copy of Operating and Maintenance Manuals in English, made up of one USB drive or Cloud based storage site for review and approval:
 - a) Organize contents into applicable sections of work to parallel project specification breakdown. Mark each section by labeled tabs projected and celluloid covers fastened to hard paper dividing sheets.
 - .2 Include the following information:
 - a) Maintenance instruction for finished surfaces and materials.
 - b) Copy of hardware and Paint Schedules, paint layout drawings, Interior and Exterior Colour and Finish Schedules
 - c) Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity and serial number.
 - d) Names, addresses and phone numbers of Sub-contractors and Suppliers.
 - e) Guarantees, warranties and bonds showing:
 - i) Name and address of projects
 - ii) Guarantee commencement date (date of Final Certificate of Completion).
 - iii) Duration of guarantee.
 - iv) Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - v) Signature and seal of Contractor.
 - .3 Neatly type all information. Use clear diagrams or manufacturer's literature.
 - .4 Final payments will not be made until complete packages, as described at 1.1.1. to 1.1.3, are received by the Board. Promptness and completeness of these packages will be taken into account as part of pre-qualification applications for future Board projects regarding the 'past performance' criteria.
 - .5 *The General Contractor, Mechanical Contractor and Electrical Contractor shall **each** note a **\$5,000.00 Hold Back value** (to be identified in all draws) will be retained to cover final submission and approval of as-built drawings and Operation and Maintenance Manuals. Hold back values will be released upon consultant review and approval of completed submittal requirements.*

END OF SECTION 01730

PART 1 - GENERAL

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|-----|----------------------------|--|
| 1.1 | General | Division One, General Requirements, is part of this section and shall apply as if repeated here. |
| 1.2 | Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:</p> <ul style="list-style-type: none"> .1 Supply and install a new 4'-0" high ornamental iron fence 3" off grade along kindergarten enclosure. .2 Supply and install concrete piers for fence anchorage. |
| 1.2 | Related Work | <ul style="list-style-type: none"> .1 Cast-in-Place Concrete Section 03300 |

PART 2 - PRODUCTS

- | | | |
|-----|---------------------------|--|
| 2.1 | Materials | <ul style="list-style-type: none"> .1 Ornamental iron fence shall be by Nuvo Iron or approved alternate. .2 The style shall be 'Nuvo VI' from the "Memorial Collection". .3 Post caps shall be pyramid style. |
| 2.1 | Materials (Cont'd) | <ul style="list-style-type: none"> .4 Finish shall be factory-applied 7 stage powder coat over galvalume-treated steel components. .5 Colour shall be high gloss black. .6 Gates shall match the 'Nuvo VI' series fencing. .7 Pickets shall be 5/8" x 5/8", 18 ga, galvalume
Rails shall be 1" x 1" 14 ga, galvalume
Posts shall be 2" x 2" 16 ga, galvalume .8 Weld type shall be stainless steel. .9 Picket interspace shall be 3 1/4" maximum. .10 Post setting shall be 94 1/8" maximum centre to centre, as coordinated with the manufacturer respective to standard panel length. |

PART 3 - EXECUTION

- .1 Install fencing plumb, level, and in proper alignment, in locations shown on architectural drawings.
- .2 Install all fencing in full accordance with the manufacturer's recommendations for the intended application, ensuring that no installation procedures compromise the product or invalidate the manufacturer's warranty in any way.

End of Section 02215

PART 1 - GENERAL

- 1.1 Description of Work .1** Supply and install of new galvanized 6'-0" high chain link fencing and as shown on drawings. Gates to be supplied complete with lockable latches, heavy-duty hinges, bottom support casters etc. suited to gate span dimensions, gate weight, installation context/conditions etc.
- .2** Supply and install concrete piers/post-holes for gate-post anchorage.

PART 2 - PRODUCTS

- 2.1 Materials .1** Fabric: chain link, hot dipped galvanized. Number 9 gauge steel wire woven in a 50 mm (2") mesh. Top selvage to have a knuckled finish, bottom selvage to have a knuckled finish. Tensile strength of individual pickets to stand a test of 552MPa (80,000 lb/sq. in.). Galvanized fabric to have an average of 488 g/m² (1.6 oz./sq. ft.) of zinc. Fabric height to suit drawings description.
- .2** Line posts: 60.3mm (2 3/8") outside diameter, stand continuous weld schedule 40 pipe, galvanized. Length 838 mm (2'-9") longer than the height of the fabric. Minimum weight per foot 1.66 kg (3.65 lb): No tubing, conduit or open seam material will be permitted.
- .3** Terminal posts: end posts, 88.9 mm (3 1/2") OD standard continuous weld schedule 40 pipe, galvanized. Length 1067 mm (3'-6") longer than height of fabric. Minimum weight per foot, 3.42 kg (7.55 lb). No tubing, conduit or open seam material will be permitted
- .4** Concrete: minimum 13.79 MPA (2,000 PSI) concrete, of following minimum dimensions:
Line posts 254 (10") diameter concrete foundation & 1067 (42") deep.
Terminal posts 305 (12") diameter conc. foundation & 1219 (48") deep.
- .5** Line post spacing: 3m (10'-0")
- .6** Line post tops: Galvanized pressed steel. Top to accommodate 42.9mm (1 11/16") OD top rail in horizontal position.

- .7 Top rail: 42.9mm (1 11/16") OD galvanized pipe, plain ends random lengths, standard continuous weld schedule 40 pipe. No tubing, conduit, or open seam material will be permitted.

- .8 Galvanize couplings of the outside sleeve type at least 178mm (7") in length will be used to join the top rail.

Fitting: Hot dipped galvanized pressed steel, aluminium or non-metallic mouldings of sufficient strength to ensure the integrity of the fence.

Fabric Panels: Fastened between line posts at approximately 305mm (12") intervals.

- .9 Gate Hardware: provide matching gate hardware to suit including heavy duty hinges, lockable latch and bottom support casters suited to gate span and weight etc.

- .10 Where applicable (daycare / kindergarten) all frame work and other fence components shall be finished with black gloss enamel by powder coat application. Prior to powder coating, all surfaces to be chemically cleaned and treated with Parker Bonderite and Chlorothene solvent or approved equals. Powder coating must be a polyester 2000 series applied in a thickness of 4-5 mils by electrostatic coat and oven cured for a smooth and even surface.

PART 3 - Execution

3.1 Fencing

- .1 Install fencing and gates plumb, level, and in proper alignment as indicated on the drawings.

END OF SECTION 02216

PART 1 GENERAL

1. RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specifications Section, apply to this Section.

2. DESCRIPTION

- A. This Section specifies furnishing and installing cast-in-place tactile panel modules where indicated on site plan drawing at barrier free entrance locations.

3. SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of panel placement including joints, and material to be used as well as outlining installation materials and procedure.
 - 1. Panel pattern shall be designed and shown between existing expansion joints with panel rib dimension used for the cut size of panels.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile panel system as certified by a qualified independent testing laboratory.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile panel and accessory as required.

4. QUALITY ASSURANCE

- A. Provide cast-in-place tactile panels and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project. Manufacturer's supervisor shall be present at initial pour.
- C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES. In addition products must comply with CALIFORNIA TITLE 24 requirements regarding pattern, color and sound on cane contact.
- D. Vitreified Polymer Composite (VPC) cast-in-place panels shall be an epoxy polymer composition with an ultra violet coating employing aluminum oxide particles in the truncated domes:
 - 1. Water Absorption of Tile when tested by ASTM-D 570 not to exceed 0.35%.
 - 2. Slip Resistance of Tile when tested by ASTM-C 1028 the combined wet/dry static co-efficient of friction not to be less than 0.80.

3. Compressive Strength of tile when tested by ASTM-D 695-91 not to be less than 18,000 psi.
 4. Tensile Strength of Tile when tested by ASTM-D 638-91 not to be less than 10,000 psi.
 5. Flexural Strength of Tile when tested by ASTM - C293-94 not to be less than 24,000 psi.
 6. Chemical Stain Resistance of Tile when tested by ASTM-D 543-87 to withstand without discoloration or staining - 1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.
 7. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM-D 2486* with reciprocating linear motion of 37 $\frac{1}{2}$ cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block to be 3.2 lb. Average wear depth shall not exceed 0.030 after 1000 abrasion cycles measured on the top surface of the dome representing the average of three measurement locations per sample.
 8. Fire Resistance: When tested to ASTM E84 flame spread be less than 25.
 9. Gardner Impact to geometry "GE" of the standard when tested by ASTM-D 5420-93 to have a mean failure energy expressed as a function of specimen thickness of not less than 450 in. 1bf/in. A failure is noted if a hairline fracture is visible in the specimen.
 10. Accelerated Weathering of Tile when tested by ASTM-G26-95 for 2000 hours shall exhibit the following result - no deterioration, fading or chalking of surface of tile.
- E. Vitrified Polymer Composite (VPC) Cast-In-Place Panels embedded in concrete shall meet or exceed the following test criteria:
1. Accelerated Aging and Freeze Thaw Test of Tile when tested to ASTM-D 1037 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other defects.
 2. Salt and Spray Performance of Tile and Adhesive System when tested to ASTM-B 117 not to show any deterioration or other defects after 100 hours of exposure.

5. DELIVERY, STORAGE AND HANDLING

- A. Panels shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings, and panel type shall be identified by part number.
- B. Panels shall be delivered to location at building site for storage prior to installation.

6. SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40 degrees F in spaces to receive tactile panels for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile panel material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40 degrees F in areas where work is completed.

- B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.
- E. Contractor shall coordinate phasing and flagging personnel operations as specified elsewhere.

7. EXTRA STOCK

- A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for cast-in-place tactile panels. Furnish not less than two (2)% of the supplied materials for each type, color and pattern installed.

8. GUARANTEE

- A. Cast-in-place tactile panels shall be guaranteed in writing for a period of five years from date of final completion. The guarantee includes defective work, breakage, deformation, fading and chalking of finishes, and loosening of panels.

Part 2 PRODUCTS**1. MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. The Vitrified Polymer Composite (VPC) Cast-In-Place Tactile Panel specified is based on Armor-Tile manufactured by Engineered Plastics Inc. (800-682-2525). Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
- C. Color: Colonial Red conforming to Federal Color No. 20109. Color shall be homogeneous throughout the tile.

2. MATERIALS

- A. Heavy duty elastomeric polyurethane sealant as manufactured by Boiardi, Mapei, Bostik or approved equal.

PART 3 EXECUTION

1. INSTALLATION

- A. During all concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. The specifications of the concrete sealants and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.
- C. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast-In-Place Tile System. An overly wet mix will cause the Cast-In-Place System to float, therefore under all conditions suitable weights such as concrete blocks or sandbags (25 lb) shall be placed on each 2' x 2' tile module.
- D. Prior to placement of the Cast-In-Place System, the manufacturer's shop drawings shall be reviewed and a layout drawing prepared by the installation contractor to resolve the issues related to pattern repeat, tile cuts, expansion joints, control joints, platform curves, platform end returns and platform surface interferences.
- E. The concrete pouring and finishing operations require typical mason's tools, however, a mason's line, radius edge (1/8 x 3/16" return) tool, 4' long x 2" wide x 1/8" thick steel straight edge, 25 lb. weights, vibrator wand and small sledge hammer with 2" x 6" x 20" wood tamping plate are specific to the installation of the Cast-In Place System.
- F. The concrete shall be poured and finished level, true and smooth to the required dimensions prior to tile placement. Immediately after pouring concrete, a mason's line should be strung parallel to track to act as a reference line for placement of tile, then the tile assembly shall be placed true to the platform edge and to each other on the concrete. The Cast-In-Place tiles shall be tamped or vibrated into the fresh concrete to ensure that the field level of tile is flush to the adjacent concrete or platform edge surface. The shop drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes. The tolerance for elevation differences between tile and adjacent surface is 1/16".
- G. Immediately after tile placement, the tile elevation is to be checked to adjacent concrete or rubbing board heights with a steel straight edge. The tile elevation should be set consistent with shop drawings to permit water drainage to or away from track as the platform design dictates.
- H. While concrete is workable a steel edging trowel 1/8" radius x 3/16" return is to be used to edge the tile to adjacent concrete surfaces running parallel to track. While edging, ensure that a clean edge definition is created between tile and adjacent concrete and that tile to concrete elevations meet the shop drawing tolerances.
- I. The placement of Cast-In-Place Tile assemblies to each other and to the mason's line or form edge shall be true and parallel to develop a true line consistent with the platform edge. A tight tile to tile placement can best be achieved by raking out the concrete at the butting edge to avoid trapping concrete or aggregate between tiles and/or form edge.
- J. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile to rock the tile, causing a void between the underside of tile and concrete.
- K. Following tile placement, review installation tolerances to shop drawings and adjust tile before the concrete sets, suitable weights of 25 lb. shall be placed on each tile and additional weights at tile to tile assemblies as necessary to ensure solid contact of tile underside to concrete.

- L. Following the curing of the concrete, the protective plastic wrap is to be removed from the tile face by cutting the plastic with a sharp knife tight to the concrete/tile interface. If concrete bleeding occurs between tiles, a wire brush will clean the residue without damage to the tile surface.
- M. An elastomeric urethane sealant shall be applied to the tile edges running parallel to the track or curb. Proper surface preparation requires that the tile and adjacent surfaces are mechanically etched with sandpaper or a carbide burr and wiped clean and dry with acetone. Applications of the urethane sealant shall be level to the adjacent surface and a straight line formed to the tile edge. A quality installation of the sealant may require that the tile face be masked off with duct tape to ensure a clean definition of sealant to the adjacent surfaces.

2. CLEANING AND PROTECTING

- A. Protect panels against damage during construction period to comply with tactile panel manufacturer's specification.
- B. Protect panels against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile panels not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile panel by method specified by tactile panel manufacturer.

End of Section

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 Do precast work in accordance with CSA A23.4-09
- .2 Do welding in accordance with CSA W59-03.

1.2 QUALITY OF MANUFACTURER

- .1 Manufacturer of precast stairs and landings shall be certified by CSA, meeting requirements of CSA A23.4-09 for appropriate class of work.
- .2 Manufacturer of precast stairs and landings shall be fully experienced in and equipped for this type of work and shall be able to document minimum five consecutive years of activity in the field and have successfully completed projects of similar size and complexity.
- .3 Manufacturer of precast stairs and landings shall be a member of the National Precast Concrete Association (NPCA).
- .4 Approved manufacturer: **Hy-Grade Precast Concrete, Sanderson Concrete** or approved equivalent.

1.3 DESIGN CRITERIA

- .1 Design precast concrete elements to carry handling and expected service loads, without detrimental effects.
- .2 Retain a structural engineer, registered in Ontario, experience in the field of precast concrete stairs and landings to ensure adequacy of the structural aspects of the design, shop drawings, manufacturing, transportation and installation of all precast concrete components, attachments, hardware and assemblies.

1.4 QUALITY ASSURANCE

- .1 Conform to requirements of CSA A23.4-09 for allowable tolerances.

1.5 SUBMITTALS

- .1 Prepare and submit detailed erection drawings, containing all pertinent information regarding the erection of the precast concrete stairs and landings including:
 - a. Location of each unit in the completed structure and identifying marks for each unit
 - b. Size and dimensions of each stair complete with connection details
 - c. Grade of reinforcement, concrete strength and admixtures
 - d. Locations and details for lifting hooks and handling points
 - e. Sequence of erection and any special instructions that may be required in handling and setting.
- .2 Shop drawings to be sealed by professional engineer licensed to practice in jurisdiction of this project.

1.6 DELIVERY, HANDLING AND STORAGE

- .1 Proper lifting devices for the stair units shall be incorporated to ensure that they will be safely and efficiently handled and not produce distortion, cracking or deflection nor strain or adversely affect the units.
- .2 Precast stair units shall be handled and adequately protected during fabrication, curing, storage and transport by methods that will prevent damage, warping, cracking, breakage, chipping, staining or other disfigurement. Units shall not be permitted to contact the earth or other staining influences.
- .3 Repair chipped, checked, cracked, blemished or defective units.
- .4 Precast stair units shall be delivered to the site clearly marked in an acceptable manner as indicated on the Shop Drawings. Markings shall not be visible once stair unit is installed.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Cement, aggregates, water, admixtures: to CSA A23.4-09.
- .2 Formwork materials: All forms shall be steel, accurately constructed, well braced and stiffened to avoid deformations under pressure of wet concrete and vibrators. The quality of forms shall be such that all dimensional tolerances and exposed concrete quality can be consistently maintained.

- .3 Use same brands and source of cement and aggregate for entire project to ensure uniformity of colouration and other mix characteristics.
- .4 Reinforcing steel: to CAN/CSA-G30.18-M92. All reinforcing steel to be weldable grade 400W.
- .5 Anchors: hot dip galvanized steel, concealed, designed to satisfy specific design and performance criteria.

2.2 CONCRETE MIXES

- .1 Use concrete mix designed to produce minimum 35 MPa compressive strength at 28 Days.

2.3 FABRICATION

- .1 The non-porous steel stair or fiberglass forms shall be manufactured to produce raised non-slip continuous parallel ridges near the tread nosing. No honeycombing will be accepted.
- .2 The underside of all precast stairs shall have a smooth trowel finish. Screed finish is not acceptable.
- .3 Accurately set reinforcing steel. Vibrate continuously during casting of concrete.
- .4 Bearing areas shall be reinforced against diagonal tension, splitting, rupture and flexure. Extra ties, stirrups and reinforcing bars shall be placed at support points.
- .5 Support precast stair units uniformly while curing. Keep a daily check to detect any development of warpage or other distortion. Rearrange supports as required to compensate for warpage or distortion.
- .6 Cast-in lifting devices required for erection of the precast concrete stair units. Ensure that lifting devices used externally or cast into units are capable of supporting the precast units in all positions that the units may be in during course of manufacture, transportation and installation. Ultimate capacity of lifting devices shall be sufficient to resist forces obtained by applying load factor of 4:1.
- .7 Mark each precast unit to correspond to identification mark on shop drawings for location.
- .8 Mark each precast unit with date cast.
- .9 Markings shall be on part of unit which will not be exposed.
- .10 Cast-in-place tactile indicators to be installed at top of all flights of stairs as shown on drawings. Attention pattern shall have truncated domes arranged in a square grid pattern with a max 4mm height x 25mm diameter. Colour shall be black and be installed flush to surface of precast.

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Prior to start of installation on site, examine location, spacing and level of inserts installed.
- .2 Report unsatisfactory conditions prior to installation. Start of installation shall imply acceptance of conditions.

3.2 INSTALLATION

- .1 Erection of the precast stairs and landings, at the site, shall be by the contractor.
- .2 All work shall be executed using workers skilled in the trade of precast erection.
- .3 All stair and landing units shall be set plumb, true and square, with joints parallel and uniform, all in accordance with approved Erection Drawings.
- .4 Units shall be anchored securely and rigidly to supporting work.
- .5 Contractor (not precast manufacturer) shall provide and supply all anchors, fixing devices, supports, and misc. installation hardware necessary
- .6 Grout joints at supports with non-shrink grout.
- .7 Patch holes at lifting hook locations, to match adjacent surfaces

3.3 CLEANING

- .1 Clean soiled precast concrete surfaces by approved means to satisfaction of consultant.
- .2 Repair units that have minor visual defects to the satisfaction of consultant.

3.4 INSPECTION AND TESTING

- .1 All inspection and testing as directed by consultant. Costs incurred for all inspection and testing shall be the responsibility of the contractor.

END

PART 1 - GENERAL

1.1 General

- .1 Division One, General requirements, is part of this Section and shall apply as if repeated here.

1.2 Description of Work

The work shall consist of the following but not limited to:

- .1 The work to be done under this section shall consist of the supply of all material, labour, supervision, plant and equipment to complete all concrete masonry unit work [in varying product types] shown on the drawings and specified herein for all structural and non-structural demising walls throughout.
- .2 Install beam and vertical reinforcing bars as supplied by Section 03300.
- .3 Steel reinforcing bars for masonry are supplied by Section 032000 and installed by the Masonry Trade. Shop drawings are to be provided by Section 032000 to the Masonry Trade.
- .4 Dovetail anchor slots for tying to concrete walls and columns are supplied and installed by Section 033000.
- .5 Loose angle lintels are supplied by Section 051223 and installed by the Masonry Trade.
- .6 Shelf angles/plates and wall plates that bear on or are attached to masonry are supplied by Section 051223 and installed by the Masonry Trade.
- .7 Masonry anchors for anchoring to steel columns are supplied by Section 051223 and installed by the Masonry Trade.
- .8 Lateral support angles at tops of exterior masonry walls are supplied and installed by Section 051223 and installed by the Masonry Trade.
- .9 Supply and install horizontal masonry reinforcing.
- .10 Examine areas which are to receive the work of this section. Do not proceed until all unsatisfactory conditions are corrected.
- .11 Supply and install masonry flashing, and connects to columns, beams, lintels, floor slabs, window, door and louvre frames or as shown on the consultants drawings or shop drawings.
- .12 Co-ordination with all other related trades as required throughout construction.

1.3 Related Work

- | | | |
|----|------------------------------------|----------------|
| .1 | Cast-in-Place Concrete | Section 03300 |
| .2 | Steel Reinforcing | Section 03200 |
| .3 | Structural Steel | Section 05120 |
| .4 | Structural Steel for Buildings | Section 051223 |
| .5 | Miscellaneous Metal | Section 05800 |
| .6 | Steel Doors and Frame | Section 08700 |
| .7 | Aluminum Windows, Frames and Sills | Section 08150 |

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.8	Painting and Decorating	Section 09900
.9	Spray Foam Insulation/Air Barrier	Section 07216
.10	Exterior Masonry Veneer	Section 04230
.11	Structural Brick	Section 04225

1.4 References

.1 American Society for Testing and Materials (ASTM).

- .1 ASTM C 207-91(1997), Standard Specification for Hydrated Lime for Masonry Purposes.
- .2 ASTM C1329-03a Standard Specification for Mortar Cement

.2 Canadian Standards Association (CSA).

- .1 CSA A179-94: Mortar and Grout for Unit Masonry.
- .2 CSA A370-94: Connectors for Masonry.
- .3 CSA A371-94: Masonry Construction for Buildings.
- .4 CSA-A3000-98 Cement Materials (Portland Cement and Masonry Cement).

1.5 Submittals

- .1 Product Data: Submit Structural Masonry products, test reports in accordance with Section 01330 - Submittal Procedures.
- .2 Samples:
 - .1 Submit samples in accordance with section 01340 Submittal Procedures. Samples to be approved by Architect prior to ordering and production.
 - .2 Tests: Submit test report of unit masonry to requirements of Section 01330 - Submittal Procedures.
 - .1 Test samples in accordance with CSA A82.1

1.6 Dimensions

- .1 Check all dimensions shown on the drawings by site measurement before commencing 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.

- | | |
|---|---|
| 1.7 Delivery,
Storage and
Handling | <ul style="list-style-type: none">.1 All materials shall be so delivered, stored and as to prevent damage and inclusion of foreign materials..2 Packaged materials shall be delivered and stored in original packages until ready for use. All materials must be kept off the ground and stored in dry areas..3 Masonry units shall be stored on skids and covered with clean waterproof tarpaulins when work is not in progress. Keep water out of all holes and reglets in units during freezing weather..4 Store adhesives and primers at temperature of 5°C and above to facilitate handling. Keep solvent away from open flame or excessive heat. |
| 1.8 Protection | <ul style="list-style-type: none">.1 Protect the work of this Section from damage resulting from the work of other Sections. Repair or replace, at no cost to the Owner, all work damaged due to the work of this Section..2 Completely cover open tops of walls each night, and when not under actual construction, with watertight coverings. Cover freshly built walls with tarpaulins during rain. Make good any damage to this work from any cause whatsoever until completion of this work. Protect mortar from freezing during the first 36 hours after placement. |
| 1.9 Workmanship | <ul style="list-style-type: none">.1 The work of this Section shall be done by skilled tradesmen and in accordance with CSA Standard, CAN3-S304-M (latest issue.).2 The Contractor shall be responsible for maintaining all dimensions, lines and levels true and plumb within the tolerances required by this part. Construct masonry walls as true planes with variation from the mean plane of 3mm (1/8") in 3.0M (10 feet) in any direction..3 Contractor shall provide, install and maintain adequate outside and inside scaffolding of approved type for the proper installation of the work. |

PART 2 - PRODUCTS

2.1 Materials

.1 **General Use Concrete Blocks/
Concrete Masonry Units (CMU):**

All general-use concrete block shall be modular metric size, Class 'A' Standard in accordance with CSA Standard A165-1-M, H/15.0/A/M (H/15.0/C/M) for Hollow Blocks, S/15.0/A/M (S/15.0/C/M) for solid blocks. Concrete block shall be the dimensions required to construct walls of thickness shown and shall be sound and free from cracks or other defects which may impair their strength, durability or appearance.

As the majority of interior blocks will be painted or receive a coating, it is imperative that blocks with surface marks or imperfections not to be used. Chipped blocks will be rejected and replaced at contractor's expense even after they have been installed. This contractor shall ensure that the block manufacturer provides him with the smoothest and most dense concrete face surface finish.

The Architect will reject batches at this contractor's expense should he deem the block faces and degree of manufactured finish unsuitable for paint.

.2 **Acoustical Masonry Units (AMU):**

Manufacturer: Day & Campbell Limited

Product: Ground Face Block, Modern Masonry Arch'l Line

Type: Acoustiwall Type II

Colour: Super-White #201

Finish Texture: Honed

General Location: Gymnasium upper walls as shown on
Architectural Drawings and Architectural
Interior Elevation drawings

.3 Sizes: All concrete block and concrete masonry unit products as noted herein are to be provided in the standard metric modular heights (190 mm high) and lengths (390 mm long). Block depths to vary relative to wall thicknesses indicated on Architectural and Structural drawings throughout.

.4 Provide special masonry shapes, such as plain bed, halves, jamb, ledger, bullnose, end, bond, sash groove, and lintel units, open-ended blocks, knock-out blocks as required to complete the work as indicated on the drawings.

.5 Mortar for concrete masonry units shall be Type S, with a minimum compressive strength of 12.5 MPa (1800 psi) in 28 days.

.6 Masonry cement used in mortar shall be type "H", conforming to

CSA CAN3-A8-M.

- .7 Portland cement used in mortar shall conform to CSA CAN3-A5-M.
- .8 Lime used in mortar shall be hydrated and free from calcium sulphate in accordance with CSA A82.43.
- .9 Sand for mortar at CMU shall consist of fine granular material composed of hard, strong, durable mineral particles which shall be free of injurious amounts of saline, alkaline, organic or other deleterious substances, and shall comply with CSA A82.56-M.
- .10 Water used in mortar shall be clean and free of oil, acid, alkali organic matter and deleterious substances, equal to water used for drinking purposes. Ensure aggregate and water used in mortar, will cause no efflorescence.
- .11 Concrete fill for lintels, bond beams vertical cores, and voids shall be high slump, fine aggregate with a minimum compressive strength of 20 MPa in 28 days, in accordance with CSA Standard A179-M and as described in Section 03300.
- .12 Beam and vertical reinforcing bars shall be deformed billet steel supplied with a minimum yield strength of 400 MPa (Grade 400) and as described in Section 03300. Bond beams shall have minimum 8" bearing each end. Bond beams must be shored until concrete is set. If door frame is used as support, centre of door frame must be shored.
- .13 Horizontal reinforcing shall be Dur-o-wal truss Design made with Hot Dipped Galvanized wire conforming to the material requirements of CSA G30.3. Reinforcement to be extra heavy duty (EHD) or heavy duty (HD) as specified in the drawings.

Exterior Walls - Hot Dipped Galvanized

Interior Walls - Mill Galvanized, Class 3

- .14 Anchor masonry to all structural steel elements located in the wall using dovetail anchors and adjustable ties hot dipped galvanized D/T Flex-O-Lok BLT series or approved equal.
- .15 All architectural masonry veneer shall be tied to the reinforced concrete masonry unit back-up wall using hot dipped galvanized shear wall connectors of a type and spacing suitable for the width of cavity in accordance with CSA CAN3-A370-M84. Ties shall allow differential vertical movement in the veneer without any horizontal

movement. Ties shall be made up of a Block Shear Connector Plate, and a V-tie at 400 vertical and 800 horizontal, as manufactured by Fero or Blok-Lok.

Galvanizing shall be in accordance with CSA CAN3-A370 1.31 oz/ft²/side of zinc coating.

- .16 Control joints shall be Dur-o-Wal rapid "T" PVC control joint or approved equivalent.
- .17 Bond Anchor: 4.76mm (3/16") diameter steel galvanized with 50mm (2") end bent 90 degrees.
- .18 Galvanizing: to specified requirements of ASTM Specification A153, Cladd B.3 coatings, for all bolts and hardware: ASTM Specifications A116, Class 3 coating for masonry ties other than above.
- .19 Non-Shrink Grout: Embeco 636 plus as manufactured by the Masters Building Company, of In-Pakt as manufactured by C.C. Chemical Limited.
- .20 In referring to recognized standards, it shall be understood that reference is made to the latest edition at the time of tender.
- .21 Rebar positioners to be DURO-O-WALL DA810 or approved alternate.
- .22 Masonry connectors (ties and anchors) are to conform to CSA A 370-14. *A signed and sealed letter by a registered professional engineer from Ontario shall be provided to confirm this.*
- .23 All ties and joint reinforcement in exterior walls are to be hot-dipped galvanized or stainless steel as required by A370-14.
- .24 Coordinate the following structural materials as called up on the Structural Drawings:

Hollow block:	CSA A165.1-H/15/X/X
Solid block:	CSA A165.1-SF/15/X/X
Concrete brick:	CSA A165.2 - Type I-25
Clay brick:	CAN/CSA A82.1M - Grade SW
Below-grade mortar:	CSA A179M - Type S
Above-grade mortar:	CSA A179M - Type S*
Grout for block cores:	CSA A179M - Coarse grout 1:3:2 cement:sand:peastone by volume with 200 mm slump

*Type N, can be used for masonry veneers and partitions.

.25 **MORTAR COLOURS AT CONCRETE MASONRY UNITS:**

Natural Mortar at CMU:

All natural coloured concrete masonry unit/concrete block walls [CMU] may use natural grey uncoloured mortar throughout.

Coloured Mortar at AMU:

Coloured mortars shall be used at 'pre-finished' ground face masonry units as noted:

- a) AMU: mortar colour is to match specified AMU colour (Super White #201)

Mason is to allow for any mortar pigmentation, cement and sand types (*including silica sand*) and quantities (% loading) of pigment and/or sand as required to ensure match of mortar to colour of masonry items noted. Mortar pigment to be as manufactured by Interstar, Northern Pigment, Harcross Pigment or approved alternate.

2.2 Quality Assurance

- .1 Masonry work to conform to CSA A371-14, masonry design and construction for buildings. Copy of this standard must be available on the site at all times.
- .2 Proposed masonry units shall be tested. Recent test(s) reports by an approved testing company on identical units will be accepted in lieu of additional reports. Provide mortar tests by independent inspection company.
- .3 Test reports on materials of this section shall be approved by Architect and Engineer before proceeding with work.

PART 3 - EXECUTION

3.1 Samples

.1 **Concrete Masonry Unit Sample Panels:**

Masonry Contractor shall supply and prepare masonry/mortar sample panels for the Architect for approval [if requested] prior to the installation of any masonry units on the job site. All samples are to be prepared and presented in the sunniest available area of the job site. A minimum 96 hour drying time is required for all samples. Minimum 4'-0" x 4'-0" panel size per masonry type.

Samples must be approved by the Architect prior to installation on the job site. Accepted/approved panel are to be retained by the contractor on the job site for reference throughout the full duration of construction.

3.2 Laying Masonry

- .1 Erection of masonry units shall conform to the requirements of CSA

S304. All work shall be carried up plumb, level and true to lines and dimensions indicated on the drawings.

- .2 Concrete block to be laid in running bond or as indicated on drawings. Full mortar bedding at all masonry.

The Architect reserves the right to reject any masonry work not in full accordance with the drawings, in terms of masonry colour detailing, unit sizes on locations, and to require full rectification of the work at the Contractor's expense.

- .3 Fully bond intersecting masonry walls (including existing if applicable) or provide galvanized metal masonry ties at every second course between intersecting walls, embedded into the filled cores of the units, unless noted otherwise on the drawings.
- .4 Use knock-out blocks where horizontal reinforcing bars occur in walls.
- .5 Remove laitence, loose rust, scale and other foreign materials from supporting bed surfaces to ensure bonding.
- .6 Joints:
 - (a) Make joints of uniform thickness (generally 10mm (3/8")) with vertical joints plumbed over each other. Do not butt corners of units, allow mortar scrapings in joints excessively, or shift and tap units after mortar has initially set.
 - (b) Form tooled concave joints for regular interior walls wherever exposed to view, whether behind cabinets, fitments, and wall accessories or not.
 - (c) Form tooled convex, raised bead joints for regular exterior walls wherever exposed to view, whether behind drains, mechanical equipment or other accessories.
 - (d) When mortar has become "Thumb-print" hard by a tool having a minimum 500mm (20") long bearing surface to avoid uneven depressions. Clean off burrs with towel or burlap.
 - (e) Rake out joints at juncture of interior and exterior walls with columns, at intersections of walls and partitions where joint reinforcement is installed, and at other caulked joints.
 - (f) Form reglets for metal flashing in masonry.
 - (g) Keep control joints, expansion joints and air spaces free from mortar and droppings (see 3.13 (g) of this section for special protection of weep holes and air cavity).

- (h) Cut joints off flush where treatment is not otherwise specified. No mortar shall protrude from joints on wall surfaces to which insulation will be applied, unless noted otherwise.
- .7 Stop off horizontal runs of walls by racking back a half unit in each horizontal course: do not tooth.
- .8 Do not wet concrete block units. Wet faces of work in place before laying new work. Units shall not have water adhering to their surfaces when laid; but shall be wet only to ensure that complete hydration takes place during hot drying weather, and when unit absorption rates are greater than 0.015 oz/sq. in./min/, so that the initial rate of absorption does not exceed above rate when laid.
- .9 Use chipped and blemished units only where concealed. Do not use defective or broken units. Do not lay concrete units that will appear smooth or slick where exposed to view, whether painted or not. See 2.1. of this section regarding acceptance and rejection of masonry units and unit faces.
- .10 Brace walls and piers continuously during construction until structure provides support.
- .11 Extend all walls to construction above except where otherwise noted on drawings. Leave deflection gap over non-load bearing walls.
- .12 Lintels:
 - a) Build in loose steel lintels, supplied under Section 05220. Set and level lintels on a bed of mortar to ensure uniform bearing.
 - b) Install concrete block lintels where indicated on drawings. Fill with concrete and reinforce as required. Support temporarily until concrete is cured. Extend reinforcement for the full bearing each end. (8" 200mm minimum)
- .13 Built-in Work:
 - (a) Verify that water stops, flashing, flashing accessories, access panels, frame anchors, guards, sills and such items specified in other Sections are available for building in before work commences. Cooperate in the setting and aligning of built-in work of other Sections, to avoid cutting, fitting, and patching.

Consult with the Architect on those areas customarily treated in a special way (ie flashing over doors/windows)

should this not be shown on drawings for clarification by the Architect prior to construction.

- (b) Build masonry around columns, beams, hollow metal frames and lintels where required on the drawings, supplied and set under the work of Section 05200 or 08100. Ensure that anchors are well secured and that frames are true and plumb. Completely fill glazing screed and door frames with mortar. Maintain protective frame covering and ensure that no mortar is left on frame faces.
 - (c) Below all wall-bearing joists, beams and or columns provide minimum 200mm (8") deep solid concrete fill. Fill voids in the masonry units under beams and joists with 20 MPa concrete grout for a minimum depth of 200mm (8") and a length of not less than 200 mm (8") beyond the bearing plate in each direction. Anchor bearing plates into walls using 2-15M weldable rods (or M16 anchor bolts) 400mm (16") long bent 50mm (2") at one end, welded to the bearing plate and embedded in to concrete filled void of the block. Lap anchor bolts particularly at the roof with the vertical wall reinforcement.
Minimum bearing plates shall be 6 x ½"thk x 6" (150mm x 12 x 150) Centre all bearing plates o the masonry below.
 - (d) Extend loose steel lintels a minimum of 150 mm (6") beyond the edge of the opening each end, bearing on solid sound concrete filled block.
- .14 Cope, cut and split concrete masonry units with power-driven abrasive disc. Cut units wherever electrical outlets, grilles, and pipes occur. Allow 1/8" (4mm) minimum clearance around items, which are incorporated in the walls. DO NOT overcut masonry at corners so the strength of the masonry unit is compromised.
 - .15 Lay hollow concrete masonry units so that cells vertically align. Lay all walls as staggered bond unless noted otherwise on the Architect's drawings.
 - .16 Fill cores of masonry units solid with core fill grout at all locations required for fixing of structural steel handrails, metal partitions and accessories required by other trades.
 - .17 Flush smooth with mortar masonry surfaces that flashings rest against to ensure that they are not punctured.

- .18 The first course of concrete block above the floor shall be placed on a full mortar bed.
- .19 Below concrete floor elements provide continuous solid block course filled with 20MPa concrete for a minimum of 200mm (8") deep reinforced with a minimum (1) 15M bar unless directed otherwise on the drawings.
At the top of all roof parapets, provide continuous solid block course filled with 20MPa concrete for a minimum of 200 mm (8") deep and (1) 15M continuous horizontal rebar.

Lap all horizontal WWF or rebar as required and particularly at corners a minimum of 400mm (16")
- .20 Build, do not cut or chases after wall is complete. Do not incorporate chases in walls of 200mm (8") thick or less, nor locate them within 500mm (20") of lateral support provided for wall, do not exceed one-third of wall thickness for chase depth.
Provide lintels over openings or chases that exceed 400mm (16") in width and that are more than one-third of wall thickness in depth. Locate adjoining chases with a minimum clear distance between them of four times wall thickness.
- .21 Where reinforced walls are built to underside of structure that is already in place, open-ended blocks are to be used at tops of walls to fit around vertical reinforcing bars.
- .22 Knock-out blocks are to be used where horizontal reinforcing bars occur in walls.

3.3 MIXING MORTARS

- .1 All mortars shall conform to CSA A179-M and be used within two hours of mixing. Mortar for all load bearing block shall be Type "S". For non-load bearing partitions, mortar may use Type "N". Mortar shall be tested when and as requested by the Consultant in accordance with CAN3.S304M.
- .2 When mixing and laying masonry in ambient temperature below 4°C, use heat and maintain temperature of masonry materials and protect completed work from freezing to satisfaction of the Consultant. Heat and maintain temperature of masonry materials to at least 4°C, but not more than 48°C, and maintain air temperature above 4°C on both sides of masonry for a period of at least 72 hours. Carry out all work in accordance with the CSA-A371-M Section 4.16 and recommendations of the Ontario Masonry Contracting Association.
- .3 Do not use scorched sand. **Do not use chloride salts,**

add mixtures or anti-freezes. No admixtures shall be added to the mortar mix unless approved. Use approved smokeless heaters.

3.4 ANCHORS, REINFORCEMENT AND TIES

- .1 All masonry reinforcement shall be as indicated on structural drawings.
- .2 Refer to structural drawings for vertical movement joint locations in load bearing walls. Provide vertical movement joints between load bearing and non-load bearing walls. Provide a 25mm gap between non-load bearing walls and structural columns / walls along the height of non-load bearing wall filled with compressive material.
- .3 Rebar positioners are to be used to position vertical reinforcing bars in walls.
- .4 Reinforce walls constructed of hollow concrete masonry units, with horizontal masonry reinforcement galvanized truss type Dur-O-Wal or equal, spaced all as specified on the drawings. Lap reinforcement as per suppliers recommendations at all junctions, intersections and ends. Unless otherwise noted on the drawings for 200 (8") and 150 (6") thick nominal block use EHD Durowal at 400 (16") o/c vertically. Walls thicker than 8" should receive Durowal at every course.

Place vertical wall reinforcement supplied under Section 03300 as specified on the drawing's schedule.

Embed vertical reinforcing in core fill concrete (20MPa) placed full height continuously filled block cores. Unless otherwise specified on the drawings, for 200 (8") thick masonry provide 1-15M every 800mm (32") o/c horizontally. Splicing of vertical bars shall be kept to a minimum and where necessary lap 600 (24") Stagger splices between adjacent cores.

- .5 At composite walls, mortar joints are to line up so that wythes can be tied together at 400 mm on centre vertically, that all collar joints be filled solidly with mortar or grout, and that the walls be built from units that have been well cured beforehand.
- .6 Anchor abutting masonry walls to the structural members (columns) *unless* otherwise specified (vertical control joint) providing lateral support, using dovetail anchors or 40 mm (1.5") by 6 mm (1/4") galvanized strap anchors, 500 mm (20") long with 50 mm (2") at one end bent 90° and welded to the structural member. Fit anchors into dovetail anchors (welded to the

structural members) and bed into cores each side of the intersecting masonry walls at every 4th course vertically and 1.8 M (6 ft) centres horizontally. Concrete fill the cores immediately adjacent the structural member (beam or column) and place 2-15M reinforcing bars.

- .7 Place adjustable hot dip galvanised connectors between the back-up block and the brick veneer in accordance with CAN3.A370-M with careful consideration given to matching the size of the connection with the width of the cavity.
- .8 Beneath all load-bearing slabs and at the top course of walls framing into the roof structure, provide continuously filled concrete bed course complete minimum 8"(200mm) thick with 1-15M minimum continuous reinforcement bars placed at the bottom. Ensure the vertical reinforcement extends into this course to lap with anchor/tie rods. Use blocks with knock outs in the web rather than the U-shape bond beam.
- .9 Below all beams and columns bearing fill cores solid with grout fill and embed anchors into the grout a minimum of 12" (300mm)

3.5 Masonry Anchorage and Support

- .1 Anchor masonry construction to ensure its stability and to withstand loads imposed by intended use and by natural elements.
- .2 Anchor masonry construction to structural steel columns with flexible anchor every 400mm (16") in height. Weld flexible tab section of anchor to structural steel.
- .3 Wall Anchorage:
 - a) For Non-Load-Bearing Partitions:

Anchor partitions that abut or intersect other walls or partitions by corrugated metal veneer anchors spaced at not more than every second course apart vertically or by joint reinforcement.
 - b) For Load Bearing Exterior and Interior Walls:

Anchor walls that face or abut other load bearing walls are solid masonry piers by toothing, or blocking, with 100mm (4") minimum and 200mm (8") maximum offsets into which strap anchors are set at a maximum spacing of 800mm (32") vertically. Use lateral support anchors but with 75mm (3") hooks. Extend anchors a minimum of 450mm (18") into masonry at both sides of intersection. Where this is not possible, install cross pins in lieu of hooks to provide true

bonding of at least 50% of the units of one wall imbedded in the other. Provide for caulked joints at intersecting walls as part of the work of Section 07900.

- .4 Lateral Support: shall be provided for masonry walls and partitions as indicated on Drawings, specified, and where required by jurisdictional authorities perpendicular to wall face and either horizontally or vertically to wall panel edges. Provide lateral support for interior walls and partitions.
 - a) Horizontally: by wedging masonry against structure, by clips or dowel plates specified Section 05210 at a maximum spacing of 2000mm (6'-8") o.c. where concealed in the final work or by continuous cover angles where exposed (refer details shown on the drawings).
 - b) Vertically: at junction with poured-in-place concrete by corrugated metal veneer anchors spaced at not more than every third course apart, one for every 100mm (4") or part thereof of masonry wall thickness, securely fastened to concrete by an approved method.
- .5 Deflection Gap:
 - a) Provide a deflection gap between tops of nonload-bearing walls and partitions and precast concrete floor/roof slabs and other structure steel or otherwise, to prevent transference of structural loads to masonry.
 - b) Fill deflection space with Type AF100 glass fibre board compressed to 50% of original thickness to completely fill space.
 - c) Deflection space shall be 25mm (1") unless otherwise designated on drawings.
 - d) Coordinate work with installation of lateral support specified in Section 05210.

3.6 Bonding

- .1 Lay concrete blocks in a running (staggered) bond unless noted otherwise.
- .2 Bond walls with metal bond anchors where they are of different unit types or dissimilar masonry headers would be exposed to view, or where otherwise indicated on drawings.
- .3 Bond walls in each course at corners. Do not use masonry bonding units at intersections of load bearing walls.

3.7 Inserts and Openings

- .1 Install all inserts and openings required in the work of this Section for

the work of other Sections.

- .2 Set and build in steel loose lintels, anchors, sleeves, conduit, piping, outlet boxes, recessed fittings and fixtures, and other items, indicated, specified or required to be built into masonry work, as provided by other trades and Contractors. When installing built in or inserted items care should be taken to ensure the reinforcement is NOT cut or damaged or the continuity compromised.
- .3 Co-operate with other Sections and Contractors to determine the location and size of openings to be left in the masonry for heating, ventilating, plumbing and electrical pipes, ducts, boxes and other items. NOT ALL OPENINGS are shown on the Architectural or Structural drawings, refer Mechanical and Electrical drawings. Any openings in block masonry greater than 16"(400mm) shall receive a lintel
- .4 Conduits and plumbing should be placed in the hollow core of the block. Unless otherwise approved by the Engineer chasing of the surface of the block to inset conduit or plumbing pipes **shall not be allowed**. Where metal outlet boxes or other similar items occur in concrete, block walls, form such openings to provide square and clean edges. Cut with a saw as required taking special care to not overcut the corners.
- .5 Provide extra trimmer reinforcement around all openings in walls to extend at minimum of 600 mm (24") beyond the opening; 1-15M vertical in the last core each side of openings and at the end of walls; horizontal reinforcement in each course for 3 courses above and below (if required).
- .6 Where **masonry block lintels** are specified, install (2) 15M continuous minimum horizontal rebars in the bottom of special bond blocks to extend a minimum of 600 past the edge of the opening. Fill bond block, full height with core fill concrete (20MPa) to the depth specified. Vertical bars in the masonry at the edges of the openings should extend continuously through the lintel block to integrate the lintel with the bearing.

3.8 Control Joints

- .1 Build vertical control joints into concrete block walls.
- .2 Provide control joints at all locations as designated on drawings, but not greater than 7500mm (25 ft) on centre. Carry joints full height of walls.
- .3 Joints shall be 12mm (1/2") wide, uniform, clean and free of mortar ready for sealing as part of the work of Section 07900. Install vertical joint filler.

- | | | |
|--------------------------------|----|--|
| 3.9 Patching | .1 | Patch masonry walls damaged by installation of work specified under other sections, and which have been rejected as defective or otherwise damaged. |
| 3.10 Cleaning/Pointing | .1 | Point all holes in mortar joints and in concrete masonry unit faces. |
| | .2 | Cut out defective mortar joints and repoint. |
| | .3 | Clean masonry with stiff bristle brushes (not wire) and as otherwise recommended by the supplier to remove mortar and stain. |
| | .4 | Should specified cleaning methods be insufficient, proceed with other methods only with the approval of Architect. |
| | .5 | Protect materials and work from damage while cleaning. |
| 3.11 Sealing | .1 | Joints to receive sealant shall not be less than 1/4" nor more than 3/8" wide and shall be cleaned out to a uniform depth of at least 3/4". |
| | .2 | Sealing shall be installed according to manufacturer's recommendations around doorframes, windows, masonry control joints and elsewhere as noted on the drawings or in the specifications. |
| 3.12 Special Protection | .1 | Protect exposed external corners of masonry with materials which will not damage or soil finished surfaces. |
| | .2 | Protect all finished surfaces from mortar droppings. |
| | .3 | <u>Cold Weather Works</u> : when surrounding air temperatures reaches, or is likely to reach 0°C (32°F) or below, work shall proceed as follows, subject to Architect's approval. <ul style="list-style-type: none"> a) Perform work in an enclosure heated to a minimum of 10°C (50°F) by smokeless heating devices vented directly to the exterior. b) Protect newly laid work, when temperature is below 4°C (40°F) by methods approved by the Architect, and which will maintain the work at a minimum temperature of 10°C (50°F) for at least 72 hours. When high-early strength Portland cement is used, maintain heat for at least 24 hours. c) Do not use materials which are frozen or contain ice. Do not place materials against work which is frozen or has frost film. d) Preheat mortar and mortar boards before use. Heat all |

masonry materials, including masonry units, before use to remove frost. When temperature is between 0°C to 4°C ((32°F to 40°F) heat sand or water to 21°C (70°F) minimum, and temperature is below 0°C (32°F) heat both sand and water to 21°C (70°F), minimum. Do not heat water and sand above 71°C (160°F).

- e) Remove frozen masonry work and make good.
- f) Provide a high-low registering thermometer on the project, where directed by Architect.
- g) Special protection and care to be taken so that wall cavity remains free and clear of mortar, throughout the entire length and width of the cavity, particularly at the bottom to avoid plugging the weep holes. The Architect and/or his representative will request that masonry be torn down if weep holes are deemed to be plugged or excess mortar plugs the cavity or cavity bottom. The contractor will be required to remove areas of masonry at the Architect's request to check for this possible or suspected deficiency.

3.13 Tolerances

- .1 Lay masonry to the following tolerances:
 - a) Planes true to within 3mm (1/8") under 3000mm (10'-0") straight edge, and to within 3mm (1/8") under 1800mm (6'-0") straight edge where thin-set tile is applied.
 - b) Plumb within 6mm (1/4") in any 6000mm (20'-0") expansion joints or other conspicuous lines; and otherwise within 12mm (1/2") in full height of building.
 - c) Level within 6mm (1/4") in any 6000mm (20'-0") expansion joints or other conspicuous lines; and otherwise within 12mm (1/2") in full height of building.
 - d) Located from position shown, and from related position of columns, walls and partitions within 12mm (1/2") 6000mm (20'-0") distance.
 - e) Opening sizes within 6mm (1/2") of Designated dimension.

3.14 Control & Testing

- .1 Field control testing is required for all loadbearing masonry and for all reinforced masonry. At least 6 mortar cubes are to be tested for each 500 m2 of wall, or portion thereof. At least 2 cylinder tests shall be made for each 20 cubic metres of grout or less. Test methods and results shall conform to CSA A179-04.
- .2 The inspection and testing company shall use a covermeter to determine approximate cover and splice length of rebar in some newly built walls near mid-height. Locations to be selected by the

Structural Engineer. Scaffold access to be provided for inspection and testing company by Contractor. Allow for 3 locations, each 3 metres long. Access to be provided at additional locations by Contractor at no extra cost if reinforcement fails test at one or more locations. Three inspection openings shall be made in walls at their mid-height in order to verify location of reinforcement if necessary. Wall to be at least 7 days old when opening is made. Locations to be selected by Consultant based on covermeter results. Scaffold access to openings to be provided for Consultant. Openings to be made good after inspection by Consultant is done. Additional access and inspection openings to be provided by Contractor at other locations at no extra cost if reinforcement fails test at one or more openings.

End of Section 04220

PART 1 - GENERAL

1.1 General

- .1 Division One, General requirements, is part of this Section and shall apply as if repeated here.

1.2 Description of Work

The work shall consist of the following but not limited to:

- .1 The work to be done under this section shall consist of the supply and installation of all material, labour, supervision, plant and equipment required to complete all masonry work shown on the Architectural drawings and specified herein including (without strict limitation to): brick veneer (with all related accents), man-made stone veneer, masonry wall caps, masonry sills, precast concrete items etc. (as applicable).
- .2 Supply and erection of all masonry veneer as shown on drawings.
- .3 Supply and erection of man-made stone veneer items shown on drawings.
- .4 Supply and erection of masonry accessory item as shown on drawings including standard shapes, specialty shapes, pilasters, medallions etc.
- .5 Supply and installation of steel reinforcing bars as supplied by Section 03300.
- .6 Supply and installation of horizontal masonry wall ties.
- .7 Supply and installation of all masonry flashing, and connections to columns, beams, lintels, floor slabs, window, door and louvre frames and all other items required or as shown on the drawings.
- .8 Supply and installation of transition membrane Blueskin SA and connections to all related Architectural features throughout. Membrane primer as per manufacturer.
- .9 Installation of pre-finished through-wall metal flashing as supplied under Metal Flashing and Sheet Metal Section 07620. Coordination shall take place between these two trades.
- .10 Supply and installation of through-wall flashing, Blue-skin T.W.F. Primer as per manufacturer.
- .11 Supply and install of mortar dropping control device and similar items shown on Architectural drawings.
- .12 Supply and installation of masonry weepers/vents as noted herein and as shown on Architectural drawings.
- .13 Supply and installation of metal flashing fire-stopping in localized areas of cavity wall where cavity exceeds 1" width (as required by O.B.C. 3.1.11.2) and/or as noted on Architectural drawings.

- .14 Examination of areas which are to receive the work of this section. Do not proceed until all unsatisfactory conditions are corrected.
- .15 Full coordination of all masonry work with related trades during construction.

1.3 Related Work

- .1 Cast-in-Place Concrete Section 03300
- .2 Concrete Block Masonry Section 04220
- .3 Structural Steel Section 05120
- .4 Steel Decking Section 05310
- .5 Miscellaneous Steel Fabrication Section 05510
- .6 Built-up Roofing System Section 07510
- .7 Steel Doors and Frame Section 08700
- .8 Aluminum Windows, Frames and Sills Section 08150
- .9 Painting & Decorating Section 09900
- .10 Spray Foam Insulation/Air Barrier Section 07216

1.4 References

- .1 American Society for Testing and Materials (ASTM) :**
 - .1 ASTM C 207-91(1997), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .2 ASTM C1329-03a Standard Specification for Mortar Cement
- .2 Canadian Standards Association (CSA) :**
 - .1 CAN/CSA-A82.1-M87 Burned Clay Brick (Solid Masonry Units Made From Clay or Shale)
 - .2 CSA A179-94: Mortar and Grout for Unit Masonry.
 - .3 CSA A370-94: Connectors for Masonry.
 - .4 CSA A371-94: Masonry Construction for Buildings.
 - .5 CSA-A3000-98 Cement Materials (Portland Cement and Masonry Cement).

1.5 Submittals

- .1 Product Data: Submit printed product literature, specifications, test reports in accordance with Section 01330 - Submittal Procedures.
- .2 Samples:
 - .1 Submit samples in accordance with section 01340 – Submittal Procedures.
 - .2 Submit not less than three representative samples for each type of brick and masonry veneer material specified or a suitable sample board to illustrate colour and texture.
 - .3 Tests: Submit test report of unit masonry to requirements of Section 01330 - Submittal Procedures.
 - .4 Test samples in accordance with CSA A82.1

1.6 Dimensions

- .1 Check all dimensions shown on the drawings by site measurement before commencing 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.

1.7 Delivery, Storage and Handling

- .1 All materials shall be so delivered, stored and as to prevent damage and inclusion of foreign materials.
- .2 Packaged materials shall be delivered and stored in original packages until ready for use. All materials must be kept off the ground and stored in dry areas.
- .3 Masonry units shall be stored on skids and covered with clean waterproof tarpaulins when work is not in progress. Keep water out of all holes and reglets in units during freezing weather.
- .4 Store adhesives and primers at temperature of 5°C and above to facilitate handling. Keep solvent away from open flame or excessive heat.

1.8 Protection

- .1 Protect the work of this Section from damage resulting from the work of other Sections. Repair or replace, at no cost to the Owner, all work damaged due to the work of this Section.
- .2 Completely cover open tops of walls each night, and when not under actual construction, with watertight coverings. Cover freshly built walls with tarpaulins during rain. Make good any damage to this work from any cause whatsoever until completion of this work. Protect mortar from freezing during the first 36 hours after placement.

1.9 Workmanship

- .1 The work of this Section shall be done by skilled tradesmen and in accordance with CSA Standard, CAN3-S304-M (latest issue.)
- .2 The Contractor shall be responsible for maintaining all dimensions, lines and levels true and plumb within the tolerances required by this part. Construct masonry walls as true planes with variation from the mean plane of 3mm(1/8") in 3.0m (10 feet) in any direction.
- .3 Contractor shall provide, install and maintain adequate outside and inside scaffolding of approved type for the proper installation of the work. All face brickwork shall be laid from scaffolds erected on the same side as the face work.

PART 2 - PRODUCTS

2.1 Materials

- .1 **BRICK VENEER (BV-xx):**
Product: Raven
Manufacturer: Brampton Brick
Finish: Velour
Manuf. Standard: Type FBX
Size: Metric Jumbo [MJU]
90 mm high x 90 mm deep x 290 mm long
[3 5/8" x 3 5/8" x 11 1/2"]
Type: Clay Brick
Standards: ASTM C43, ASTM C67, ASTM C216, CSA A371, CSA A82 [exterior grade, severe weather]
Installation Bond: BV-RB: brick veneer in running bond
BV-SB: brick veneer stack bond
(installation bonds in locations shown on architectural drawings)
- .2 **MASONRY SILL (MS):**
Product: Renaissance Custom Profiles
Manufacturer: Arriscraft
Shape: Sloped Sill/Watertable
Type: Calcium Silicate Masonry Unit
Overall Size: 90 mm high x 140 mm deep x 590mm long
[3 5/8"high x 5 33/64"deep x 23 1/4"long]
Chamfer Size: A [horiz. dimension] = 51 mm [2"]
B [vert. dimension] = 51 mm [2"]
Standards: ASTM C73 Grade SW, CSA A371
Colour: Driftwood
Finish: Smooth
- .4 Provide special masonry veneer shapes, such as plain bed, halves, jamb, ledger, bullnose, end, bond, sash groove, and lintel units, as

required to complete the work illustrated on the drawings.

.5 **MORTAR FORMULATIONS:**

Mortar formulations for all brick and man-made stone items are to be as recommended by the material manufacturer for the intended application. No mortar formulations specified herein are intended to supersede the manufacturer's recommendations, and are indicative of general intent only.

.6 Portland cement used in mortar shall conform to ASTM C150.

.7 Lime used in mortar shall be hydrated and free from calcium sulphate in accordance with ASTM C-207.

.8 Sand for mortar shall consist of fine granular material composed of hard, strong, durable mineral particles which shall be free of injurious amounts of saline, alkaline, organic or other deleterious substances, and shall comply with CSA A179 AND ASTM C-144. Allow for any specialty sand types (including silica sand) as may be required to provide mortar colour matches identified elsewhere herein.

.9 Water used in mortar shall be clean and free of oil, acid, alkali organic matter and deleterious substances, equal to water used for drinking purposes. Ensure aggregate and water used in mortar, will cause no efflorescence.

.10 Control joints shall be Dur-o-Wal rapid "T" PVC control joint or approved equivalent.

.11 Non-Shrink Grout: Embeco 636 plus as manufactured by the Masters Building Company, or In-Pakt as manufactured by C.C. Chemical Limited.

.12 **MASONRY MORTAR COLOURS:**

Mortar at Brick Veneer (BV-#):

Mortar at all new exterior brick veneer 1 and brick veneer 2 is intended to match specified brick colours throughout. Mason is to allow for any mortar pigmentation, cement and sand types required to ensure match of mortar to the related masonry items. Mortar pigment to be as manufactured by Interstar, Northern Pigment, Harcross Pigment or approved alternate. Joint profile is to be standard raked joint.

Mortar at Masonry Sill (MS):

Mortar at head joints of masonry sill is to be pigmented to match the sill throughout. Mason is to allow for any mortar pigmentation, cement and sand types required to ensure match of mortar to the related masonry items. Mortar pigment to be as manufactured by Interstar, Northern Pigment, Harcross Pigment or approved alternate. Joint profile is to be standard raked joint.

- .13 **Masonry Flashing** shall be Blueskin T.W.F. as manufactured by Bakor Products of Mississauga or approved equivalent.
- .14 **Transition Membrane** shall be Blueskin S.A. as manufactured by Bakor Products of Mississauga or approved equivalent. Transition membrane shall be compatible with Spray in Place Foam Insulation/Air Barrier, Section 07216.
- .15 Primer for self-adhering membranes shall be as recommended by the membrane manufacturer.
- .16 In referring to recognized standards, it shall be understood that reference is made to the latest edition at the time of tender.

.17 **Mortar Dropping Control Device :**

At the bottom of all cavities in cavity wall assemblies, supply and install Mortar Net DA1008 control device system, by DUR-O-WALL (or approved alternate).

Function : Designed to control mortar droppings to insure clear air spaces in cavity walls.

Dimensions : 10" (250mm) wide x 5' (1.5M) lengths to accommodate a 1" (25mm) air cavities.

Notes : 1" width fabricated from either high density polyethylene or 100% polyester.

.18 **Cavity Clearance Masonry Mat :**

In locations noted on Architectural drawings and/or as specified herein, supply and install masonry cavity clearance matt to ensure continuity of rainscreen cavity drainage in and around obstructions (eg. structural steel components) within wall assemblies surrounded by masonry veneer.

Product: Caviclear Masonry Mat by Archovations

Function: prevents mortar bridges in rainscreen cavity/airspace; eliminates weep obstructions in cavities and provides continuous drainage path

Thickness: determine thickness to suit project requirements

Notes: supplied in sheets and rolls, in varying thicknesses to suit project requirements; fabricated from 100% polymer mesh

.19 **Masonry Weepers/Vents :**

Acceptable weepers/vents at bottom course of masonry above grade include DUR-O-WALL "Cell Vent" weepers installed vertically in masonry head joints at 24" on center.

Acceptable weepers above windows and doors include DUR-O-WALL "Cell Vent" weepers installed vertically in masonry head joints at 24" on center.

.20 Masonry Ties:

Masonry veneer exterior cladding materials are to be structurally tied to the back-up structural walls throughout, generally comprised of concrete block units [CMU] or poured concrete [at base of cross tower]. All ties to be as recommended by the brick manufacturer for the intended application and related wall heights. Use adjustable ties as/if required. Refer to structural for related masonry tie specifications.

2.2 Quality Assurance

- .1** Masonry veneer work to conform to **CSA A371, *Masonry Construction for Buildings***. Copy of this standard must be available on the site at all times.
- .2** Proposed masonry units shall be tested. Recent test(s) reports by an approved testing company on identical units will be accepted in lieu of additional reports. Provide mortar tests by independent inspection company.
- .3** Test reports on materials of this section shall be approved by Architect and Engineer before proceeding with work.

PART 3 - EXECUTION**3.1 Samples****.1 Masonry Veneer Sample Panels:**

Masonry Contractor shall supply and prepare masonry/mortar sample panels for the Architect for approval prior to the installation of any masonry units on the job site. All samples are to be prepared and presented in the sunniest available area of the job site. A minimum 96 hour drying time is required for all samples. Minimum sample requirements are as follows:

- up to 3 sample panels for brick veneer, each with variations in mortar colour and/or joint type as directed by Architect
- minimum 4'-0" x 4'-0" panel size per masonry type

Samples must be approved by the Architect prior to installation on the job site. Accepted/approved panel are to be retained by the contractor on the job site for reference throughout the full duration of construction.

3.2 Laying Masonry

- .1** Erection of masonry units shall conform to the requirements of CSA S304. All work shall be carried up plumb, level and true to lines and dimensions indicated on the drawings. Supply and maintain all items required for the performance and erection of the work (including scaffolding, cranes, lift machinery etc.) to suit.

.2 **Installation Bonds:**

Brick Veneer (BV) to be laid in one half running bond throughout unless noted otherwise on architectural drawings. Full mortar bedding. Decorative brick treatments (soldier courses, stack bonds, headers, etc.) are to be as per Architectural drawings in the brick sizes, colours, and locations as shown on drawings. Should any treatments be unclear, masonry contractor is responsible to consult Architect prior to product ordering and/or installation.

The Architect reserves the right to reject any masonry work not in full accordance with the drawings and/or specifications in terms of colour blending in the wall, mortar colours, mortar joint types etc. and will require full rectification of the work at the Contractor's expense.

- .3 Fully bond intersecting masonry walls and provide galvanized metal masonry ties at every second course between intersecting walls, embedded into the filled cores of the units, unless noted otherwise on the drawings.

- .4 Remove laitence, loose rust, scale and other foreign materials from supporting bed surfaces to ensure bonding.

.5 **MASONRY JOINTS:**

Brick Veneer (BV), Masonry Sills (MS) and Masonry Wall Cap (MWC) Joints:

Concave (lightly tooled) joint, 3/8" [10mm] high throughout; vary joint marginally as may be required by masonry dimensions and to maintain coursing with concrete block behind. Form joints as noted below:

- (a) Make setting joints of uniform thickness vertically and horizontally with vertical joints plumbed over each other. Do not excessively admit mortar scrapings into joints or shift and tap units after mortar has initially set.
- (b) Form tooled concave joints (unless noted otherwise) wherever exposed to view, whether behind cabinets,
- (c) When mortar has become "Thumb-print" hard by a tool having a minimum 500mm (20") long bearing surface to avoid uneven depressions. Clean off burrs with towel or burlap.
- (d) Rake out joints at juncture of interior and exterior walls with columns, at intersections of walls and partitions where joint reinforcement is installed, and at other caulked joints.
- (e) Form reglets for metal flashing in masonry.

- (f) Keep control joints, expansion joints and air spaces free from mortar and droppings; see requirements for mortar dropping control device and weep holes elsewhere herein.
 - (g) Rake joints concave where alternate treatment is not otherwise specified. On concave raked joints, mortar shall protrude from joints on wall surfaces to which insulation will be applied, unless noted otherwise.
 - (h) Provide decorative masonry joints and masonry control joints (MCL) at all locations as shown on Architectural drawings. Ensure that masonry control joints are finished with caulking to match specified mortar colours in surrounding masonry throughout.
- .6 Stop off horizontal runs of walls by racking back a half unit in each horizontal course: do not tooth.
- .7 Wet clay and shale masonry units before placing. Do not wet concrete or calcium silicate units. Wet faces of work in place before laying new work. Units shall not have water adhering to their surfaces when laid; but shall be wet only to ensure that complete hydration takes place during hot drying weather, and when unit absorption rates are greater than 0.015 oz/sq. in./min/, so that the initial rate of absorption does not exceed above rate when laid.
- .8 Distribute exterior masonry units of varying colours, sizes, and textures to match adjacent existing stonework. Do not use units which contrast too greatly with overall range. As noted elsewhere herein, sample panels are to be prepared displaying this requirement.
- .9 Use chipped and blemished units only where concealed. Do not use defective or broken units. Do not lay concrete units that will appear smooth or slick where exposed to view, whether painted or not. See 2.1. of this section regarding acceptance and rejection of masonry units and unit faces.
- .10 Built-in Work:
- (a) Verify that water stops, flashing, flashing accessories, access panels, frame anchors, guards, sills and such items specified in other Sections are available for building in before work commences. Cooperate in the setting and aligning of built-in work of other Sections, to avoid cutting, fitting, and patching. Consult with the Architect on those areas customarily treated in a special way (i.e. flashing over doors/windows) should this not be shown on drawings for clarification by the Architect prior to construction.

- (b) Build masonry around hollow metal frames and lintels supplied and set under the work of Section 08100. Ensure that anchors are well secured and that frames are true and plumb. Completely fill frames with mortar. Maintain protective frame covering and ensure that not mortar is left on frame faces.
- .11 Lay hollow concrete masonry units so that cells vertically align. If they do not in bond courses, use solid bonding units.
- .12 Install solid masonry units at all locations required for fixing of handrails, metal partitions and accessories of all description.
- .13 Flush smooth with mortar masonry surfaces that flashings rest against to ensure that they are not punctured.
- .14 Install masonry veneer weep holes at 600mm (24") o.c. or as shown on drawings in vertical joints of masonry courses above damp-proofing and flashing, and above windows.
- .15 Keep cavity spaces free and clear of mortar in cavity walls. Ensure installation of mortar dropping control devices throughout. This item will require constant monitoring by this Contractor and will be regularly inspected by the Architect.

3.3 Mixing Mortar

- .1 All mortars shall conform to CSA A179-M and be used within two hours of mixing. Mortar for all load bearing brick and block shall be Type "S". For non-load bearing partitions, mortar maybe Type "N". Mortar shall be tested when and as requested by the Consultant in accordance with CAN3.S304M.
- .2 When mixing and laying masonry in ambient temperature below 4°C, use heat and maintain temperature of masonry materials and protect completed work from freezing to satisfaction of the Consultant. Heat and maintain temperature of masonry materials to at least 4°C, but not more than 48°C, and maintain air temperature above 4°C on both sides of masonry for a period of at least 72 hours. Carry out all work in accordance with the CSA-A371-M Section 4.16 and recommendations of the Ontario Masonry Contracting Association.
- .3 Do not use scorched sand. Do not use chloride salts. No admixtures shall be added to the mortar mix unless approved. Use approved smokeless heaters for installation in weather temperatures below 5 degrees celcius

[maintained for 72 hours] or as recommended by mortar manufacturer for the intended application.

- .4
 - a) Once the mortar colour is established, use the same materials, proportions and mixing techniques for the whole of the project.
 - b) Under no circumstances shall the pigment exceed 10% of the cementitious material by weight.
 - c) Add the mortar colouring to the dry mix prior to adding water. Mix the mortar in accordance with manufacturers' recommendations until a uniform colour throughout has been achieved.
 - d) Once the mortar colour is established, use the same materials, proportions and mixing techniques for the whole of the project.

3.4 Anchors, Reinforcement and Ties

- .1 Refer to 04220 Structural Concrete Block Masonry and requirements listed elsewhere herein.

3.5 Masonry Flashing

- .1 Install masonry flashing continuously under full length of exterior veneer, wythe, over steel lintels over opening supporting veneer and under sills and elsewhere as indicated on drawings. Lap joints 150mm (6"). Use adhesive as per manufacturer's instructions and recommendation.
- .2 Flush up surfaces to receive masonry flashing with mortar and install flashing. Ensure that no coarse aggregate or other protrusions will pierce flashing, and protect it until work resumes. Use adhesive as per manufacturer's recommendations and instructions.
- .3 Through wall flashing shall be dressed through veneer wythe of wall assembly across air space and turn-up at least 150mm (6"). Lap joints 150mm (6") use adhesive as per manufacturer's instructions and recommendations. See drawings for installation or consult Architect if unclear.
- .4 Where flashing is exposed to view or must bridge air-space without support, use sheet metal flashings provided and installed as part of the work of Section 07620. See drawings for areas of pre-finished through-wall metal flashing and cooperate fully with Section 07620, lap joints 150mm (6").
- .5 When mortar bed for flashing has set, resume a laying of masonry.

3.6 Inserts and Openings

- .1 Install all inserts and openings required in the work of this Section for the work of other Sections.
- .2 Set and build in steel loose lintels, anchors, sleeves, conduit, piping, outlet boxes, recessed fittings and fixtures, and other items, indicated, specified or required to be built into masonry work, as provided by other trades and Contractors.
- .3 Co-operate with other Sections and Contractors to determine the location and size of openings to be left in the masonry for heating, ventilating, plumbing and electrical pipes, ducts, boxes and other items, not necessarily shown on the Architectural or Structural drawings, refer Mechanical and Electrical drawings.
- .4 Conduits and plumbing should be placed in the hollow core of the block. Unless otherwise approved by the Engineer chasing of the surface of the block to inset conduit or plumbing pipes shall not be allowed. Where metal outlet boxes or other similar items occur in concrete, block walls, form such openings to provide square and clean edges. Cut with a saw as required taking special care to not overcut.
- .5 Provide extra trimmer reinforcement around all openings in walls to extend at minimum of 600 mm (24") beyond the opening; 1-15M vertical in the last core each side of openings and at the end of walls; horizontal reinforcement in each course for 3 courses above and below (if required).
- .6 Where masonry lintels are specified, install (2) 15M continuous horizontal rebars in the bottom of special bond blocks to extend a minimum of 600 past the edge of the opening. Fill bond block, full height with core fill concrete (20MPa) to the depth specified.

3.7 Masonry Control Joints

- .1 Build vertical control joints into concrete block walls.
- .2 Provide control joints at all locations as designated on drawings, but not greater than 7500mm (25 ft) on centre. Carry joints full height of walls.
- .3 Joints shall be 12mm (1/2") wide, uniform, clean and free of mortar ready for sealing as part of the work of Section 07900. Install vertical joint filler.

3.8 Cleaning/Pointing

- .1 Point all holes in mortar joints and in concrete masonry unit faces.
- .2 Cut out defective mortar joints and repoint.
- .3 Clean masonry with stiff bristle brushes (not wire) and as otherwise recommended by the supplier to remove mortar and stain.

- .4 Should specified cleaning methods be insufficient, proceed with other methods only with the approval of Architect.
 - .5 Protect materials and work from damage while cleaning.
- 3.9 Sealing**
- .1 Joints to receive sealant shall not be less than 1/4" nor more than 3/8" wide and shall be cleaned out to a uniform depth of at least 3/4".
 - .2 Sealing shall be installed according to manufacturer's recommendations around doorframes, windows, masonry control joints and elsewhere as noted on the drawings or in the specifications.
- 3.10 Special Protection**
- .1 Protect exposed external corners of masonry with materials which will not damage or soil finished surfaces.
 - .2 Protect all finished surfaces from mortar droppings.
 - .3 Cold Weather Works: when surrounding air temperatures reaches, or is likely to reach 0°C (32°F) or below, work shall proceed as follows, subject to Architect's approval.
 - a) Perform work in an enclosure heated to a minimum of 10°C (50°F) by smokeless heating devices vented directly to the exterior.
 - b) Protect newly laid work, when temperature is below 4°C (40°F) by methods approved by the Architect, and which will maintain the work at a minimum temperature of 10°C (50°F) for at least 72 hours. When high-early strength Portland cement is used, maintain heat for at least 24 hours.
 - c) Do not use materials which are frozen or contain ice. Do not place materials against work which is frozen or has frost film.
 - d) Preheat mortar and mortar boards before use. Heat all masonry materials, including masonry units, before use to remove frost. When temperature is between 0°C to 4°C ((32°F to 40°F) heat sand or water to 21°C (70°F) minimum, and temperature is below 0°C (32°F) heat both sand and water to 21°C (70°F), minimum. Do not heat water and sand above 71°C (160°F).
 - e) Remove frozen masonry work and make good.
 - f) Provide a high-low registering thermometer on the project, where directed by Architect.

- g) Special protection and care to be taken so that wall cavity remains free and clear of mortar, throughout the entire length and width of the cavity, particularly at the bottom to avoid plugging the weep holes. The Architect and/or his representative will request that masonry be torn down if weep holes are deemed to be plugged or excess mortar plugs the cavity or cavity bottom. The contractor will be required to remove areas of masonry at the Architect's request to check for this possible or suspected deficiency.

3.11 Tolerances

- .1 Lay masonry to the following tolerances:
 - a) Planes true to within 3mm (1/8") under 3000mm (10'-0") straight edge, and to within 3mm (1/8") under 1800mm (6'-0") straight edge where thin-set tile is applied.
 - b) Plumb within 6mm (1/4") in any 6000mm (20'-0") expansion joints or other conspicuous lines; and otherwise within 12mm (1/2") in full height of building.
 - c) Level within 6mm (1/4") in any 6000mm (20'-0") expansion joints or other conspicuous lines; and otherwise within 12mm (1/2") in full height of building.
 - d) Located from position shown, and from related position of columns, walls and partitions within 12mm (1/2") 6000mm (20'-0") distance.
 - e) Opening sizes within 6mm (1/2") of designated dimension.

END OF SECTION 04230

PART 1 - GENERAL

1.1 Description of Work

- .1 The work to be done under this section shall consist of the supply of all materials labour, supervision, plant and equipment to construct all miscellaneous metal items [structural and decorative] as shown on the drawings and/or as specified herein (metal support brackets, metal support legs, metal lintels etc.). Work shall also include decorative exterior steel items such as exterior cross/cross tower and miscellaneous items indicated on the drawings.
- .2 Carefully examine all drawings and the site to determine the extent of the work. Ensure that all Drawings and Specification Sections, including those for structural, mechanical and electrical work, are consulted to establish the extent of work required for this Section.

1.2 Shop Drawings

- .1 Submit 5 (five) copies of Shop Drawings to the Architect for examination, giving complete information necessary for the fabrication of the various members and components of the stairs, including structural steel material specifications and the location, type and size of all bolts and welds. Distinguish clearly between shop and field bolts and welds.
- .2 All modifications and substitutions proposed by the Contractor must be submitted for approval to the Engineer for the structural adequacy. All modifications and substitutions must be shown on shop drawings for final approval.
- .3 Do not commence fabrication until final approval of the drawings is received.

1.3 Shop Painting

- .1 The steel shall be cleaned by shot blasting, scraping and abrading or wire brushing to remove all loose mill scale, rust, oil dirt and other foreign matter. Surfaces shall be completely dry before painting.
- .2 One coat of paint shall be applied in the shop unless noted on the drawings, conforming to CGS-G2-40D.
- .3 Surfaces which will be inaccessible after assembling shall be given two coats prior to assembly. Touch up all bolts, welds and surfaces of connecting members damaged during construction.
- .4 Areas to be embedded or encased in concrete, edges and surfaces adjacent to field welds and bolted connections, shall be left unpainted.

1.4 Storage and Handling

- .1 All materials shall be handled and stored at the site in a manner to avoid damage of any kind.
- .2 Materials damaged due to faulty storage or handling shall be repaired or replaced, without additional expense to the Owner, all to the satisfaction of the Architect.

PART 2 - PRODUCTS

- 2.1 Material
- .1 Lintels:
 - a) Steel of sizes shown on Lintel Schedules and Structural Drawings.
 - b) Provide concealed angle clips welded to lintels and anchored with bolts at lintel supports.
 - c) Finish: Prime and paint.
 - .2 Miscellaneous Steel Channels, Clip Angles, Bar Stock, Plate Stock and Shapes: as required and/or as indicated to complete all work as part of this project.
 - .3 Steel for lintel and structural steel plates shall be in accordance with C.S.A. specification G.40.21-44W.

PART 3 - EXECUTION

- 3.1 Fabrication
- .1 Use welded joints throughout wherever practical. All welding shall conform to the requirements of the current edition of C.S.A. Standard W59 and the fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with the requirements of C.S.A. Standard W47. Wherever possible (without affecting integrity of the weld), grind welds smooth and flush on all miscellaneous metal items exposed to view during daily operations of the facility.
 - .2 The jointing in built-up sections shall be made with hairline joints in the least conspicuous location and manner. All work shall be assembled in the most substantial manner and reinforced where necessary with fastenings. All screws shall be countersunk unless otherwise noted. Exposed surfaces of wrought iron and rolled steel shapes shall be around or filed perfectly smooth.
 - .3 Apply a coat of primer to all interior ferrous metals before leaving the shop unless noted otherwise. Touch up any areas damaged after erection.
 - .4 All items shall be fabricated, finished and assembled in the shop as much as is possible, consistent with the size and shipping problems. Assembly on the job shall be kept to a minimum.
- 3.2 Anchors
- .1 Provide and install all anchors required for fastening miscellaneous metal items in concrete or masonry anchors shall be strap steel bent to shape, welded to backs of members with bent end for building facing inward. Sizes and spacing shall be as indicated but where not specially noted, they shall be not less than 38 x 4mm (1-1/2" x 3/16") and spaced at not over 914mm (3'-0") c/c with minimum of 3 anchors per member.
 - .2 For attaching work to masonry or concrete where anchors or insert cannot be built in, provide approved self-drilling anchors.

END OF SECTION 05500

PART 1 - GENERAL

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| 1.1 Description of Work | <p>.1 Including the following but not limited to: sheathing, furring, rough framing, grounds, blocking, rough hardware, wood preserving, concealed wood anchoring within stud wall assemblies for all metal door and glazing screen frames, concealed wood anchoring for all wall and/or ceiling mounted fitments, features and equipment items identified on the drawings, etc.</p> <p>.2 Temporary carpentry, including fencing, hoarding, etc. as required throughout the course of construction to comply with all items in Division 1.</p> | | | | | | |
| 1.2 Related Work Specified Elsewhere | <table border="0"> <tr> <td style="vertical-align: top; padding-right: 20px;">.1</td> <td style="vertical-align: top;">Finish Carpentry</td> <td style="vertical-align: top; text-align: right;">Section 06200</td> </tr> <tr> <td style="vertical-align: top; padding-right: 20px;">.2</td> <td style="vertical-align: top;">Architectural Woodwork/Millwork</td> <td style="vertical-align: top; text-align: right;">Section 06400</td> </tr> </table> | .1 | Finish Carpentry | Section 06200 | .2 | Architectural Woodwork/Millwork | Section 06400 |
| .1 | Finish Carpentry | Section 06200 | | | | | |
| .2 | Architectural Woodwork/Millwork | Section 06400 | | | | | |
| 1.3 Source Quality | <p>.1 Identify lumber by grade stamp of an agency certified Control by Canadian Lumber Standard Administration Board.</p> <p>.2 Identify pressure treated wood by stamp of approval and Licensed applicator of Kopper's "Wolmanized" system.</p> | | | | | | |

PART 2 - PRODUCTS

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| 2.1 Lumber | <p>.1 Except as indicated or specified otherwise, lumber materials shall be softwood, not greater than 19% moisture content at time of installation, in accordance with the following standards:</p> <p style="margin-left: 20px;">(a) CSA 0141</p> <p style="margin-left: 20px;">(b) NLGA Standard Grading Rules for Canadian Lumber, effective 1979.</p> <p>.2 Machine stress-rated lumber is acceptable for all purposes.</p> <p>.3 Framing and board lumber; in accordance with Table 9.3.2A of O.B.C. 1990 except as indicated or specified otherwise.</p> <p>.4 Plywood coping and sheathing: exterior grades thickness as shown.</p> <p>.5 Preserved wood: pressure treated softwood, to CSA 080, using Wolman CCA preservative.</p> <p>.6 Plywood: CSA 0151M - Softwood.</p> |
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2.2 Fastenings and Hardware

- .1 Nails, spikes and staples.
 - (a) Use common spiral nails and spiral spikes except where indicated otherwise.
 - (b) Use hot galvanized finish steel for exterior work, pressure-preservative treated lumber except where indicated otherwise.
- .2 Bolt, nut, washer, screw and pin type fasteners: with hot-dip galvanized finish for exterior work, interior highly humid areas and for pressure-preservative treated lumber; elsewhere with primer paint finish where installed on sight-exposed surfaces.
- .3 Use surface fastenings of following types, except where specific type is indicated.
 - (a) To hollow masonry, plaster and panel surfaces use toggle bolt.
 - (b) To solid masonry and concrete use expansion shield with lag screw or lead plug with wood screw.
 - (c) To structural steel use bolts through drilled hole or welded stud-bolts or power driven self-drilling screws.

PART 3 - EXECUTION**3.1 Furring and Blocking**

- .1 Install furring and/or solid wood blocking as required to support and/or to solidly anchor finishes, fitments, features, white boards and all wall and ceiling-mounted equipment items throughout. Use solid wood blocking within concealed wall, ceiling and/or bulkhead assemblies as required.
- .2 Align and plumb face of furring and blocking to tolerance of 1:600.
- .3 Ensure provision of continuous 2" wide x depth to suit wood blocking around all door frames in steel stud wall assemblies. Blocking depth to be full depth of steel studs surrounding door/glazing screen framing.

3.2 Rough Bucks

- .1 Install wood bucks and nailers as indicated and/ or where nailers required.
- .2 Except where indicated otherwise use material at least 38mm thick secured with 9mm bolts located within 300mm from ends of members and uniformly spaced at not over 1200mm between.

- .3 Countersink bolts where necessary to provide clearance for other work.

**3.3 Coping, Curbs
and Sheathing**

- .1 Install backing, curbs and other wood supports for roofing and sheet metal work, and roof mounted equipment, as indicated.
- .2 Secure with galvanized bolts where indicated, galvanized screws elsewhere. Locate fastenings within 300mm from ends and uniformly spaced between. Space bolts at 1200mm maximum and nails at 600mm centers maximum except where indicated otherwise.
- .3 Install wood nailers for roof hopper, dressed, tapered and recessed slightly below surface of roof insulation.

**3.4 Electrical
Equipment
Blackboard**

- .1 Provide backboards for mounting electrical equipment as indicated. Use 19mm thick poplar or fir face veneer CPS/SIS or DFP/GIS on 19 x 38mm furring around perimeter maximum 300mm intermediate spacing

END OF SECTION 06100

PART 1 - GENERAL

The work under this section consists of the following but is not limited to:

1.1	Description	.1	Fabrication and installation of milled wood slat benches and wall-mounted shelves.	
		.2	Fabrication and installation of architectural wood trimwork items identified on the drawings [including custom wood crosses at building interior]	
		.3	Supply and installation of white boards and tack boards.	
		.4	Fabrication and installation of miscellaneous wood and/or millwork trim items as indicated on drawings.	
		.5	Installation of pressed hollow metal door frames, supplied under Section 08100.	
		.6	Installation of hollow metal glazing screens supplied by other sections.	
		.7	Hanging of hollow metal doors supplied under other sections.	
		.8	Hanging of solid core wood doors [as/if applicable] supplied under other sections.	
		.9	Installation of Finished Hardware supplied under Section 08710.	
1.2	Related Work Specified Elsewhere	.1	Rough Carpentry	Section 06100
		.2	Architectural Woodwork	Section 06400
		.3	Steel Doors and Frames	Section 08100
		.4	Wood Doors	Section 08210
		.5	Finish Hardware	Section 08710
		.6	Painting and Finishing	Section 09900
		.7	White Boards and Tack Boards	Section 10120
1.3	Reference Standards	.1	Do millwork to millwork standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC).	

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| 1.4 Samples | <p>.1 Submit duplicate 300mm x 300mm samples of each type of panelling and each type of solid wood or plywood to receive paint finish, in accordance with Section 01340.</p> <p>.2 Submit duplicate 300mm long samples of each type of trim moulding, in accordance with Section 01340.</p> |
|--------------------|---|

PART 2 - PRODUCTS

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| 2.1 Materials | <p>.1 Softwood Lumber: to CSA 0141 and National Lumber Grades Authority requirements, with maximum moisture content of 10%.</p> <p>.2 Hardwood Lumber: to National Hardwood Lumber Association (NHLA) requirements; moisture content to AWMAC - premium grade; species, red oak or birch as indicated or scheduled.</p> |
| 2.2 Trimwork | <p>.1 Mill wood trims and related components to dimensions and profiles indicated on the drawings.</p> <p>.2 All products to be machine dressed for final finish. Final finishing in place to include fine-grit sanding over compatible filler to conceal all joints, irregularities, fasteners etc. All trims to be prepared to receive topcoat [paint or stain & clear urethane] as specified elsewhere herein.</p> |

PART 3 - EXECUTION

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| 3.1 Interior Trim | <p>.1 Trimwork and custom wood items to be fabricated to AWMAC custom grade construction.</p> <p>.2 Trimwork to be of wood species [as noted] in clear No. 1 grade solid wood in species noted.</p> <p>.3 Set nails and screws, apply plain wood filler to indentations, sand smooth and leave ready to receive finish.</p> |
| 3.2 Erection | <p>.1 Set and secure materials and components in place, rigid, plumb, and square.</p> <p>.2 Provide heavy duty fixture attachments for wall mounted cabinet work.</p> <p>.3 Provide solid and secure fastening of finish wood elements to rough blocking or other structurally-integrated supporting material.</p> <p>.4 Prepare external exposed and semi-exposed surfaces ready for painting.</p> |

3.3 Hardware

- .5 Apply bituminous coating over wood framing members in contact with masonry or cementitious construction.
- .1 Install hinges, latches and pulls and specified hardware at wood doors. Install using templates supplied by Hardware consultant; hang wood doors in specified frames; adjust for smooth free movement, free of binding. Ensure that all doors are properly balanced to close and do not 'hang' open.
- .2 Install latches, locks, striker plates, pulls, pushes, closers, panic devices, etc., in pre-fabricated openings in steel doors and frames.

END OF SECTION 06200

PART 1 - GENERAL**1.1 Description
of Work**

The work shall consist of but not be limited to the following:

- .1 Supply and installation of shop-fabricated counters, countertops, cupboards, cabinetry, shelves, storage units, display cases, built-in millwork items, slatwall/slotwall displays, kneewall caps, trims, millwork wall panels etc. and all other similar and/or related millwork items shown on the Architectural drawings.
- .2 Supply and installation of all miscellaneous wood, melamine, and plastic laminate-faced trims and panelized wall treatments as shown on Architectural drawings. Note localized requirement for panelized wall treatments [millwork wall paneling] on feature bulkheads as indicated on the drawings.
- .3 Supply and installation of all hardware for Architectural millwork items [covered in this Section] is to be by Division 06400. This includes (without strict exception to) all hinges, drawer glides, cabinet knobs and pulls, cabinet catches/latches, cabinet locks at doors and drawers countertop grommets, cabinet leveling legs, countertop support legs, casters, coat rods, coat hooks, glass shelving, glass shelving support suspension systems, sliding glass doors and tracks, glass at glazed cabinet doors, cabinet glazing stops, shelf support pilasters, pilaster clips, shelf support pins
- .4 Supply and installation of countertops associated with millwork items in the specified materials [including those made of plastic laminate, solid surfacing, quartz, stainless steel, etc.] as specified on the Architectural drawings and/or as noted herein.
- .5 Installation only of all cabinetry hardware items associated with this Division.

**1.2 Related Work
Specified
Elsewhere**

- .1 Rough Carpentry Section 06100
- .2 Finish Carpentry Section 06200
- .3 Sealant Section 07900
- .4 Finish Hardware Section 08710
- .5 Glass & Glazing Section 08800
- .6 Resilient Tile Flooring Section 09660
- .7 Painting Section 09900
- .8 White Boards and Tack Boards Section 10120
- .9 Steel Stud and Gypsum Board Section 09111
- .10 Mechanical Section 15000
- .11 Electrical Section 16000

		.12	Metal Fabrication (Misc. Metals)	Section 05500
1.3	Requirements of Regulatory Agencies	.1	All finishes shall meet the flame spread and smoke development requirements of the Ontario Building Code for the specific location and application for all parts of the Work.	
1.4	Prevailing Performance Standard	.1	Notwithstanding information provided elsewhere herein, all millwork items supplied and/or installed by this Division are to be fabricated to the 'Custom Grade' standards outlined in the most current edition of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) 'Architectural Woodwork Quality Standards' Guide prepared by the Architectural Woodwork Institute. This Guide is to be taken as the standard for fabrication of all items herein and shall be acknowledged by the Millwork Trade as a mandatory supplementary reference guide (in addition to this Specification) for the completion of all related work for this project.	
1.5	Samples	.1	Submit duplicate 300mm x 300mm samples of each type laminate, melamine and solid surfacing material specified herein for Architect's approval prior to product ordering. All samples shall fully conform to the colours and finishes specified.	
1.6	Shop Drawings	.1	Submit shop drawings in accordance with Section 01340.	
		.2	Clearly indicate details of construction, profiles, jointing fastening and other related details. All finishes to be noted respective to rooms and locations. Ensure that all millwork items bounding pieces of equipment are coordinated with actual equipment dimensions supplied by Owner.	
1.7	Product Handling	.1	Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means.	
		.2	Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22°C (72°F).	
1.8	Warranty	.1	Contractor hereby warrants that laminated plastic work, solid surface countertops, stainless steel countertops and melamine finish items will not warp, crack or delaminate for two years from the date of Occupancy.	

PART 2 - PRODUCTS

2.1 Materials

- .1 **Softwood Lumber:** to CSA 0141 and National Lumber Grades Authority requirements, with maximum moisture content of 6% for interior work. Pine species, to AWMAC custom grade for concealed framing.
- .2 **Hardwood Lumber:** to National Hardwood Lumber Association (NHLA) requirements, moisture content of maximum 6% for interior work. Maple species, to AWMAC custom grade for all solids as detailed, including nosing and edging. Mill worker to select only clear, regular grained pieces, free of all knots, warps, splits, sapwood streaks and any visible irregularities. The Architect reserves the right to refuse any pieces deemed unsatisfactory for replacement to his satisfaction at no cost increase.
- .3 **Hardwood Veneered Plywood:** to CSA 0115 in thicknesses indicated on drawings. Maple veneer on plywood core or on industrial grade particle board core having minimum 720 kg/m^3 (45 lb/cu. ft.) density and meeting CAN30 018801 M78. Grade "R" Maple veneer, free of visible irregularities including knots, grain worbles, heavily contrasting grain patterns etc. The Architect reserves the right to reject any pieces deemed unsatisfactory for replacement to his satisfaction at no cost increase.
- .4 **Particle Board:** Laminated surfaces to have substrate of industrial grade particle board having minimum 720 kg/m^2 (45 lb/cu. ft) density and meeting CAN-3001881. Particle board thickness as noted on drawings.
- .5 **Medium Density Fiberboard (MDF):** MDF materials to conform to ANSI A208.2-2009 (Grade 155) with a density of 46 - 48 lbs/cubic ft. MDF thickness as noted on drawings. Product to be Uniboard Excel + Grade or approved alternate.

Where MDF is used in exterior applications and in interior applications subject to even infrequent water exposure, ensure use of Extrirra water-resistant MDF throughout.

.6 **PLASTIC LAMINATE FOR FLATWORK:**

General Purpose Laminate:

For cabinet bodies and general surfacing applications (excluding post-formed countertops) laminate to conform to CAN3 A172 M79, Grade standard GP (R) grade, 1.15 mm (1/64") thick throughout, with resin-impregnated kraft-paper core.

Post-Forming Grade Laminate:

Post-forming grade plastic laminate to be used only where post-formed countertops are indicated.

PLASTIC LAMINATE #1 [PL.LAM #1]:

MANUFACTURER: FENIX - NTA
 DISTRIBUTER: FORMICA
 COLOUR: JO789 ROSSO NAMIB
 FINISH: SOFT-TOUCH MATTE
 SHEET SIZE: to suit [up to 5'-2" wide x 13-9" long or smaller to suit the intended application]
 GEN. LOCATION: MWP-2 [MILLWORK WALL PANEL 2]
 EDGEBANDING: MATCHING 1.0mm THICK PVC EDGE-BANDING AS SUPPLIED BY DOELLKEN (SURETECO) #20934MM FUSION EDGE IN COLOUR ROSSO NAMIB

- .7 Plastic Laminate Adhesive: contact adhesive to CGSB 71-GP-10M, or as per respective manufacturer's specifications.

.8 MELAMINE PRODUCTS:

Melamine surfaces (melamine component panels) are to be used in locations where noted on Architect's drawings. Colours to be selected by Architect and as noted in the drawings. All melamine finished panels to be thermo-fused melamine resins (with specified photo paper) on particle board backing in thicknesses noted on drawings.

Melamine Finishes at Visible Exteriors:

For all visible and/or exposed melamine finishes (i.e. finishes at exterior cabinet faces and/or at interior cabinet faces visible through glass doors and as used on Millwork Wall Panels [MWP-#]), acceptable products (in locations noted on Architectural drawings) to be:

MELAMINE #1 [MEL #1]:

MANUFACTURER: UNIBOARD
 DISTRIBUTER: MERCURY WOOD PRODUCTS
 COLOUR: #290, CLASSIC MAPLE
 FINISH: SUPERMAT
 GEN. LOCATION: GENERAL CABINET BODIES, MWP-1
 CORE: PARTICLE BOARD
 THICKNESSES: ¾" thick at CABINET BODIES [AS PER DRAWINGS]; ½" THICK AT MILLWORK WALL PANEL 1 [MWP-1]
 PANEL SIZE: to suit [up to 5'-0" wide x 12'-0" long or smaller to suit the intended application]
 EDGEBANDING: MATCHING 1.0mm THICK PVC EDGE-BANDING AS SUPPLIED BY MERCURY WOOD PRODUCTS
 GRAIN DIRECTION: VERTICAL UNLESS NOTED OTHERWISE

NOTE for Melamine Grain Control:

- woodgrain orientation to be vertical on all door and drawer facings throughout (as illustrated on architectural drawings)

- ensure continuity of the grain on vertically stacked facing panels (i.e. between stacked drawers and/or doors) to ensure that finished installation appears to be cut from one consistent veneer [in conformance with AWMAC 'CUSTOM STANDARD' specified herein]

Melamine Finish at Concealed Cabinet Interiors:

Melamine surfaces at concealed cabinet interiors (i.e. concealed behind opaque cabinet doors and/or drawers) may be standard "Cabinet White" melamine throughout.

.9 MILLWORK EDGEBANDING:

All edgebanding to be as noted below for respective application. Edgebands are to be finished true and flush with adjacent surfaces throughout. Unless noted otherwise edgebanding to be:

a) Polyester Edgebanding at Concealed Melamine Interiors:

"Cabinet White" polyester tape to match adjacent finishes

b) PVC Edgebanding at Visible/Exposed Millwork Finishes:

At all exposed cabinet bodies and facings, full perimeter of exposed shelves, drawer faces, cupboard doors, gables, panelized wall cladding, melamine trims, etc. (and all similar items shown on drawings) are to be finished in PVC edgebanding to match panel faces throughout as noted below:

Edgebanding at MEL #1:

Distributor: Mercury Wood Products
 Colour: to match melamine #1 [#290 Classic Maple]
 Finish/Texture: to match melamine #1 [Supermat]
 Thickness: 1.0 mm ABS/PVC
 Width: 15/16" or 24mm wide [cut to suit 20 mm melamine stock thickness]

Edgebanding at PL LAM#1

Manufacturer: DOELLKEN/SURETOCO
 Colour: Doellken #20934 MM Fusion Edge to match melamine #2 [FENIX Rosso Namib #789]
 Finish/Texture: to match melamine #2
 Thickness: 1.0 mm ABS/PVC
 Width: 23 mm wide [cut to suit 12 mm melamine stock thickness]

ABS/PVC edgebanding on facing panels is to be supplied in over-sized widths and finished flush to adjacent melamine surfaces in shop by commercial grade edgebander.

Edgebanding to be applied to melamine boards in full

accordance with edgeband manufacturer's specifications for recommended application, including all related materials, adhesives and execution techniques.

Ensure ABS/PVC edgebanding specified above is used below all millwork components in contact with floor (side gables, toekicks etc.) to provide optimal water-resistance. Continuous clear silicone sealant at junctures of millwork with resilient flooring finishes throughout.

Ensure that all shelves are finished with edgebanding on all 4 sides (typical throughout).

c) **Edgebanding at Plastic Laminate Finishes:**

Unless noted otherwise, edgebanding at plastic laminate items to be 'self edged' plastic laminate, horizontal grade material matching adjacent panels.

- .10 Nails and staples: to CSA B111, plain finish.

.11 **CABINET DOOR AND DRAWER PULLS:**

Cabinet pulls to be Richelieu 'Modern Metal Pull 2362', model #BP2362160107; 175 mm long [160 mm c/c mounting] modern D-pull in 'Orion Gray' finish [zinc construction]

.12 **Door Hinges at Cabinets:**

All hinges at melamine cabinet doors to be Blum 'Modul' series throughout, min. 107° opening c/w soft-close feature at all standard cabinets (unless noted otherwise). 2 hinges (1 pair) per door minimum. Doors exceeding 2'-6" height shall have additional hinges to suit.

.13 **Drawer Glides:**

All drawer glides to be side-mounted full extension ball-bearing glides with soft-close feature and with a capacity of 75 lbs min. per pair. Acceptable products by Accuride, Blum, Grasse, Hettich or approved alternate.

.14 **Millwork Locks:**

All millwork locks for drawers & cabinet doors to be chrome plated, disk tumbler lock with removable cam core; provide 3 keys per lock. Coordinate final selection of lock type to ensure mounting compatibility with specified door and drawer materials. Lock locations to be as indicated on drawings.

.15 **GARMENT HOOKS/COAT HOOKS:**

Self-Releasing Hooks in Changerooms 131-4 and 131-5:

Self-releasing safety hooks [in and related to millwork items] in rooms noted to Richelieu Safety Hook HD #HDB001IP [HenkelHook] in graphite finish, in quantities and locations shown on drawings.

Standard-Use Hooks [in all Other Rooms]:

All standard-use coat hooks [in and related to millwork items] in to be Hafele #845.12.809 double-prong coat hook in polished aluminum finish, in quantities and locations shown thereon.

- .16 Caulking/sealants for interior use in accordance with Section 07900.
- .17 Paints, stains, and clear topcoats: see Section 09900.
- .18 **Coat Rods:**
Coat rods to be 1.25" diameter chrome-plated steel tube commercial coat rods with matching chrome-plated steel anchoring collars to suit. Single piece coat rods throughout in lengths cut to suit required dimensions. Expandable coat rods with integral anchoring collars will not be accepted.
- .19 **Adjustable Shelf Supports:** All adjustable shelves are to be supported with 4 metal shelf support clips/shelf, fitted into ferrule/sleeve-lined holes running vertically in cabinet body at 1.5" o.c. Vertical runs of shelf-support holes are to be positioned approx. 1.5" in from edge of shelves on all four corners of shelf. Products to be:
- shelf support clips: Richelieu L-shaped [anti-tip] metal shelf clip with ¼" diameter metal pin, all in nickel finish; Richelieu product # 2000NS [or alternate]
 - hole sleeves: 5/16" deep metal ferrule ¼" diameter metal pin, all in nickel finish; Richelieu product # 2292180 [or alternate]
- .20 **Solid Surfacing #1 [SS-1]:**
Solid surfacing material to be 1/2" thick throughout c/w thickened nosing profiles [ranging from 1 ½" to 4"] as shown on the architectural drawings .
- Solid Surfacing to be:
LG Hausys 'Hi-Macs' in colour L017, Kamet
- Solid Surfacing items are to be fabricated in full accordance with the manufacturer's recommendations for the intended application throughout.
- .21 **Aluminum Support Legs:**
Aluminum support legs below coat cubbies in Kindergarten Coat Rooms 105-2, 106-2, 107-2, 108-2 and 109-2 and in Daycare Coat Rooms 110-10 and 110-12 to be:
- Richelieu Adjustable Furniture Leg #503048170, 12 " high x 2" diameter stainless steel legs [with 1 3/16" vertical adjustment capability] secured to concealed wood blocking at underside

of cubbies to suit as required to ensure final installation height; locations and quantities as per architectural drawings.

PART 3 - EXECUTION**3.1 Fabrication of Cabinetwork**

- .1 Fabricate caseworks to **AWMAC** conventions and standards for 'Custom Grade' construction as noted in Part 1 herein.
- .2 Site measure rooms and spaces to verify/obtain governing dimensions before fabricating millwork items, particularly those between architectural openings and those accommodating equipment or fixturing (supplied by others). Millwork trade is to verify the size of all related fixtures and equipment items prior to fabrication.
- .3 Report all dimensional discrepancies between the drawings and subsequent site conditions to the Architect for input prior to fabrication.
- .4 Fabricate all product to the dimensions, material and details shown on the drawings.
- .5 Finish all edgebanding flush and true to surrounding millwork faces, easing edges slightly to remove sharpness of outside edges.
- .6 Countersink all nails and apply plain wood filler to indentations, finishing it smooth and ready to receive finish. Touch up all filled fasteners to match surrounding finish.
- .7 Shop install cabinet hardware for doors, shelves and drawers. Recess pilaster strips for adjustable shelves throughout [unless noted otherwise].
- .8 Ensure that all millwork cabinet facings, trims and panelized wall cladding is installed flush, plumb and true throughout. Cabinet facings to be adjusted as required to ensure correct operation of doors and drawers, with consistent, straight and aligned gaps between doors, drawers and filler strips throughout.
- .9 Provide cutouts for plumbing fixtures, electrical pass- throughs and all related items to be accommodated.
- .10 Provide concealed wood support members (or substrate products) below rigid countertop materials to prevent countertop cracking under heavy load during use.

3.3 Fabrication of Pl. Laminate Work

- .1 Comply with CAN3-A172-M79, Appendix 'A'.
- .2 Ensure adjacent parts of continuous laminate facings or abutting laminate facings match in colour and pattern.

- .3 Laminates with a directional pattern (wood grains or patterned designs) to be oriented as per Architect's instructions. Fabricator to clarify related uncertainties with Architect prior to fabrication.
 - .4 Bond plastic laminate to core material in accordance with manufacturer's instructions for the intended application. Ensure that core and laminate materials contact uniformly throughout to ensure 100% bond over entire surface. Use continuous laminate lengths up to 3000mm (10').
 - .5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material as indicated. Do not mitre laminate edges.
 - .6 Install work plumb, true and square, neatly scribed to adjoining surfaces.
 - .7 Backsplashes and countertops to be post-formed only where shown on drawings. Post-formed countertops to have integral backsplashes only where shown on drawings. Backsplash heights to be 3" above countertop level (typical). Countertops to have post-formed bullnose edging types as shown on drawings, and projecting 1 1/2" beyond face of adjacent cabinets below (typical). Only those bullnose types shown on the Architectural drawings will be accepted.
- 3.3 Fabrication of Solid Surfacing Countertops & Panels**
- .1 All solid surfacing countertop are to be fabricated in full accordance with the product manufacturer's fabrication guide (and related requirements therein) respective to the intended application. Particular attention should be paid to:
 - provision of proper supporting substrates throughout
 - provision of matching solid surfacing seam blocks at all joints in material
 - provision of radiused inside blocks at all inside countertop corners
 - provision of gaps between solid surface material and substrate to provide adequate allowance for thermal expansion and contraction, including use of manufacturer-recommended adhesives
 - .2 All 'L-shaped' solid surface countertops must not be seamed on a 45° angle, but rather on an 'L-shaped' joint, with a min. 1" radius plus a 1" straight run at the inside corner, ensuring a 90° joint between adjacent surfaces. Consult manufacturer's fabrication guide for full requirements.
 - .3 Ensure provision of adequate support below all countertop cut-outs, and use of thermal isolation tape at any cut outs to

accommodate heat generating equipment items.

- .4 Ensure that all joints in solid surface materials are chemically welded with manufacturer-recommended colour-matching seaming adhesive. All joint seams are to be sanded and buffed smooth and co-planar throughout, free of perceptible lines and distinction between adjacent surfaces when complete.
- .5 All solid surfacing used as wall and/or bulkhead facing are to be adhered to full plywood substrates in full accordance with the manufacturer's recommendations for the intended application, utilizing recommended products and techniques.
- .6 Solid surfacing materials are to be left in natural 'matt' finish throughout and are not to be buffed to a higher sheen.

3.4 Cabinetry Installation

- .1 Set and secure all materials and components in place ensuring that they are, plumb, true and square.
- .2 Provide heavy-duty mechanical attachment for wall- mounted items and cabinets.
- .3 Apply bitumous water-resistant coating over wood framing members in contact with masonry or cementitious construction subject to moisture.
- .4 After installation, fit and adjust operating hardware for cabinet doors, drawers and shelves to ensure operation.
- .5 Make allowances around perimeter where fixed objects pass through or project into work to permit normal movement without restriction.
- .6 Provide cutouts for inserts, appliances, outlets boxes and penetrations. Round internal corners, chamfer edges and seal exposed core.
- .7 Scribe all materials neatly and tight to surrounding walls and related architectural features free of gaps and irregularities.
- .8 At junction of millwork items and adjacent walls (including around projections) apply a small continuous bead of sealant in accordance with Section 07900. Sealant/caulking colour to match adjacent wall surface.
- .9 Setting Agents at Solid Surface Countertops:
All solid surface countertops are to be adhered to substrates with dabs of clear silicone in full accordance with the manufacturer's recommendations. No rigid adhesive setting agents may be used unless specifically recommended by solid surfacing manufacturer.
- .10 Handling, storing, cutting, finishing and fastening of all compact laminate panels are to be in full accordance with manufacturer's

recommendations throughout.

- .11 Install all cabinetry hardware items specified herein in full accordance with the manufacturer's recommendations for the intended application. Ensure that all hardware is firmly anchored and performing correctly, adjusting as required to suit. Ensure that all cabinetry facing hardware is adjusting to provide plumb and level facing panels, with consistent gapping throughout.

3.4 Trimwork Installation

- .1 Set and secure all materials and components in place ensuring that they are plumb, true and square unless noted otherwise.
- .2 All seams between adjacent trims in continuous run are to be mitred and overlapped. Glue and mechanically fasten joints to suit, filling and finishing to match specified trim finish. Ensure finished joints are flush and co-planar, free of gaps and visual irregularities.
- .3 Joints at 90 degree corners are to be mitred to suit, unless otherwise noted. Ensure finished joints are flush and co-planar, free of gaps and visual irregularities.

3.4 Millwork Wall Panel Installation

- .1 Set and secure all materials and components in place, ensuring that they are plumb, true and square unless noted otherwise.
- .2 Ensure that finished recessed face of all reveals behind decorative/millwork wall panels [where visible] are fully finished to match panel facings unless noted otherwise.
- .3 Install all millwork wall panels utilizing concealed fastening techniques including adhesion to applicable substrates with permanent construction adhesive offering high initial tack [LePage PL-Premium or approved alternate]. Temporarily brace all panels as required following initial setting to maintain position. Remove bracing only after adhesives are securely set and fully cured.

END OF SECTION 06400

PART 1 - GENERAL**1.1 Description
of Work**

The work shall consist of but not be limited to the following:

- .1 Supply and installation of shop-fabricated counters, countertops, cupboards, cabinetry, shelves, storage units, display cases, built-in millwork items, slatwall/slotwall displays, kneewall caps, trims, millwork wall panels etc. and all other similar and/or related millwork items shown on the Architectural drawings.
- .2 Supply and installation of all miscellaneous wood, melamine, and plastic laminate-faced trims and panelized wall treatments as shown on Architectural drawings.
- .3 Supply and installation of all hardware for Architectural millwork items [covered in this Section] is to be by Division 06400. This includes (without strict exception to) all hinges, drawer glides, cabinet knobs and pulls, cabinet catches/latches, cabinet locks at doors and drawers countertop grommets, cabinet leveling legs, countertop support legs, casters, coat rods, coat hooks, glass shelving, glass shelving support suspension systems, sliding glass doors and tracks, glass at glazed cabinet doors, cabinet glazing stops, shelf support pilasters, pilaster clips, shelf support pins
- .4 Supply and installation of countertops associated with millwork items in the specified materials [including those made of plastic laminate, solid surfacing, quartz, stainless steel, etc.] as specified on the Architectural drawings and/or as noted herein.
- .5 Installation only of all cabinetry hardware items associated with this Division.

**1.2 Related Work
Specified
Elsewhere**

- | | | |
|-----|----------------------------------|---------------|
| .1 | Rough Carpentry | Section 06100 |
| .2 | Finish Carpentry | Section 06200 |
| .3 | Sealant | Section 07900 |
| .4 | Finish Hardware | Section 08710 |
| .5 | Glass & Glazing | Section 08800 |
| .6 | Resilient Tile Flooring | Section 09660 |
| .7 | Painting | Section 09900 |
| .8 | White Boards and Tack Boards | Section 10120 |
| .9 | Steel Stud and Gypsum Board | Section 09111 |
| .10 | Mechanical | Section 15000 |
| .11 | Electrical | Section 16000 |
| .12 | Metal Fabrication (Misc. Metals) | Section 05500 |

1.3	Requirements of Regulatory Agencies	.1	All finishes shall meet the flame spread and smoke development requirements of the Ontario Building Code for the specific location and application for all parts of the Work.
1.4	Prevailing Performance Standard	.1	Notwithstanding information provided elsewhere herein, all millwork items supplied and/or installed by this Division are to be fabricated to the ' Custom Grade ' standards outlined in the most current edition of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) 'Architectural Woodwork Quality Standards' Guide prepared by the Architectural Woodwork Institute. This Guide is to be taken as the standard for fabrication of all items herein and shall be acknowledged by the Millwork Trade as a mandatory supplementary reference guide (in addition to this Specification) for the completion of all related work for this project.
1.5	Samples	.1	Submit duplicate 300mm x 300mm samples of each type laminate, melamine and solid surfacing material specified herein for Architect's approval prior to product ordering. All samples shall fully conform to the colours and finishes specified.
1.6	Shop Drawings	.1	Submit shop drawings in accordance with Section 01340.
		.2	Clearly indicate details of construction, profiles, jointing fastening and other related details. All finishes to be noted respective to rooms and locations. Ensure that all millwork items bounding pieces of equipment are coordinated with actual equipment dimensions supplied by Owner.
1.7	Product Handling	.1	Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means.
		.2	Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22°C (72°F).
1.8	Warranty	.1	Contractor hereby warrants that laminated plastic work, solid surface countertops, stainless steel countertops and melamine finish items will not warp, crack or delaminate for two years from the date of Occupancy.

PART 2 - PRODUCTS

2.1 Materials

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- .2 **Hardwood Lumber:** to National Hardwood Lumber Association (NHLA) requirements, moisture content of maximum 6% for interior work. Maple species, to AWMAC custom grade for all solids as detailed, including nosing and edging. Mill worker to select only clear, regular grained pieces, free of all knots, warps, splits, sapwood streaks and any visible irregularities. The Architect reserves the right to refuse any pieces deemed unsatisfactory for replacement to his satisfaction at no cost increase.
- .3 **Hardwood Veneered Plywood:** to CSA 0115 in thicknesses indicated on drawings. Maple veneer on plywood core or on industrial grade particle board core having minimum 720 kg/m³ (45 lb/cu. ft.) density and meeting CAN30 018801 M78. Grade "R" Maple veneer, free of visible irregularities including knots, grain worbles, heavily contrasting grain patterns etc. The Architect reserves the right to reject any pieces deemed unsatisfactory for replacement to his satisfaction at no cost increase.
- .4 **Particle Board:** Laminated surfaces to have substrate of industrial grade particle board having minimum 720 kg/m² (45 lb/cu. ft) density and meeting CAN-3001881. Particle board thickness as noted on drawings.
- .5 **Medium Density Fiberboard (MDF):** MDF materials to conform to ANSI A208.2-2009 (Grade 155) with a density of 46 - 48 lbs/cubic ft. MDF thickness as noted on drawings. Product to be Uniboard Excel + Grade or approved alternate.

Where MDF is used in exterior applications and in interior applications subject to even infrequent water exposure, ensure use of Extrirra water-resistant MDF throughout.

.6 **PLASTIC LAMINATE FOR FLATWORK:**

General Purpose Laminate:

For cabinet bodies and general surfacing applications (excluding post-formed countertops) laminate to conform to CAN3 A172 M79, Grade standard GP (R) grade, 1.15 mm (1/64") thick throughout, with resin-impregnated kraft-paper core.

Post-Forming Grade Laminate:

Post-forming grade plastic laminate to be used only where post-formed countertops are indicated.

PLASTIC LAMINATE #1 [PL.LAM #1]:

MANUFACTURER: FENIX - NTA
 DISTRIBUTER: FORMICA
 COLOUR: JO789 ROSSO NAMIB
 FINISH: SOFT-TOUCH MATTE
 SHEET SIZE: to suit [up to 5'-2" wide x 13-9" long or smaller to suit the intended application]
 GEN. LOCATION: MWP-2 [MILLWORK WALL PANEL 2]
 EDGEBANDING: MATCHING 1.0mm THICK PVC EDGE-BANDING AS SUPPLIED BY DOELLKEN (SURETECO) #20934MM FUSION EDGE IN COLOUR ROSSO NAMIB

- .7 Plastic Laminate Adhesive: contact adhesive to CGSB 71-GP-10M, or as per respective manufacturer's specifications.

.8 MELAMINE PRODUCTS:

Melamine surfaces (melamine component panels) are to be used in locations where noted on Architect's drawings. Colours to be selected by Architect and as noted in the drawings. All melamine finished panels to be thermo-fused melamine resins (with specified photo paper) on particle board backing in thicknesses noted on drawings.

Melamine Finishes at Visible Exteriors:

For all visible and/or exposed melamine finishes (i.e. finishes at exterior cabinet faces and/or at interior cabinet faces visible through glass doors and as used on Millwork Wall Panels [MWP-#]), acceptable products (in locations noted on Architectural drawings) to be:

MELAMINE #1 [MEL #1]:

MANUFACTURER: UNIBOARD
 DISTRIBUTER: MERCURY WOOD PRODUCTS
 COLOUR: #290, CLASSIC MAPLE
 FINISH: SUPERMAT
 GEN. LOCATION: GENERAL CABINET BODIES, MWP-1
 CORE: PARTICLE BOARD
 THICKNESSES: ¾" thick at CABINET BODIES [AS PER DRAWINGS]; ½" THICK AT MILLWORK WALL PANEL 1 [MWP-1]
 PANEL SIZE: to suit [up to 5'-0" wide x 12'-0" long or smaller to suit the intended application]
 EDGEBANDING: MATCHING 1.0mm THICK PVC EDGE-BANDING AS SUPPLIED BY MERCURY WOOD PRODUCTS
 GRAIN DIRECTION: VERTICAL UNLESS NOTED OTHERWISE

NOTE for Melamine Grain Control:

- woodgrain orientation to be vertical on all door and drawer facings throughout (as illustrated on architectural drawings)

- ensure continuity of the grain on vertically stacked facing panels (i.e. between stacked drawers and/or doors) to ensure that finished installation appears to be cut from one consistent veneer [in conformance with AWMAC 'CUSTOM STANDARD' specified herein]

Melamine Finish at Concealed Cabinet Interiors:

Melamine surfaces at concealed cabinet interiors (i.e. concealed behind opaque cabinet doors and/or drawers) may be standard "Cabinet White" melamine throughout.

.9 MILLWORK EDGEBANDING:

All edgebanding to be as noted below for respective application. Edgebands are to be finished true and flush with adjacent surfaces throughout. Unless noted otherwise edgebanding to be:

a) Polyester Edgebanding at Concealed Melamine Interiors:

"Cabinet White" polyester tape to match adjacent finishes

b) PVC Edgebanding at Visible/Exposed Millwork Finishes:

At all exposed cabinet bodies and facings, full perimeter of exposed shelves, drawer faces, cupboard doors, gables, panelized wall cladding, melamine trims, etc. (and all similar items shown on drawings) are to be finished in PVC edgebanding to match panel faces throughout as noted below:

Edgebanding at MEL #1:

Distributor: Mercury Wood Products
 Colour: to match melamine #1 [#290 Classic Maple]
 Finish/Texture: to match melamine #1 [Supermat]
 Thickness: 1.0 mm ABS/PVC
 Width: 15/16" or 24mm wide [cut to suit 20 mm melamine stock thickness]

Edgebanding at PL LAM#1

Manufacturer: DOELLKEN/SURETOCO
 Colour: Doellken #20934 MM Fusion Edge to match melamine #2 [FENIX Rosso Namib #789]
 Finish/Texture: to match melamine #2
 Thickness: 1.0 mm ABS/PVC
 Width: 23 mm wide [cut to suit 12 mm melamine stock thickness]

ABS/PVC edgebanding on facing panels is to be supplied in over-sized widths and finished flush to adjacent melamine surfaces in shop by commercial grade edgebander.

Edgebanding to be applied to melamine boards in full

accordance with edgeband manufacturer's specifications for recommended application, including all related materials, adhesives and execution techniques.

Ensure ABS/PVC edgebanding specified above is used below all millwork components in contact with floor (side gables, toekicks etc.) to provide optimal water-resistance. Continuous clear silicone sealant at junctures of millwork with resilient flooring finishes throughout.

Ensure that all shelves are finished with edgebanding on all 4 sides (typical throughout).

c) **Edgebanding at Plastic Laminate Finishes:**

Unless noted otherwise, edgebanding at plastic laminate items to be 'self edged' plastic laminate, horizontal grade material matching adjacent panels.

- .10 Nails and staples: to CSA B111, plain finish.

.11 **CABINET DOOR AND DRAWER PULLS:**

Cabinet pulls to be Richelieu 'Modern Metal Pull 2362', model #BP2362160107; 175 mm long [160 mm c/c mounting] modern D-pull in 'Orion Gray' finish [zinc construction]

.12 **Door Hinges at Cabinets:**

All hinges at melamine cabinet doors to be Blum 'Modul' series throughout, min. 107° opening c/w soft-close feature at all standard cabinets (unless noted otherwise). 2 hinges (1 pair) per door minimum. Doors exceeding 2'-6" height shall have additional hinges to suit.

.13 **Drawer Glides:**

All drawer glides to be side-mounted full extension ball-bearing glides with soft-close feature and with a capacity of 75 lbs min. per pair. Acceptable products by Accuride, Blum, Grasse, Hettich or approved alternate.

.14 **Millwork Locks:**

All millwork locks for drawers & cabinet doors to be chrome plated, disk tumbler lock with removable cam core; provide 3 keys per lock. Coordinate final selection of lock type to ensure mounting compatibility with specified door and drawer materials. Lock locations to be as indicated on drawings.

.15 **GARMENT HOOKS/COAT HOOKS:**

Self-Releasing Hooks in Changerooms 131-4 and 131-5:

Self-releasing safety hooks [in and related to millwork items] in rooms noted to Richelieu Safety Hook HD #HDB001IP [HenkelHook] in graphite finish, in quantities and locations shown on drawings.

Standard-Use Hooks [in all Other Rooms]:

All standard-use coat hooks [in and related to millwork items] in to be Hafele #845.12.809 double-prong coat hook in polished aluminum finish, in quantities and locations shown thereon.

.16 Caulking/sealants for interior use in accordance with Section 07900.

.17 Paints, stains, and clear topcoats: see Section 09900.

.18 Coat Rods:

Coat rods to be 1.25" diameter chrome-plated steel tube commercial coat rods with matching chrome-plated steel anchoring collars to suit. Single piece coat rods throughout in lengths cut to suit required dimensions. Expandable coat rods with integral anchoring collars will not be accepted.

.19 **Adjustable Shelf Supports:** All adjustable shelves are to be supported with 4 metal shelf support clips/shelf, fitted into ferrule/sleeve-lined holes running vertically in cabinet body at 1.5" o.c. Vertical runs of shelf-support holes are to be positioned approx. 1.5" in from edge of shelves on all four corners of shelf. Products to be:

- shelf support clips: Richelieu L-shaped [anti-tip] metal shelf clip with ¼" diameter metal pin, all in nickel finish; Richelieu product # 2000NS [or alternate]
- hole sleeves: 5/16" deep metal ferrule ¼" diameter metal pin, all in nickel finish; Richelieu product # 2292180 [or alternate]

.20 Solid Surfacing #1 [SS-1]:

Solid surfacing material to be 1/2" thick throughout c/w thickened nosing profiles [ranging from 1 ½" to 4"] as shown on the architectural drawings .

Solid Surfacing to be:

LG Hausys 'Hi-Macs' in colour L017, Kamet

Solid Surfacing items are to be fabricated in full accordance with the manufacturer's recommendations for the intended application throughout.

.21 Aluminum Support Legs:

Aluminum support legs below coat cubbies in Kindergarten Coat Rooms 105-2, 106-2, 107-2, 108-2 and 109-2 and in Daycare Coat Rooms 110-10 and 110-12 to be:

Richelieu Adjustable Furniture Leg #503048170, 12 " high x 2" diameter stainless steel legs [with 1 3/16" vertical adjustment capability] secured to concealed wood blocking at underside

of cubbies to suit as required to ensure final installation height; locations and quantities as per architectural drawings.

PART 3 - EXECUTION**3.1 Fabrication of Cabinetwork**

- .1 Fabricate caseworks to **AWMAC** conventions and standards for 'Custom Grade' construction as noted in Part 1 herein.
- .2 Site measure rooms and spaces to verify/obtain governing dimensions before fabricating millwork items, particularly those between architectural openings and those accommodating equipment or fixturing (supplied by others). Millwork trade is to verify the size of all related fixtures and equipment items prior to fabrication.
- .3 Report all dimensional discrepancies between the drawings and subsequent site conditions to the Architect for input prior to fabrication.
- .4 Fabricate all product to the dimensions, material and details shown on the drawings.
- .5 Finish all edgebanding flush and true to surrounding millwork faces, easing edges slightly to remove sharpness of outside edges.
- .6 Countersink all nails and apply plain wood filler to indentations, finishing it smooth and ready to receive finish. Touch up all filled fasteners to match surrounding finish.
- .7 Shop install cabinet hardware for doors, shelves and drawers. Recess pilaster strips for adjustable shelves throughout [unless noted otherwise].
- .8 Ensure that all millwork cabinet facings, trims and panelized wall cladding is installed flush, plumb and true throughout. Cabinet facings to be adjusted as required to ensure correct operation of doors and drawers, with consistent, straight and aligned gaps between doors, drawers and filler strips throughout.
- .9 Provide cutouts for plumbing fixtures, electrical pass- throughs and all related items to be accommodated.
- .10 Provide concealed wood support members (or substrate products) below rigid countertop materials to prevent countertop cracking under heavy load during use.

3.3 Fabrication of Pl. Laminate Work

- .1 Comply with CAN3-A172-M79, Appendix 'A'.
- .2 Ensure adjacent parts of continuous laminate facings or abutting laminate facings match in colour and pattern.

- .3 Laminates with a directional pattern (wood grains or patterned designs) to be oriented as per Architect's instructions. Fabricator to clarify related uncertainties with Architect prior to fabrication.
- .4 Bond plastic laminate to core material in accordance with manufacturer's instructions for the intended application. Ensure that core and laminate materials contact uniformly throughout to ensure 100% bond over entire surface. Use continuous laminate lengths up to 3000mm (10').
- .5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material as indicated. Do not mitre laminate edges.
- .6 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .7 Backsplashes and countertops to be post-formed only where shown on drawings. Post-formed countertops to have integral backsplashes only where shown on drawings. Backsplash heights to be 3" above countertop level (typical). Countertops to have post-formed bullnose edging types as shown on drawings, and projecting 1 1/2" beyond face of adjacent cabinets below (typical). Only those bullnose types shown on the Architectural drawings will be accepted.
- 3.3 Fabrication of Solid Surfacing Countertops & Panels**
- .1 All solid surfacing countertop are to be fabricated in full accordance with the product manufacturer's fabrication guide (and related requirements therein) respective to the intended application. Particular attention should be paid to:
- provision of proper supporting substrates throughout
 - provision of matching solid surfacing seam blocks at all joints in material
 - provision of radiused inside blocks at all inside countertop corners
 - provision of gaps between solid surface material and substrate to provide adequate allowance for thermal expansion and contraction, including use of manufacturer-recommended adhesives
- .2 All 'L-shaped' solid surface countertops must not be seamed on a 45° angle, but rather on an 'L-shaped' joint, with a min. 1" radius plus a 1" straight run at the inside corner, ensuring a 90° joint between adjacent surfaces. Consult manufacturer's fabrication guide for full requirements.
- .3 Ensure provision of adequate support below all countertop cut-outs, and use of thermal isolation tape at any cut outs to

accommodate heat generating equipment items.

- .4 Ensure that all joints in solid surface materials are chemically welded with manufacturer-recommended colour-matching seaming adhesive. All joint seams are to be sanded and buffed smooth and co-planar throughout, free of perceptible lines and distinction between adjacent surfaces when complete.
- .5 All solid surfacing used as wall and/or bulkhead facing are to be adhered to full plywood substrates in full accordance with the manufacturer's recommendations for the intended application, utilizing recommended products and techniques.
- .6 Solid surfacing materials are to be left in natural 'matt' finish throughout and are not to be buffed to a higher sheen.

3.4 Cabinetry Installation

- .1 Set and secure all materials and components in place ensuring that they are, plumb, true and square.
- .2 Provide heavy-duty mechanical attachment for wall- mounted items and cabinets.
- .3 Apply bitumous water-resistant coating over wood framing members in contact with masonry or cementitious construction subject to moisture.
- .4 After installation, fit and adjust operating hardware for cabinet doors, drawers and shelves to ensure operation.
- .5 Make allowances around perimeter where fixed objects pass through or project into work to permit normal movement without restriction.
- .6 Provide cutouts for inserts, appliances, outlets boxes and penetrations. Round internal corners, chamfer edges and seal exposed core.
- .7 Scribe all materials neatly and tight to surrounding walls and related architectural features free of gaps and irregularities.
- .8 At junction of millwork items and adjacent walls (including around projections) apply a small continuous bead of sealant in accordance with Section 07900. Sealant/caulking colour to match adjacent wall surface.
- .9 Setting Agents at Solid Surface Countertops:
All solid surface countertops are to be adhered to substrates with dabs of clear silicone in full accordance with the manufacturer's recommendations. No rigid adhesive setting agents may be used unless specifically recommended by solid surfacing manufacturer.
- .10 Handling, storing, cutting, finishing and fastening of all compact laminate panels are to be in full accordance with manufacturer's

recommendations throughout.

- .11 Install all cabinetry hardware items specified herein in full accordance with the manufacturer's recommendations for the intended application. Ensure that all hardware is firmly anchored and performing correctly, adjusting as required to suit. Ensure that all cabinetry facing hardware is adjusting to provide plumb and level facing panels, with consistent gapping throughout.

3.4 Trimwork Installation

- .1 Set and secure all materials and components in place ensuring that they are plumb, true and square unless noted otherwise.
- .2 All seams between adjacent trims in continuous run are to be mitred and overlapped. Glue and mechanically fasten joints to suit, filling and finishing to match specified trim finish. Ensure finished joints are flush and co-planar, free of gaps and visual irregularities.
- .3 Joints at 90 degree corners are to be mitred to suit, unless otherwise noted. Ensure finished joints are flush and co-planar, free of gaps and visual irregularities.

3.4 Millwork Wall Panel Installation

- .1 Set and secure all materials and components in place, ensuring that they are plumb, true and square unless noted otherwise.
- .2 Ensure that finished recessed face of all reveals behind decorative/millwork wall panels are fully finished to match panel facings unless noted otherwise.
- .3 Install all millwork wall panels/panelized wall cladding true, plumb and square unless noted otherwise utilizing concealed fastening techniques including adhesion to applicable substrates with permanent construction adhesive offering high initial tack. Temporarily brace all panels as required following initial setting to maintain position. Remove bracing only after adhesives are securely set and fully cured.

END OF SECTION 06400

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Provide a complete polyurethane waterproofing floor coating system in Service Rooms 211 and 311 on second and third floors, including all applicable sealants and elastomeric flashings needed to ensure a complete waterproof and weathertight system for entire floor area.
- B. 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.

1.02 SUBMITTALS

- A. Comply with pertinent provisions of Section 01330.
- B. Product data:
 - 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 or catalog illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades;
 - 4. Manufacturer's current recommended installation procedures which, when reviewed by Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 5. Written documentation of applicator's qualifications, including reference projects of similar scope and complexity, with current phone contacts of architects and owners for verification.

1.03 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- B. Applicator qualifications:
 - 1. Applicator shall have at least three years experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.
 - 2. Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.
- C. Convene a pre-installation job-site conference four weeks prior to commencing work of this Section:
 - 1. Secure attendance by Architect, Contractor, applicator, and authorized representatives of the coating system manufacturer and interfacing trades.
 - 2. Examine Drawings and Specifications affecting work of this Section, verify all conditions, review installation procedures, and coordinate scheduling with interfacing portions of the Work.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to job site in manufacturer's unopened containers with all labels intact and legible at time of use.
- B. Maintain the products in accord with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
- C. Comply with pertinent provisions of Section 01600.

1.05 SUBSTRATE CONDITIONS

- A. General:
 - 1. Provide applicator with surfaces that are broom clean, dry, sound and free of voids, bugholes, rockpockets, honeycombs, protrusions, excessive roughness, foreign matter, frost, ice and other contaminants which may inhibit application or performance of the waterproofing coating system.
 - 2. Using suitable abrasive methods, remove residue of form release, curing compound, chemical retarders and other surface treatments, laitance, mortar smear, sawcutting residue, mill scale, rust, loose material and other contaminants from concrete, masonry and ferrous metal surfaces to receive the work of this Section.
- B. Concrete: Where work of this Section will be applied to concrete, provide surfaces that are smooth with finish equal to one that is light steel troweled followed by a fine hair broom.
- C. Decks:
 - 1. Slope deck surfaces to drains that have flanges at coating level which are flush with deck surfaces.
 - 2. Rigidly install pipe, vents and other surface protrusions, properly flash them, and cover to prevent entry of coating materials.
- D. Metal flashings: Where metal flashings are substrate to waterproofing coating, set the flashings in continuous bedding bead of urethane sealant; install sealant S-bead between metal laps and mechanically fasten to substrate along leading edges at every 4" on center, staggered linearly, to lay flat without fishmouths.
- E. Joints: Configuration shall be consistent with this Section and with all other requirements of the Contract Documents.

1.06 WARRANTY

- A. Deliver to the Architect signed copies of the following written warranties against defective materials and workmanship for a period of two years following date of completion. Warrant that installed waterproof coating system shall be free of defects including adhesive failure, cohesive failure, weathering deficiencies and waterproofing failure resulting from substrate cracking up to 1/16 inch.
 - 1. Manufacturer's standard warranty covering materials;
 - 2. Applicator's standard warranty covering workmanship.

PART 2 PRODUCTS

2.01 GENERAL

- A. **Waterproof Flooring System [WFS]**: Provide a complete liquid applied polyurethane waterproofing flooring system having the following minimum attributes:
1. System designed for waterproofing decks subject to pedestrian traffic;
 2. Complying with ASTM C957-91 and having a Class A fire rating on concrete substrates.
 3. Color to be selected by Architect from manufacturer's standard color range.
 4. Acceptable products: Vulkem Mechanical Room Coating System by Tremco.
 - a. 40 mil Vulkem 350 base coat
 - b. 12 mil Vulkem 346TC top coat with embedded aggregate (Slate Gray)

2.02 ACCESSORIES

- A. Primer: As recommended by coating system manufacturer.
- B. Joint backing: Closed-cell, polyethylene rod as recommended by coating manufacturer.
- C. Aggregate: 40-50 mesh silica sand; local aggregate approved by coating manufacturer

2.03 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the coating system manufacturer as compatible, subject to review of the Architect.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Applicator shall examine the areas and conditions under which work of this Section will be performed.
1. Verify conformance with manufacturer's requirements;
 2. Report unsatisfactory conditions in writing to the Architect;
 3. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Surface preparation and detailing procedures to be in accord with waterproof coating system manufacturer's instructions and recommendations except where more stringent requirements are indicated.
- B. Clean all deck surfaces to receive coating system in accord with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive sealants, detailing materials or coatings immediately prior to installation.
- C. Rout, clean, prepare and detail surface cracks in accord with manufacturer's instructions; install backer rod where required.
- D. Clean metal surfaces to bright metal by wire brushing or mechanical etching; scuff-sand lead flashing and plastic surfaces.
- E. Prime surfaces in accord with manufacturer's instructions.
- F. Install 1/4" diameter backer rod into corner of all horizontal-to-vertical junctures subject to movement and cover with 1" detail cant of approved sealant; install 1" detail cants at projections, curbs and other horizontal-to-vertical junctures.
- G. Install detail coats, joint and crack treatments, and liquid flashings in accord with manufacturer's instructions.
- H. Allow detail applications to cure in accord with manufacturer's instructions prior to general application of coating.

3.03 APPLICATION

- A. Install waterproof coating system in accord with manufacturer's recommendations and instructions as applies to the Work except where more stringent requirements are indicated.
 - 1. Grid deck surfaces to assure proper coverage rates and verify coating wet-film mil thickness with gauges as work progresses.
 - 2. Retain empty product containers during course of work to aid in determining whether completed coating system complies with manufacturers average thickness requirements.
- B. Verify proper dry condition of substrate using method recommended by coating system manufacturer; perform adhesion checks prior to general application of coating system using field adhesion test method recommended by manufacturer.
- C. Mask off adjoining surfaces not to receive coating system.
- D. Wipe clean all detail coats with white rags wetted with Xylene solvent; do not saturate detail coat.
- E. Apply coating base coat uniformly and allow to cure in accord with manufacturer's instructions.
- F. Feather edge when entire area cannot be completed in one day; clean area 6" wide along edge of coating with Xylene solvent on clean white rags prior to startup on next working day; use interlaminary primer per manufacturer's instructions as needed; overlap existing work by 6" with new work.
- G. Apply coating system finish coat in accord with manufacturer's instructions.
 - 1. Immediately broadcast aggregate into wet material at rate recommended by manufacturer and backroll to evenly distribute and totally encapsulate.
 - 2. Allow to cure per manufacturer's instructions.

3.04 PROTECTION AND CLEAN-UP

WATERPROOFING FLOORING SYSTEM

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- A. Promptly remove primer or coating material from adjacent surfaces with MEK, Toluene or Xylene; leave work area in broom clean condition.
- B. Allow completed Work to cure 24 hours before opening to pedestrian traffic.

END OF SECTION

PART 1 - GENERAL

- | | | | |
|------------|----------------------------|----|--|
| 1.1 | Description of Work | .1 | Supply and install rigid perimeter below grade insulation as shown on the Drawings. |
| 1.2 | Product Handling | .1 | Store insulation in dry areas, protected from sunlight and traffic; store insulation board flat, on a flat surface, so as to prevent edge damage and placing of materials on top of stored boards. |
| | | .2 | Ensure that insulation board adhesives are stored at a minimum temperature of 40 degrees F for 12 hours before installation and that freezable adhesives are stored only at temperatures above 0 degrees C (32 degrees F). |
| 1.3 | Protection | .1 | Do not expose insulation board to sunlight after installation. Protect with cover as recommended by manufacturer if covering is not completed within 24 hours. |

PART 2 - PRODUCTS

- | | | | |
|------------|-------------------|----|---|
| 2.1 | Insulation | .1 | Expanded polystyrene: Foamular NGX-C-200 by Owens Corning or approved alternate; 2 - 1 1/2" thick (total R-15), square edges, 2'-0" wide boards in longest lengths practical. |
| 2.2 | Adhesive | .1 | Bakor 200-02 or approved alternate recommended by insulation manufacturer. |

PART 3 - EXECUTION

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|------------|---------------------|----|--|
| 3.1 | Examination | .1 | Before commencing work, ensure that all surfaces to which insulation board is applied are clean and smooth with no abrupt changes in plane, free of grease and with protruding fins of mortar or concrete removed, and that the surfaces are otherwise acceptable for insulation application as specified. |
| 3.2 | Adhesive | .1 | Prime surfaces before application as recommended by adhesive manufacturer. |
| | | .2 | Use 50mm (2") diameter pads of adhesive as required to hold boards to prevent movement during backfill. |
| 3.3 | Installation | .1 | Position and press boards into full contact with adhesive and ensure that they are maintained in place until adhesive has set. |
| | | .2 | Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. |

RIGID INSULATION

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END OF SECTION 07212

PART 1 - GENERAL

- 1.1 General** Division One, General Requirements, is part of this section and shall apply as if repeated here.
- 1.2 Description of Work** Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:
- .1 The protection of the interior and exterior surfaces of the building to be worked on and any equipment on or under the area of work.
 - .2 Application of the Spray Foam Insulation/Air Barrier.
 - .3 Maintaining a clean work area and final clean-up of the site upon completion of the Spray Foam Insulation/Air Barrier.
 - .4 This specification is based on Walltite XL01 by BASF Canada. Equivalent products and applicators shall meet this specification.
- 1.3 Related Work**
- .1 Thermal and Moisture Membranes Section 07261
 - .2 Rough Carpentry Section 06100
 - .3 Built Up Roofing System Section 07510
 - .4 Steel Doors and Frames Section 08100
 - .5 Aluminum Windows, Frames and Sills Section 08150
- 1.4 References**
- .1 CAN/ULC-S 705.1-15: Standard regarding rigid polyurethane foam spray thermal insulation, intermediate density - materials specifications
 - .2 CCMC 13588-L Spray Applied Rigid Polyurethane Foam Insulation.
- 1.5 Test Results**
- .1 Submit, in compliance with section 01340 (shop drawings, data sheets, and samples), the results of all tests conducted in order to verify if the quality of the insulation material is equal or superior to the requirements outlined in the present section.
 - .2 Submit the results of all **CCMC air barrier system using transition membrane** tests approved according to the CCMC's Technical Manual #07272 conducted in order to prove that the **air barrier system** with transition membrane meets National

Building Code (2015) requirements.

1.6 Submittals

- .1 Product Data: Provide data on material characteristics and performance criteria and limitations.
- .2 Manufacturer's Installation Instructions: Indicate preparation, installation requirements and techniques, product storage and handling criteria.

1.7 Quality Assurance

- .1 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. Licensing is required by CAN/ULC S705.2-05 Installation Standard.
- .2 A copy of the BASF installation manual or guide for the application of sprayed on polyurethane foam must be kept on site. In cases of transition membrane installation, a copy of the manufacturer's installation manual or guide is required.
- .3 Tests should be conducted daily on both core density and cohesion/adhesion to the substrate, following procedures established by BASF. The results of these tests should be entered in the daily report forms provided by BASF
- .4 Once the curing time required by the membrane manufacturer has elapsed, a test should be conducted to verify adhesion between the membrane and the substrate. All adhesion tests should be performed using **COM-TEN INDUSTRIES Series 301N1M** equipment or an equivalent. If adhesion is lower than the required minimum of 110 kPa (16 psi), the membrane should be mechanically fastened.
- .5 Adhesion tests should be conducted on all corners and building angles, as well as at the wall/cement slab intersections. Do one test on every wall that is less than 30 m (100 ft) in length. For walls that are between 30 and 60 m (100 and 200 ft) in length, two tests should be conducted. If the wall is more than 60 m (200 ft) long, do one test every 30 m (100 ft). If it is not possible to conduct any adhesion tests on the cement slab, the membrane should be mechanically fastened. Repeat this procedure at the wall-roof intersections.
- .6 Verify the adhesion of the transition membranes at the

perimeters of all openings. If the project comprises more than 10 openings, adhesion tests should be conducted on 15% of them. For jobs comprising 10 or fewer openings, 30% of these should undergo adhesion tests.

- .7 Adhesion tests should be performed on the transition membranes at periodic intervals and spacings.
- .8 Adhesion tests are not required if the membrane is adjusted mechanically.
- .9 Third party testing will be by Jocelyn Roofing Consultants. Costs will be billed directly to DSBN.

1.8 Qualifications

- .1 Installer to be a Qualified Applicator of the product from manufacturer/distributor. Submit proof of status upon request.
- .2 Material manufacturer/distributor must have on-site quality assurance program. Submit one copy of quality assurance program upon request.

1.9 Mock-up

- .1 Construct typical exterior wall panel, 2 m long by 2 m wide, incorporating window and frame and sill insulation, building corner condition illustrating materials interface and seals.
- .2 Mock-up may not remain as part of the work.
- .3 Using the polyurethane foam insulation sample that was sprayed in place, the following trials must be conducted on site, as required by the Canadian Urethane Foam Contractor Association (CUFCA):
 - .1 Verify core density
 - .2 Verify adhesion between the transition membrane and the substrate
 - .3 Verify cohesion/adhesion between the insulation material and the substrate
 - .4 Ensure results are in compliance and enter them in the CUFCA daily report.

1.10 Warehousing and Transportation

- .1 All materials should be delivered and stored in their original packaging bearing the manufacturer's name, quantity, CCMC numbers, and other appropriate technical indicators or references. The expiry date must also appear on the containers

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|---|---|
| <p>1.11 Environmental Requirements</p> | <ul style="list-style-type: none"> .1 Maintain temperature and humidity recommended by the materials manufacturer before, during and after installation. .2 Only spray the insulating material if the surface and ambient air temperatures are within the manufacturer's prescribed limits, i.e., - 10°C to +35°C (+14°F to +95°F). .3 Surfaces to be covered with polyurethane foam must be clean and dry, as required by CAN / ULC-S705.2. Since adhesion of the polyurethane foam is of the utmost importance, the substrate must be free of all frost, dust, oil, grease, oxidization, or any other element that may affect this property, nor should it present a high moisture content. .4 Metallic surfaces should be checked to ensure no oxidization has occurred. Use of a primer is strongly recommended. \ .5 Use the transition membranes listed in the CCMC report, air barrier system #12932-R. Contact manufacturer if other membranes are to be utilized. These membranes should be installed in compliance with the manufacturer's recommendations. Adhesion of the insulation material to the substrate must be sufficient to resist the stress applied by the polyurethane foam during the curing time (in summer, ± 24 hours and in winter, ± 48 hours). .6 All of the following stages must be completed before spraying on the foam: <ul style="list-style-type: none"> .1 anchoring to masonry .2 furring, unfinished window frames .3 all mechanical and electrical work |
| <p>1.12 Coordination</p> | <ul style="list-style-type: none"> .1 Coordinate the work of this section with all sections referencing this section. |
| <p>1.13 Warranty</p> | <ul style="list-style-type: none"> .1 Warrant work of this section against defects or deficiencies for a period of two years from date Work is certified as substantially complete in accordance with General Condition of the Contract. .2 Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period. |

2.1 Materials

- .1 Insulation: a spray polyurethane foam listed under CAN / ULC-S705.1-15, with CCMC #12840-R for insulation and CCMC #12932-R for the **air barrier system**, according to CCMC technical manual #07272, with the following physical properties:
 - Density (ASTM D-1622) = 28.9 kg/m³ (1.8 lb/ft.³), minimum - Thermal resistance approved by the standard
 - Long Term Thermal Resistance (LTTR) RSI 3.87 (R22) @103mm (4.1")
 - Dimensional stability (ASTM D-2126), % volume change after 28 days = 0.2% at -20°C, 1.7% at +80°C with relative humidity >90±3%.
 - Flame spread classification (CAN /ULC S102, including S127) = 375
 - Compressive strength (ASTM D-1621), 10% parallel to rise = 201 kPa (29 psi). -Tensile strength (ASTM D-1623) = 325 kPa (47 psi) -Open cell content (ASTM D-2856) = 6% -Water absorption (ASTM D-2842) by volume = 0.6%
 - Smoke determined = 288 -VOC results during the curing period were **below the detectable limit after 24 hrs.**
 - Product reference: WALLTITE XL01 by BASF Canada, or approved equivalent
- .2 Primers: As recommended in the BASF Technical Manual, taking into account the type and condition of work surfaces.

2.1 Equipment, Quantities & Spraying

- .1 Spraying should be done using a positive displacement pump with preset ratios specially designed for use with rigid polyurethane foam. Follow the directions for use and the cleaning and maintenance procedures set out in the equipment manufacturer's manual.

PART 3 - EXECUTION

3.1 Applicators

- .1 Certified CUFCA spray foam Contractors as licensed by BASF.

3.2 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.
- .2 Examine joints before sealing to ensure configuration, surfaces and widths are suitable for foam sealant. Report in writing the

locations of joints which are deemed unacceptable for the application of joint sealant.

3.3 Preparation

- .1 Surfaces to receive foam insulation 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, mill scale and other contaminants which will affect adhesion and integrity of the foam insulation 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.

3.4 Application

- .1 Apply foam insulation in strict accordance with manufacturer's written instructions, specifications or recommendations, along complete building perimeter.
- .2 Apply foam insulation only when surfaces and ambient temperatures are within limits prescribed by the material manufacturer.
- .3 Fill joints with foam sealant making allowances for post expansion of foam.
- .4 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.
- .5 Apply foam insulation to within the following tolerances: +6.4 mm (1/4"); - 0 mm of thicknesses indicated on drawings.
- .6 Finished spray foam insulation shall be free of voids and imbedded foreign materials.
- .7 Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.
- .8 Remove over-spray and masking materials immediately after

foam has cured to hard surface film.

- .9 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.
- .10 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 caused the damage.

END OF SECTION 07216

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Application of an under-slab soil gas barrier to all concrete slab-on grade, and around elevator pit foundation.

1.02 RELATED SECTIONS

- A. Section 03300 - Concrete.
- C. Section 09850 – Gym Wood Flooring.
- D. Section 09660 - Resilient Flooring.

1.03 REFERENCES

- A. ASTM D1434: Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.
- B. ASTM D1709: Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- C. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.
- D. ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
- E. ASTM E1643: Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- F. ASTM E1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- G. ASTM F1249: Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- H. K124/02/95: Determination of Radon Transmittance.

1.04 SUBMITTALS

- A. Comply with Section 01340 - Submittal Procedures.
- B. Submit manufacturer's product data and application instructions.

1.05 QUALITY ASSURANCE

- A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the soil gas barrier.
- B. Obtain gas barrier materials from a single manufacturer regularly engaged in manufacturing the product.

- C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Protect materials during handling and application to prevent damage or contamination.
- D. Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 85" (220 cm).

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Do not apply on frozen ground.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

- A. Soil Gas Barrier
 - 1. Performance-Based Specification: Gas barrier membrane shall be a seven layer co-extruded barrier manufactured from polyethylene and ethylene vinyl alcohol (EVOH) resins, meeting the shall meet the following minimum performance requirements:
 - a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
 - i. As received: 0.0098 perms.
 - ii. After Wetting and Drying: 0.0079 perms.
 - iii. Resistance to Plastic Flow and Temperature: 0.0079 perms.
 - iv. Effect Low Temperature and Flexibility: 0.0097 perms.
 - v. Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0113 perms.
 - b. Puncture Resistance, ASTM D1709: 2,600 grams.
 - c. Tensile Strength, ASTM E154, Section 9: 58 Lb. Force/Inch.
 - d. Radon Diffusion Coefficient, k124/02/95: $<1.1 \times 10^{-13} \text{ m}^2/\text{s}$.
 - e. Methane Permeance, ASTM D1434: $3.68 \times 10^{-12} \text{ GTR}$.
 - f. Aqueous Phase Film Permeance
 - i. Benzene Permeance: $1.57 \times 10^{-10} \text{ m/s}$.
 - ii. Toluene Permeance: $2.18 \times 10^{-10} \text{ m/s}$.
 - iii. Ethylbenzene Permeance: $1.71 \times 10^{-10} \text{ m/s}$.
 - iv. M & P Xylenes Permeance: $1.62 \times 10^{-10} \text{ m/s}$.
 - v. O Xylene Permeance: $1.53 \times 10^{-10} \text{ m/s}$.

2. Proprietary-Based Specification:
 - a. PERMINATOR EVOH by W. R. MEADOWS.

2.03 ACCESSORIES

- A. Double Sided Seam Tape
 1. Double sided butyl tape for overlap sealing in gas barrier installations. Minimum width 2" (50 mm).
 - a. PERMINATOR EVOH BUTYL TAPE by W. R. MEADOWS.
- B. Pipe Collars
 1. Construct pipe collars from gas barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION**3.01 SURFACE PREPARATION**

- A. Prepare surfaces in accordance with project requirements.
- B. Level, tamp, or roll earth or granular material beneath the slab base.

3.02 EXAMINATION

- A. Examine surfaces to receive membrane. Notify consultant if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.03 INSTALLATION

- A. Vapor Barrier
 1. Install the vapor barrier membrane in accordance with manufacturer's instructions and ASTM E1643.
 2. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
 3. Lap vapor barrier over footings and seal to foundation walls with 4" (100 mm) seam tape.
 4. Overlap joints 6" (152 mm) and seal with 4" (100 mm) seam tape and roll press into place.
 5. Seal all penetrations (including pipes) with manufacturer's written installation procedures.
 6. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
 7. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6" (150 mm) and taping all four sides with tape.

B. Soil Gas Barrier

1. Install the gas barrier membrane in accordance with manufacturer's instructions and ASTM E1643.
2. Unroll gas barrier membrane with the longest dimension parallel with the direction of the pour.
3. Lap gas barrier over the footing and seal to foundation walls with 2" (50 mm) double sided butyl tape and roll press into place with rubber roller.
4. Apply gas barrier seam tape to the terminated edge of the gas barrier membrane and onto the concrete foundation.
5. Roll press into place.
6. Joint Overlap
 - a. Apply double sided butyl tape 6" (150 mm) from the termination of the gas barrier membrane and press into place.
 - b. Overlap the next layer of gas barrier membrane 12" (300 mm) and roll press into place.
 - c. Apply gas barrier seam tape centered over the joint and roll press into place.
7. Repair of Damaged Areas
 - a. Cut out damaged area of gas barrier membrane allowing for an overlap of 12" (300 mm) in all directions.
 - b. Apply double sided butyl tape 6" (150 mm) from the cut edges of the gas barrier membrane in all directions and press into place.
 - c. Place the new piece of gas barrier membrane overlapping the existing areas a minimum of 12" (300 mm) and roll press into place.
 - d. Apply 4" (100 mm) gas barrier seam tape centered over the joint in all directions and roll press into place.

END OF SECTION

PART 1 - GENERAL**1.1 General Requirements:**

- .1 The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.
- .2 The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

1.2 Description of Work:

This division applies to the provision of 'air barriers, vapour barriers, moisture barriers, transition membrane' and similarly named membranes referred to on the Architectural drawings including (without strict limitation to) the following:

- .1 Supply labour, materials, plant, tools and equipment to complete the Work as shown on the Drawings and as specified herein to bridge and seal the following air leakage pathways and gaps:
 - 1. Connections of the walls to the roof air barrier.
 - 2. Connections of the walls to the foundations.
 - 3. Seismic and expansion joints.
 - 4. Openings and penetrations of window and door frames, curtain wall etc.
 - 5. Piping, conduit, duct and similar penetrations
 - 6. Masonry ties, screws, bolts and similar penetrations.
 - 7. All other air leakage pathways in the building envelope.
- .2 Materials and installation methods of the primary air/vapour & rain barrier membrane system on applicable substrates, behind specified cladding materials.
- .3 Materials and installation methods of damp-proof coursing and through-wall flashing membranes.
- .4 Materials and installation methods for the adhesion of rigid and semi-rigid insulating materials.

1.3 Related Sections:

- | | | |
|----|-------------------------|---------------|
| .1 | Metal Siding: | Section 07460 |
| .2 | Built Up Roofing: | Section 07510 |
| .3 | Steel Doors and Frames: | Section 08100 |
| .4 | Aluminum Windows: | Section 08150 |

1.4 REFERENCES

- .1 The following standards are applicable to this section:
 - .1 ASTM E2178: Standard Test Method for Air Permeance of Building Materials.
 - .2 ASTM E283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .3 E1677 Specification for Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
 - .4 ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - .5 ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

- .6 ASTM E96: Water Vapor Transmission of Materials.
- .7 CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced.
- .8 ASTM 2357 certifying the air leakage and vapour permeance rates for assembly.

1.5 Submittals

- .1 Submit documentation from an approved independent testing laboratory certifying the air leakage rates of the air barrier membranes assembly, including primary membrane, adhesive, primer and sealants have been tested to meet ASTM E 2357. Submittal to include testing for both regular and low temperature grades on both porous and sheathing substrates.
- .2 Submit documentation from an approved independent testing laboratory certifying the air leakage and vapour permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the requirements of the Massachusetts Energy Code and in accordance with ASTM E2178.
 - 1. Test report submittals shall include test results on porous substrate and include sustained wind load and gust load air leakage results.
 - 2. Test reports to be provided for both regular and low temperature grades.
- .3 Prior to commencing the Work, submit documentation from an approved independent testing laboratory certifying that the air leakage and vapour permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the requirements of the National Building Code.
- .4 Prior to commencing the Work submit copies of manufacturers' current ISO certification. Membrane, primers, sealants, adhesives and associated auxiliary materials shall be included.
- .5 Prior to commencing the Work submit references clearly indicating that the membrane manufacturer has successfully completed projects on an annual basis of similar scope and nature for a minimum of fifteen years. Submit references for a minimum of ten projects.
- .6 Prior to commencing the Work submit manufacturers' complete set of standard details for the air barrier membrane systems showing a continuous plane of air tightness throughout the building envelope.
- .7 Prior to commencing work provide material checklist complete with application rates & minimum thickness of primary membranes.

1.6 Quality Assurance

- .1 Submit in writing, a document stating that the applicator of the primary air/vapour barrier membranes specified in this section is recognized by the manufacturer as suitable for the execution of the Work.
- .2 Perform Work in accordance with the manufacturer's written instructions of the air/vapour barrier membrane and this specification.
- .3 Maintain one copy of manufacturer's written instructions on site.
- .4 At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the air/vapour barrier membrane manufacturers' representative.
- .5 Components used in this section shall be sourced from one manufacturer, including sheet membrane, air/vapour barrier sealants, primers, mastics and adhesives.

1.7 Mock-Up

- .1 Construct mock-up in accordance with Section 01340 - Shop Drawings, Product Data, Samples and Mock-ups.
- .2 Where directed by architect, construct typical exterior wall panel, 2 m long by 2 m wide,

incorporating substrate, window frame, attachment of insulation, and showing air/vapour barrier membrane application details.

- .3 Allow 48 h for inspection of mock-up by architect before proceeding with air/vapour barrier work. Mock-up may remain as part of the Work.

1.8 Delivery, Storage and Handling

- .1 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- .2 Store role materials on end in original packaging.
- .3 Store adhesives and primers at temperatures of 5 degrees C and above to facilitate handling.
- .4 Keep solvent away from open flame or excessive heat.
- .5 Protect rolls from direct sunlight until ready for use.

1.9 Co-ordination

- .1 Ensure continuity of the air/vapour barrier membrane system throughout the scope of this section.

1.10 Alternates

- .1 Submit requests for alternates in accordance with Section 01005.
- .2 Alternate submission format to include:
 - .1 Submit evidence that alternate materials meet or exceed performance characteristics of Product requirements as well as documentation from an approved independent testing laboratory certifying that the air leakage and vapour permeance rates of the air/ vapour barrier membranes, including primary membrane and transition sheets, exceed the requirements of the National Building Code, ASTM E 2357, the Massachusetts Energy Code and in accordance with ASTM E 2178.
 - .2 Submit copies of the manufacturers' current ISO certification.
 - .3 Submit references clearly indicating that the membrane manufacturer has successfully completed projects on a annual basis of similar scope and nature for a minimum of fifteen years.
 - .4 Submit manufacturers' complete set of standard details for air/vapour barrier membrane systems showing a continuous plane of air tightness throughout the building envelope.
 - .3 Submit requests for alternates to this specification a minimum of ten (10) working days prior to tender closing for evaluation. Include a list of ten projects executed over the past ten years.
 - .4 Acceptable alternates will be confirmed by addendum. Substitute materials not approved in writing prior to tender closing shall not be permitted for use on this project.

1.11 Warranty

- .1 Provide manufacturer's standard 5-year material warranty.

PART 2: PRODUCTS

- 2.1 Air/vapour barrier membrane components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.
- 2.2 Membrane Manufacturer: **Henry** or pre-approved alternate.
- 2.3 Membranes
- .1 Primary sheet air/vapour barrier membrane shall be Blueskin® SA manufactured by Henry, a SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film. For application temperatures down to -12 °C use Blueskin® SA LT. Membrane shall have the following physical properties:
 - .1 Thickness: 1.0 mm (40 mils),
 - .2 Air leakage: <0.005 L/s.m² @ 75 Pa to ASTM E283-91,
 - .3 Tested to ASTM E 2357 for the air barrier assembly,
 - .4 Water vapour permeance: 1.6 ng/Pa.m².s (0.03 perms) to ASTM E96,
 - .5 Low temperature flexibility: -30 °C to CGSB 37-GP-56M,
 - .6 Elongation: 200% to ASTM D412-modified.
 - .2 Through-wall flashing membrane and dampproof course (Self-Adhering) shall be Blueskin® TWF manufactured by Henry, a SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, having the following physical properties:
 - .1 Colour: Yellow,
 - .2 High Temperature Stability: 110 degrees C min. to ASTM D5147 (resistance to flow)
 - .3 Thickness: 1.0 mm (40 mils),
 - .4 Air leakage: <0.005 L/s.m² @ 75 Pa to ASTM E283-91,
 - .5 Water vapour permeance: 1.6 ng/Pa.m².s (0.03 perms) to ASTM E96,
 - .6 Low temperature flexibility: -30 °C to CGSB 37-GP-56M.
 - .3 Primary water resistive air barrier membrane and window flashing on plywood backing shall be Blueskin VP160 manufactured by Henry; a self-adhering reinforced modified polyolefin tri-laminate (Blue) sheet air barrier membrane for wall construction, specifically designed to be water resistant and vapour permeable. Patented adhesive backing to be protected with a 2 piece release film. Membrane shall have the following physical properties:
 - .1 Air leakage: <0.02L/s/m² @ 75Pa [$<0.004 \text{ CFM/ft}^2$ @ 1.57 lbs/ft^2] when tested in accordance with ASTM E 2178.
 - .2 Water Vapour Permeance: 1658 ng/Pa.m².s (29 perms) to ASTM E96, Method B - Desiccant Method.
 - .3 Tested to ASTM E 2357 for Air Leakage of Air Barrier Assemblies.
 - .4 Resistance to Water Penetration: Pass ICC-ES AC 38.
 - .5 Water Penetration Resistance around Nails: Pass when tested to AAMA 711-05 & ASTM D 1970 modified.
 - .6 Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84: Flame Spread Rating of 0 and Smoke Development Classification of 105.
 - .7 Basis Weight: 120 g/m², when tested in accordance with TAPPI Test Method T-410.
 - .8 Tensile Strength: 182N MD and 129N CD per ASTM D828.
 - .9 Average Dry Breaking Force: 565N MD, and 405N CD per ASTM D 5034.
 - .10 Cyclic and Elongation: Pass at 100 cycles, -29 deg C. (-20 deg F.) per ICC-ES AC 48.
- 2.4 Adhesive and Primers
- .1 Adhesive for self-adhering membranes at temperatures above -12 °C shall be Blueskin®

Adhesive manufactured by Henry, a synthetic rubber based adhesive, quick setting, having the following physical properties:

- .1 Colour: Blue,
 - .2 Weight: 0.8 kg/l,
 - .3 Solids by weight: 35%,
 - .4 Drying time (initial set): 30 minutes.
 - .2 Primer for self-adhering membranes at temperatures above -4 degrees C shall be Aquatac™
Primer manufactured by Henry, a polymer emulsion based adhesive, quick setting, having the following physical properties:
 - .1 Colour: Aqua,
 - .2 Weight: 1.0 kg/l,
 - .3 Solids by weight: 53%,
 - .4 Water based, no solvent odours,
 - .5 Drying time (initial set): 30 minutes at 50%RH and 20 degrees C.
 - .3 Adhesive for self-adhering membranes at temperatures above -12 °C shall be Blueskin® LVC
Adhesive a quick drying, lower volatile organic compound (VOC) formulation, rubber based adhesive designed to enhance the adhesion of self-adhesive membranes such as **Blueskin®**
 - .1 Colour: Blue
 - .2 Weight: 0.9 kg/l
 - .3 Solids By Weight: 40%
 - .4 VOC Content: < 250 g / L
 - .5 Drying Time (initial set): Approximately 30 minutes.
- 2.5 Mastics & Termination Sealants
- .1 Liquid air seal mastic and insulation adhesive shall be Air-Bloc 21 or 230-21 Insulation
Adhesive manufactured by Henry, a synthetic, trowel applied, rubber based adhesive, having the following characteristics:
 - .1 Compatibility: With air/vapour barrier membrane, substrate and insulation.
 - .2 Air leakage: 0.013 L/s.m² @ 100 Pa.,
 - .3 Water vapour permeance: 1.7 ng/Pa.m².s. (0.03 perms),
 - .4 Long term flexibility: CGSB 71-GP-24M,
 - .5 Chemical resistance: Alkalis and salt.
 - .2 Termination Sealant shall be HE925 BES Sealant manufactured by Henry, a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
 - .1 Compatible with sheet air barrier, roofing & waterproofing membranes and substrate,
 - .2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
 - .3 Complies with ASTM C 920, Type S, Grade NS, Class 25,
 - .4 Elongation: 450 - 550%,
 - .5 Remains flexible with aging,
 - .6 Seals construction joints up to 25mm wide.
 - .7 For use in concealed or exposed application.
 - .3 Termination Sealant shall be POLYBITUME® 570-05 Polymer Modified Sealing Compound manufactured by Henry, a polymer modified sealing compound having the following characteristics:
 - .1 Compatible with sheet waterproofing membrane and substrate,

- .2 Solids by volume: 70%,
- .3 Vapour permeance: 2.9 ng/Pa.m².s, ASTM E96,
- .4 Complies with CGSB 37.29,
- .5 Remains flexible with ageing,
- .6 Chemical resistance: Alkalies, calcium chloride, mild acid and salt solutions.

PART 3: EXECUTION

3.1 Examination

- .1 Verify that surfaces and conditions are ready to accept the Work of this section. Notify consultant in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.
- .2 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush.
- .3 New concrete should be cured for a minimum of 14 days and must be dry before air/vapour barrier membranes are applied.
- .4 Where curing compounds are used they must be clear resin based without oil, wax or pigments.

3.3 Adhesive or Primer for Transition and Through-wall Flashing Membrane (Self-Adhering)

- .1 Apply adhesive or primer for self-adhering membranes at rate recommended by manufacturer.
- .2 Apply to all areas to receive transition sheet and / or through-wall flashing membrane, as indicated on drawings by roller or spray and allow minimum 30 minute open time. Surfaces not covered by self-adhering transition membrane or self-adhering through-wall flashing membrane during the same working day must be re-applied.

3.4 Transition Membrane (Self-Adhering)

- .1 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps.
- .2 Tie-in to window frames, aluminium screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials as indicated in drawings
- .3 Promptly roll all laps and membrane with a counter top roller to effect seal.
- .4 Ensure all preparatory work is complete prior to applying liquid applied air vapour barrier membrane.

3.5 Through-wall Flashing Membrane & Dampproof Course (Self-Adhering)

- .1 Apply through-wall flashing and dampproof coursing membrane in accordance with CSA A371-94 Masonry Construction for Buildings; along the base of masonry veneer walls, over windows, doors and other wall openings required to be protected.
- .2 Applications shall form a continuous flashing membrane and shall extend up a minimum of 200 mm up the back-up wall.
- .3 At the end of each days work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel apply a feathered edge to seal termination and shed water.
- .4 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. At locations where flashing terminates or intersects wall openings including

door frames, “end dam” flashing to protect openings and redirect water out. Trim off excess as directed by the consultant.

- .5 Apply dampproof coursing membrane over slabs on grade, prepare and prime surfaces, align and position membrane between slab and masonry block work.
- .6 Align and position the leading edge of self-adhering through-wall flashing membrane with the front horizontal edge of the foundation walls, self angles and other substrates to be protected, partially remove protective film and roll membrane over surface and up vertically.
- .7 Press firmly into place. Ensure minimum 50 mm overlap at all end and side laps. Promptly roll all laps and membrane to affect the seal.
- .8 Ensure all preparatory work is complete prior to applying self-adhering through-wall flashing membrane.
- .9 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. Trim off excess as directed by the consultant.

3.6 Air/Vapour Barrier Membrane

- .1 Apply self-adhering membrane complete and continuous to prepared and primed substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
- .2 Align and position self-adhering membrane, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps. Promptly roll all laps and membrane with a counter top roller to affect the seal.
- .3 At the end of each days work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel apply a feathered edge to seal termination and shed water.
- .4 Tie-in to window frames, aluminium screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials as indicated in drawings. Refer to manufacturers' standard details.
- .5 Ensure all projections, including wall ties, are properly sealed with a caulk application of liquid air seal mastic.
- .6 Mechanically fasten membrane through securement bars to all window, door, louvers and curtain wall sections as recommended by membrane manufacturer where proper adhesion and bonding cannot be maintained.
- .7 Membrane applied to the underside of substrate surfaces shall receive special attention on application to ensure maximum surface area adhesion is obtained.

3.7 Installation of Insulation

- .1 Co-ordinate with Cavity Wall Insulation Section 07216 for insulating materials.
- .2 Upon the curing of the air/vapour barrier membrane system apply the liquid air seal mastic and insulation adhesive in a serpentine pattern over completed air/vapour barrier membrane system.
- .3 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.
- .4 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.

3.8 Inspection

- .1 Notify consultant when sections of work are complete so as to allow for review prior to installing insulation.

3.9 Protection of Finished Work

- .1 Air-Bloc and Blueskin® membranes are not designed for permanent exposure. Product designed to withstand reasonable job site exposure, however good practice calls for covering as soon as possible.
- .2 Damp substrates must not be inhibited from drying out. Do not expose the backside of the substrate to moisture or rain.
- .3 Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane. Drying time varies depending on temperature and relative humidity.
- .4 Air barrier membranes are not designed for permanent exposure. Good practice calls for covering as soon as possible.

END OF SECTION 07261

PART 1 - GENERAL

- | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---------------|---------------------|---------------|----|-------------------|---------------|----|--|---------------|----|--------------------------|---------------|----|--|---------------|----|---------------------------------------|---------------|----|------------------------|---------------|----|-----------------------|---------------|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.2 Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:</p> <ul style="list-style-type: none"> .1 Work of this Section shall include design, fabrication, supply and installation of all aluminum composite panel items as noted on architectural drawings (including without strict limitation to: wall panels, canopy edges, eyebrows, soffit returns, decorative profiles etc.). .2 Supply and installation of metal framing system associated with support and attachment of the aluminum composite panel [ACP] system [including but not limited to adjustable z-girts, mounting clips, metal hat channels, gusset anchors etc.] | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.3 Related Work | <table border="0" style="width: 100%;"> <tr> <td style="width: 5%;">.1</td> <td style="width: 85%;">Steel Stud framing:</td> <td style="width: 10%;">Section 09111</td> </tr> <tr> <td>.2</td> <td>Structural steel:</td> <td>Section 05120</td> </tr> <tr> <td>.3</td> <td>Self-Adhered Membrane/Air Vap. Barrier</td> <td>Section 07261</td> </tr> <tr> <td>.4</td> <td>Prefinished Metal Soffit</td> <td>Section 07465</td> </tr> <tr> <td>.5</td> <td>Aluminum Curtain Wall, Windows & Doors</td> <td>Section 08150</td> </tr> <tr> <td>.6</td> <td>Spray-in-Place Insulation Air Barrier</td> <td>Section 07216</td> </tr> <tr> <td>.7</td> <td>Concrete Masonry Units</td> <td>Section 04220</td> </tr> <tr> <td>.8</td> <td>Vertical Metal Siding</td> <td>Section 07460</td> </tr> </table> | .1 | Steel Stud framing: | Section 09111 | .2 | Structural steel: | Section 05120 | .3 | Self-Adhered Membrane/Air Vap. Barrier | Section 07261 | .4 | Prefinished Metal Soffit | Section 07465 | .5 | Aluminum Curtain Wall, Windows & Doors | Section 08150 | .6 | Spray-in-Place Insulation Air Barrier | Section 07216 | .7 | Concrete Masonry Units | Section 04220 | .8 | Vertical Metal Siding | Section 07460 |
| .1 | Steel Stud framing: | Section 09111 | | | | | | | | | | | | | | | | | | | | | | | |
| .2 | Structural steel: | Section 05120 | | | | | | | | | | | | | | | | | | | | | | | |
| .3 | Self-Adhered Membrane/Air Vap. Barrier | Section 07261 | | | | | | | | | | | | | | | | | | | | | | | |
| .4 | Prefinished Metal Soffit | Section 07465 | | | | | | | | | | | | | | | | | | | | | | | |
| .5 | Aluminum Curtain Wall, Windows & Doors | Section 08150 | | | | | | | | | | | | | | | | | | | | | | | |
| .6 | Spray-in-Place Insulation Air Barrier | Section 07216 | | | | | | | | | | | | | | | | | | | | | | | |
| .7 | Concrete Masonry Units | Section 04220 | | | | | | | | | | | | | | | | | | | | | | | |
| .8 | Vertical Metal Siding | Section 07460 | | | | | | | | | | | | | | | | | | | | | | | |
| 1.4 Quality Assurance | <ul style="list-style-type: none"> .1 Supplier/installer shall have minimum 15 years proven experience and must have completed at least 5 major projects (projects of equivalent or greater value) in the specified aluminum composite material panel system. | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 Design and Performance Requirements | <ul style="list-style-type: none"> .1 Design, fabricate and erect a pressure equalized wall panel system to meet the following requirements. <ul style="list-style-type: none"> a) Rain Penetration: prevent rain penetration through the wall system. Design system based on "Rain Screen Principle", incorporating means of draining to the exterior. b) Wind Load: Design wall systems to resist wind loads, positive and negative, expected in this geographical region (OBC climatic data, 30 years probability) with maximum deflection of 1/180 of span and without | | | | | | | | | | | | | | | | | | | | | | | | |

causing rattling, vibration or excessive deflection of panels, overstressing of fasteners, clips and other detrimental effects on system.

1.5 Design and Performance Requirements (Cont'd)

- c) Structural and Thermal Movement: Accommodate movement of supporting structural framing and movement caused by thermal expansion and contraction of system component parts without causing bowing, buckling, delamination, oil canning, failure of joint seals, excessive stress on fasteners or any other detrimental effects.
- .2 Panel flatness tolerance: Fabricate panels not exceeding the following tolerances:
 - a) Rises and falls across panel, (local bumps and depressions) will not be accepted.
 - b) 080" (2mm) in a concave/convex direction, measured perpendicular to normal plane.
- .3 Panel removal: System/procedure to allow removal of individual panels within wall system.
- .4 Maximum deviation from vertical and horizontal alignment of erected panels: 1/4" in 20'-0" (6mm in 6m).
- .5 Testing: Provide wall assembly that has been tested and certified to conform to the following criteria:
 - a) Air Leakage: Not more than 0.006 (cfm)/sf of wall area (.003(L/s) m², when tested at 6.24 psf (300 Pa) in accordance with ASTM E283.
 - b) Water Penetration: No water infiltration under static pressure when tested in accordance with ASTM E331 at a pressure level of 14.61 psf (700 kPa) minimum, after 15 minutes.
 - a) Water penetration is defined as the appearance of uncontrolled water in the wall.
 - b) Wall design shall feature provisions to drain to the exterior face of the wall any leakage of water at joints and any condensation that may occur within the construction.
 - c) Structural: Provide systems that have been tested in accordance with ASTM E330 at a design pressure of 65 psf(3.12 kPa) and have been certified to be without permanent deformation of failures of structural

members.

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| 1.6 Samples | .1 | Submit samples in accordance with Section 01340. |
| | .2 | Submit duplicate, minimum 5" x 7" samples of each colour selected. |
| 1.7 Shop Drawings | .1 | Submit shop drawings in accordance with Section 01340. |
| | .2 | Indicate elevations, profiles, dimensions and thickness of panels and joint details. |
| | .3 | Indicate attachment clips, system extrusions, fastening, anchor and installation details. |
| 1.8 Maintenance Data | .1 | Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual. |
| 1.9 Mock-up | .1 | Submit mock-up in accordance with Section 01340. |
| | .2 | Erect mock-up panel approximately 10' long x 10' high in location as directed by Engineer. |
| | .3 | Mock-up panel shall include all components of the wall system and will be incorporated into work once approved. |
| 1.10 Product Delivery, Handling and Storage | .1 | Protect panel face with a plastic film adhered to panel in accordance with panel manufacturer's recommendation. |
| | .2 | Store components and materials in accordance with panel manufacturer's recommendations. |
| 1.11 Kynar Panel Finish Warranty | .1 | Provide a manufacturer's written warranty: Furnish panel manufacturer's written warranty covering failure of factory-applied exterior finish on composite metal panels within the warranty period; warrant finish per ASTM D4212 for chalk not in excess of 8 NBS units and fade not in excess of 5 NBS units per ASTM D2244. Warranty period for finish; 30 years after the date of substantial completion. |
| 1.12 Material and Workmanship Warranty | .1 | Warranty against defects or deficiencies shall be for a period of one year from date of substantial completion |

PART 2 - PRODUCTS

2.1 Panels

.1 Aluminum Composite Panels (ACP):

- .1 Composition: Two sheets of aluminum sandwiching a core of extruded thermoplastic, formed in a continuous process without the use of glues or adhesives between dissimilar materials. Bond integrity testing to adhere to ASTM D1781-76.
- .2 Aluminum face sheets: aluminum alloy 3003, thickness: 0.020" (0.51mm)
- .3 Panel thickness: 4 mm (.157")
- .4 Panel weight: 1.12 lbs/sq. ft. (5.5 kg/sq. m.)
- .5 Tolerances:
 - a) Panel bow: Maximum 0.8% of panel dimension (width or length).
 - b) Panel Dimensions: Take site measurements before proceeding with production unless dimensions can be guaranteed by General Contractor.
 - c) Panel lines, breaks and angles to be sharp and true; panel surfaces to be free from warp or buckle.
- .6 Panel System: Dry joint SL-2000 with 0.5" (12.5mm) wide panel joints using proprietary aluminum extrusions. Custom internal, triangular-shaped, support Gussets to be included & engineered by ACM Fabricator where detailed at canopy, parapet cornices or other conditions, as required.
- .7 Acceptable material and manufacturer:
 - .1 Reynobond aluminum composite panels as formed, supplied and installed by Sobotec Ltd., 67 Burford Rd., Hamilton Ontario, L8E 3C6 Tel. (905) 578-1278 [or approved equivalent prior to close of Tender]
- .8 **Panel Sizes & Shapes:**
Panel sizes & shapes to be as shown on the Architectural drawings throughout.

Note positions of panel joints relative to and/or aligned with adjacent architectural features as shown on Elevations and related drawings. Joint locations and panel sizes to be as shown on Architectural drawings.

Panel supplier to site measure prior to fabrication to verify dimensions and panel joint locations where shown.

Specialty panel shapes and profiles to be as per Architectural drawings.

2.1 Panels (Cont'd) .2 ACP PANEL FINISH/COLOURS:Finish:

Kynar, two/three coat, coil-coated baked enamel finish containing Kynar 500 or Hylar 5000 polyvinylidene fluoride resins. AAMA 2605 finish performance standard offering 30-year warranty; lowest finish sheen available [matte finish]

Colours:

ACP-1: Reynobond 'Design Line' series in colour 'French Walnut'

ACP-2: Reynobond 'Design Line' series in colour 'Tender Oak'

Pattern Note:

ACP-1 and ACP-2 are woodgrain products. In all installations, the visual pattern [i.e. grain] is to run vertically throughout.

Ensure continuity of the grain between vertically stacked ACP panels so that finished installation appears to be cut from a single piece of wood [as may be possible].

Coordinate joint locations between panels where shown on architectural drawings [or as indicated therein] relative to surrounding architectural features.

.3 Panel and Wall Accessories:

- .1 Provide proprietary aluminum extrusions to manufacturer's standard profiles for a complete installation.
- .2 Fasteners: as recommended by the panel manufacturer, concealed and non-corrosive.
- .3 Extrusions and extrusion clips for attaching panels to the sub-structure: purpose made aluminum. Extrusions shall be full length around panel perimeter for panel reinforcement and alignment. Intermittent clips are unacceptable.
- .4 Plastic shims, shall be used as thermal separator between extrusions and sub-girts.
- .5 Sub-girts: To be manufactured from G-90 galvanized steel and shall be designed to accommodate expansion and contraction, dynamic movements and design load requirements.
- .6 Joint filler strip: same material and colour as panels. Use of caulking at joints is not acceptable.

PART 3 - EXECUTION

- 3.1 Wall Panel System**
- .1 Before proceeding, examine work of other sections upon which this section depends.
 - .2 Install subgirts/spacers straight, true and plumb to support the work.

Install galvanized metal clips [running vertically] in depth to suit the intended application prior to application of spray-foam insulation.

Following installation of spray-foam insulation, install continuous vertical z-girts, mechanically fasted to face of clips protruding beyond finished face of insulation.

Z-girts and related support clips to run at 16" -24" on centre vertically [or in alternate orientations] as recommended by cladding manufacturer recommendations.

Ensure that finished face of ACP panels relates to finished faces of surrounding cladding materials as indicated on the architectural drawings. Ensure selection of subgirt support items [in related/appropriate dimensions] to ensure the intended final offset of the ACP relative to surrounding materials.
 - .3 Erect panels and joint filler strip in accordance with system manufacturer's details and instructions to meet specified design criteria and performance.
 - .4 Finished work shall be securely anchored, free of distortion and surface imperfections, uniform in colour.
 - .5 Use concealed fastenings only.
 - .6 Install panels plumb, true, level and in alignment to established lines and elevations.
- 3.2 Clean-up**
- .1 Remove protective film from panels.
 - .2 Repair and touch-up with colour matching high grade enamel minor surface damage.
 - .3 Replace damaged panels and components which cannot be satisfactorily repaired.

PART 1 - GENERAL

- 1.1 General** Division One, General Requirements, is part of this section and shall apply as is repeated here.
- 1.2 Description of Work** Provide all labour, materials, and equipment required or called for in this specification, and as shown on the drawings or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:
- .1 Prefinished vertical metal siding [in types as specified herein] including all exterior-grade z girts, furring channels [and related sub-structure support items], starter strips, inside and outside corners, edging, drips, caps, flashings, trims, sealants, etc. as required for a complete installation.
- 1.3 Standards and Design Criteria** Design cladding system in accordance with:
- .1 Canadian Sheet Steel Building Institute Standards.
 - .2 National Building Code of Canada
 - .3 Deflection of the cladding system is not to exceed 1/180th of the span for the specified dead loads, wind and suction forces acting on it.
 - .4 Design expansion joints to accommodate movement in cladding and between cladding and structure, to prevent permanent distortion or damage to the cladding.
 - .5 Design wall system to maintain the following erection tolerances:
 - a) Maximum variation from plane or location shown on shop drawings: 20mm/10m (3/4 inch/30 feet).
 - b) Maximum offset from true alignment between two adjacent members abutting end to in line: 1.00mm (0.04 inches).
- 1.4 Related Work**
- .1 Rough Carpentry Section 06100
 - .2 Prefinished Metal Flashing & Sheet Metal Section 07620
 - .3 Air/Vapour Barrier Membrane & Insulation Section 04220
 - .4 Aluminum Composite Panels Section 07460
 - .5 Masonry Veneer Section 04230
 - .6 Concrete Masonry Units Section 04220
 - .7 Aluminum Curtain Wall, Window & Doors Section 08150
- 1.5 References**
- .1 CSA B35.3-1962 Tapping and Drive Screws Slotted and Recessed head, Thread Forming and Thread Cutting Screws, and Metallic Drive Screws.
 - .2 CGSB 93-GP-4M-78 Siding, Soffits and Fascia, Steel, Galvanized, Prefinished.

- 1.6 Samples**
- .1 Submit samples in accordance with Section 01340 - Submittals.
 - .2 Submit duplicate 300 x 300 mm samples of siding material, colour and profile to be selected by Architect.
- 1.7 Quality Assurance and Substitutions**
- .1 Manufacturer of cladding, and installer shall demonstrate at least five years experience in projects similar in scope.
 - .2 This section establishes the standard of quality required for the cladding system. Proposed substitutions must meet this standard, and will be considered as follows:
 - a) A written request for approval of a substitution is received at least ten (10) days prior to tender closing.
 - b) 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.
- 1.8 Shop Drawings**
- .1 Submit shop drawings in accordance with Section 01340.
 - .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, and related work.
 - .3 Each shop drawing shall be stamped by a Professional Engineer.
 - .4 Submit samples of prefinished metal cladding for review by the consultant, prior to fabrication.
- 1.9 Handling and Protection**
- .1 Store cladding products in accordance with manufacturer's recommendations, and protected from elements.
 - .2 Protect prefinished steel during fabrication, transportation, site storage and erection, in accordance with CSSBI Standards.

PART 2 - PRODUCTS

2.1 Prefinished Metal Siding

Supply and installation of the following metal siding items:

.1 **Vertical Metal Siding # (VMS-#):**

Fabricate all vertical metal siding and related trims from zinc-coated steel, to ASTM-A446 Grade "A" with G90 zinc coating with rust-inhibition, anti-fade, anti-corrosion, anti-peeling and anti-chalking painted finish.

All vertical metal siding to be fabricated of sheet steel finished in 'Perspectra Plus Series' finish [silicone-modified polyester topcoat] conforming to the following standards:

film thickness: 1.0 mils (ASTM D5796)
film cure: ASTMD5402
film hardness: ASTM D3363
film adhesion: ASTM D4145
film gloss: ASTM D523
film flexibility: ASTM D4145
adhesion impact: ASTM D2794
humidity resistance: ASTM D2247
finish coating: Class F1S [finished 1 side]
base steel thickness: 0.030
metal standard: CGSB 93-GP-4M, CSA S136-01

Vertical Metal Siding 1 [VMS-1]:

Panel Pattern: Agway HF-6NF [no flute]
Colour: QC 18-1028 Natural Zinc [Print Series]
Panel Width: 12"
Profile Depth: 1.5" [38 mm]

Vertical Metal Siding 2 [VMS-2]:

Panel Pattern: Agway HF-8F [with flute]
Colour: QC 11078 Light Pewter [Metallic Series]
Panel Width: 12"
Profile Depth: 1.5" [38 mm]

Vertical Metal Siding 3 [VMS-3]:

Panel Pattern: Agway HF-11F [with flute]
Colour: QC 28695 Cambridge White
Panel Width: 12"
Profile Depth: 1.5" [38 mm]

VMS-# installation patterns, locations and quantities are to be as shown on architectural drawings throughout.

Warranty on Perspectra Plus finish to be 40-years from date of supply related to cracking, peeling and blistering and 30-years from date of supply related to chalking and fade resistance all as per standard manufacturer's standard provisions.

.2 Trims & Accessories at Vertical Metal Siding:

Prefinished metal siding trims are to be used at all outside corners, inside corners, tops and bottoms of siding expanses (including required closures, edging strips, drips, sills, jambs, j-moulds etc.) between adjacent (differing) siding profiles and at decorative joints (at/between/adjacent to prefinished metal siding where shown on Architectural Building Elevations) and at all locations as required to ensure a fully finished product. All metal trims are to be provided by the metal siding manufacturer and are to be fully compatible with the siding profiles specified. All trims to be formed to provide positive water drainage to exterior of siding faces. Ensure the use of drip edge profile at underside of all horizontal trims.

Miscellaneous Finishing Trims:

Supply and install pre-formed finishing trims including [without strict limitation to] inside and outside corner trims, closure trims, edging trims, jamb trims, sill drips, j-trims, etc. [as required for a complete installation] in colour to match the adjacent/abutting VMS siding. Trims are to be fabricated of 24 gauge stock finished in the Perspectra Plus colours noted:

At VMS-1, miscellaneous trims to be finished in:
QC 18-1028 Natural Zinc [Print Series]

At VMS-2, miscellaneous trims to be finished in:
QC 11078 Light Pewter [Metallic Series]

At VMS-3, miscellaneous trims to be finished in:
QC 28695 Cambridge White

- .3** Supply and install all supporting metal sub-girts, furring strips, hat channels, spacers, flashings, trims and closures, fasteners etc. as required to complete the installation.

Z-girts, furring channels, related support clips etc. to run at centre-to-centre dimensions and in orientation direction as recommended by cladding manufacturer for the intended application.

Ensure that finished face of VMS panels relates to finished faces of surrounding cladding materials as indicated on the architectural drawings. Ensure selection of subgirt support items [in related/appropriate dimensions] to ensure the intended final offset of VMS cladding items relative to surrounding materials.

- .4** Sealants for exterior sheet (factory applied) flashings all to make the installation water tight.

- 2.2 Supporting Sub-Girts, Spacers and Integral Thermal Clips** .1 Minimum 1.2mm (0.048 inches) thick formed galvanized steel, ASTM A446 Grade A with Z275 zinc coating.
- 2.3 Fasteners** .1 **Concealed Fasteners at VMS-#:**
Concealed fasteners are to be set only into the concealed fastening flutes and/or fastener perforations and are to be small enough to permitting proper fit of adjacent interlocking pieces.
- Acceptable product:**
As recommended by the siding manufacturer for the intended application and siding type. Ensure use of self-sealing fasteners throughout, with J-1000 anti-corrosion plating/finish as supplied by Leland Industries Inc.
- Leland Industries Inc.**, 95 Commander Blvd., Toronto, M1S 3S9
tel: 1-416-819-6399
- NOTE:**
Metal siding supplier to ensure that all fastener components and metal composition is compatible (i.e. creates no galvanic corrosion) with all materials being bonded.
- 2.4 Accessories/Trims** .1 Flashing, Trim and Closures: Use only coil stock metal, pre-finished to match metal siding products (unless noted otherwise). Fabricate to profiles indicated on shop drawings and/or as required to meet performance requirements and to ensure positive drainage of rainwater away from cladding to the building exterior. Use preformed corner pieces only. Double- back (roll) exposed edges ensuring no sharp edges remain. Exposed trims including (without strict limitation to) inside corners, outside corners, cap strips, drip cap, undersill trim, starter strip trim are to be of the same material, colour and gloss-sheen as cladding (unless noted otherwise), with fastener holes pre-punched.
- Ensure the use of drip edges below all metal siding cladding situated above windows and door openings.***
- .2 Sealants:
.1 Concealed: Tape or compound, non-skinning, non-drying, butyl rubber.
.2 Exposed: One part silicone to CGSB 19-GP-18M. In accordance with Section 07900, Tremo 'Dymeric' Range.
- 2.5 Fabrication** .1 Fabricate wall components to comply with dimensions, profiles,

gauges and details as shown on the shop drawings, including fascia and soffit panels and all companion flashing.

- .2 Fabricate all components of the system in the factory, ready for field installation.
- .3 Provide cladding and all accessories in longest practicable length to minimize field lapping of joints.

3.1 Installation

- .1 Install all metal wall and roof cladding products in accordance with CGSB 93-GP-5M, and manufacturer's products written instructions respective to the intended application and all related design conditions.
- .2 Install grits, thermal clips and subgirts as required to suit.
- .3 Install continuous starter strips, inside and outside corners, edgings, drip, cap, sill and louvre opening flashings as indicated.
- .4 Install outside corners, fillers, and closure strips with carefully formed and profiled work.
- .5 Install fascia facings and exposed trim as indicated.
- .6 Maintain joints in exterior cladding as true to line, tight fitting, hairline joints.
- .7 Attach components in manner not restricting thermal movement.
- .8 Install all fasteners in quantities at centreline dimensions as recommended by the cladding manufacturer to suit the intended application.

NOTE: At all siding items with exposed fasteners, ensure that fasteners are installed plumb, true and aligned with each other. Following installation, all fasteners should look equally spaced and consistently aligned throughout. Ensure that all required sub-girts are installed to facilitate this final finished appearance.

- .9 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07900 - Sealants.

3.2 Final Touch-Up

- .1 Touch up minor paint abrasions with manufacturer approved touch-up paint.
- .2 Clean cladding by dry and/or wet wiping to ensure that it is free of dust and debris.

END OF SECTION 07465

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 DIVISION 1
- .2 Section 07900 - Joint sealers

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM 653/A A653M - 15e1 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM D 2369-10, Standard Test Method for Volatile Content of Coatings.
 - .3 ASTM D 2832-92(R2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .4 ASTM D 5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
 - .5 ASTM D 4214-07 (2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
 - .6 ASTM D 2244-16, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type..
 - .2 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.
 - .3 CAN/CGSB-93.4-92, Galvanized Steel and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.
 - .4 CGSB 93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.
- .4 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A247-96, Insulating Fibreboard.
 - .2 CSA B111-1974, Wire Nails, Spikes and Staples.
- .5 Underwriters Laboratories (UL)
 - .1 UL 2761, Sealants and Caulking Compounds
- .6 Underwriters Laboratories (Canada) ULC
 - .1 CAN/ULC-S706-09, STANDARD FOR WOOD FIBRE INSULATING BOARDS FOR BUILDINGS
 - .2 CAN/ULC-S741-08 STANDARD FOR AIR BARRIER MATERIALS - SPECIFICATION

1.3 SAMPLES AND PROJECT DOCUMENTATION

- .1 Data sheets
 - .1 Submit pre-finished steel/siding manufacturer's data sheets and pertinent technical documentation. Data sheets must contain product specifications, size, performance, limits and finishes.
- .2 Submit samples in accordance with [Division 01] [section 01330 - Submittal Procedures].
- .3 Submit duplicate] 12" x 12" samples of the specified siding and/or soffit products in the specified colour.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert used metal cut-offs from landfill by disposal [into the on-site metals recycling bin] [removed for disposal at the nearest metal recycling facility].
- .2 Divert reusable materials for reuse at nearest used building materials facility.
- .3 Divert unused caulking, sealants, and adhesive materials from landfill through disposal at hazardous material depot.
- .4 Separate and recycle waste materials in accordance with Section [01355 - Waste Management and Disposal], and with Waste Reduction Workplan.
- .5 Place materials defined as hazardous or toxic waste in designated containers.
- .6 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.1 TRANSPORT, HANDLING AND STORAGE

- .1 Transport store and handle the products per [Section 01 61 00 - Basic product requirements] [and] [Manufacturer's written instructions].
- .2 Delivery and reception: All materials and accessories to be delivered on site, in their original packaging, bearing the manufacturer's identification.
- .3 Upon receiving a shipment, proceed with an inspection to assess any potential damage related to transportation and to asses order fulfilling. Do not install any product that could have been damaged, or for which the paint or finish could have been altered during transport or handling.
 - .1 Installed materials and accessories are considered free of transport and handling related defect;
 - .2 Store [sidings] adequately to prevent [Scuff marks, graze and scratches]
 - .3 Replace all damaged materials and accessories with new ones.
- .4 Store siding and accessories in a dry, well ventilated place, inside, to manufacturer's recommendation.
- .5 If however siding and accessories are left outside, follow the manufacturer's recommendations, do not store in broad daylight and/or in freezing temperatures (protective plastic wrap might be difficult to remove and/or might leave glue residue).
 - .1 In order to mitigate any weather related damages, store under a protective tarp
- .6 Before any installation, keep materials and accessories above freezing temperatures for at least [24] [48] hours. Do not try to remove the protective wrap [in freezing temperatures] [under 0°C].
- .7 Handle siding packages strictly following written instructions. To prevent planar deformation, always lift the boxes short side up, not widthway.
- .8 Wear protective equipment, including gloves, safety goggles, hard hat and safety boots, in order to prevent injuries, as with the handling of any sheet metal products.

1.6 SITE CONDITIONS

- .1 Only carry out the work described in this section when the environmental conditions are within the manufacturer's recommended set regarding temperature, relative humidity and ventilation.
- .2 Do not install in areas subject to salt sprays or exposed to artificially or naturally occurring harsh chemicals.
- .3 Do not install within 1 000 meters from salt water.

1.7 WARRANTY

- .1 Order all necessary materials at once and obtain from the manufacturer that it comes from the same lot.
 - .1 Consider material loss percentage according to job complexity.
- .2 In order for the manufacturer to honor his warranty all materials and accessories to be installed as per National Building Code (NBC) most recent version and written manufacturer's instructions.
 - .1 All installation work to be carried strictly following NBC and applicable local bylaws.
- .3 In accordance with the relevant clauses, conditions and exceptions of the manufacturer's warranty:
 - .1 Metalunic Design warranties that the "Granite Deep Mat Series" and the "Wood Series" (collectively designated as the "Products" within the warranty) pre-painted, steel cladding paint film will not show, on a routine inspection, any sign of flaking, peeling, flecking and loss of adhesion, for a period of forty (40) years from the delivery date, in a normal environmental set (excluding all corrosive or aggressive environment such as any chemically contaminated area or marine environment), for installation projects in Canada and continental US, including Alaska.
 - .2 Obtain a copy of the manufacturer's warranty and provide it to the Client.

PART 2 - PRODUCTS

2.1 METAL CLADDING

.1 PRE-FINISHED METAL SOFFIT [PMS]:

Product to be:

‘Distinction’ pre-finished soffit as manufactured by MetalUnic and as distributed by Gentek.

MANUFACTURER:

MetalUnic Design, 164, rue Royal, Les Coteaux (Qc) J7X 1A6

Phone : (450)267-2330

Fax : (450)267-2582

PMS is to be provided in n smooth profiles throughout in colour:

#773 ‘Cedarwood’; nuanced multi-tone woodgrain pattern from ‘Wood Shade Series’

Supply and install pre-finished, pre-punched vented soffit strips at approx. **63” on centre** max. [or every 12th strip].

Miscellaneous Installation Trims:

PMS is to be installed complete with all pre-formed metal finishing trims, corner pieces, drip edges etc. as supplied by manufacturer for the intended application. All trims are to be colour-matched to specified PMS colour throughout.

.2 PMS Fabrication:

- .1 Finish coating : Class F2S, with manufacturer-selected back finish in Perspectra paint
- .2 Finished Face Colours: as specified elsewhere herein
- .3 Base Metal thickness : 0.46mm 26Ga
- .4 Galvanisation: To ASTM A653, G90
- .5 Standard Profile: 5 ¼" wide x 7/16" deep pre-formed profile with interlocking joints and fastener holes pre-punched.
 - a. Fastener holes: 3/4" (19mm)
 - b. Fastener holes spacing: 2-1/4" (57mm)
- .6 Physical properties:
 - a. Yield point (min) Fy = 33,000.00 P.S.I (228Mpa)
 - b. Maximal stress Fb = 60,000.00 P.S.I (144Mpa)
 - c. Young Modulus = 29,500,000.00 P.S.I (203Mpa)
- .7 Standard vented profile (at Soffit applications only): [2.75 sq inches per linear feet (58.17 cm2 per linear meter) opening] [preformed with elongated slits and small perforations] fastener holes pre-punched.
 - a. Fastener holes: 3/4" (19mm)
 - b. Fastener holes spacing: 2-1/4" (57mm)
- .8 Physical properties:
 - a. Yield point (min) Fy = 33,000.00 P.S.I (228Mpa)
 - b. Maximal stress Fb = 60,000.00 P.S.I (144Mpa)
 - c. Young Modulus = 29,500,000.00 P.S.I (203Mpa)

Finishing Trims at PMS: 'Distinction' Siding/Soffit Trims CGSB 93.4:

- .1 Finish coating: Class F1S.
- .2 Finished Face Colours: as noted elsewhere herein [to match adjacent PMS cladding]
- .3 Base Metal thickness : [0.46mm 26Ga]
- .4 Galvanisation: To ASTM A653, G90
- .5 Profile: To suit the intended application

2.2 ACCESSORIES

- .1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same [material], [colour] [and] [gloss] as cladding, with fastener holes pre-punched.
 - .1 Always leave 1/8" gap for vertical assemblies and 1/4" for horizontal assemblies involving trims.
- .2 Standard manufacturer-supplied pre-formed and prefinished trims (finish and colour to match adjacent cladding) including without strict limitation to the following:
 - a. "J" Trim
 - b. Drip Cap
 - c. Partition trim
 - d. Conversion trim
 - e. Starting strip
 - f. Exterior corner
 - g. Inside corner

- .3 Furring strips: [1x4 wood furring strips] or [galv. steel furring channels, 1.59mm (16Ga)] as per drawings; ensure spacing of furring is at 16" on centre max. or as recommended by the manufacturer for the intended application.
- .4 Touch-up paint as provided by manufacturer for selected finish and colour.

2.3 FASTENERS

- .1 Screws to ANSI B18.6.4. Fasteners to be purpose made, as supplied by the siding by manufacturer.
 - a. [K-Lath screws, #8 x 1-1/8", [406 mm (16")]] apart on wood furring strips.
 - b. [Self-tap screws #8 x 1/2", [406 mm (16")]] apart on galv. furring channels.

2.4 CAULKING

- .1 Sealants: all caulking and sealants are to be as per related Specification Section in formulations compatible with adjoining materials in Architect-selected colour.

PART 3 - PRODUCTS

All items are to be installed in full accordance with the manufacturer's Installation Guide for the intended application.

3.1 INSTALLATION

- .1 Install Distinction siding in accordance with CGSB 93.5, and manufacturer's written instructions throughout. ENSURE ALL PRODUCT IS INSTALLED IN THE INSTALLATION ORIENTATIONS INDICATED ON THE DRAWINGS.
- .2 Distinction soffit is to be installed in orientations and locations shown on Architectural drawings.
- .3 Prior to any installation work, proceed with an inspection to ensure surface is straight, plumb, rigid and ready to receive siding work. Preliminary inspection is paramount to a successful, warp-free installation.
- .4 Install exterior wall sheathing [air barrier] [weather barrier] membrane as per manufacturer's written instructions, lapping edges at least 50mm for glued membranes and 150mm for mechanically fastened membranes.
- .5 Maintain air circulation behind cladding to prevent risks of condensation:
 - a. Install cladding on furring strips, 16" (406mm) apart, properly aligned, perpendicular to metal siding/soffit cladding. Ensure furring strips are securely fastened using appropriate mechanical fasteners.
 - b. Fitting joints to be centered on furring.
 - c. Vertical cladding installations [if applicable] to be installed on discontinuous horizontal furring strips, with at least 2" (50mm) between furring sections.
- .6 Install continuous starter strips, inside [and outside] corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.
- .7 Install outside corners, fillers and closure strips with carefully formed and profiled work.
- .8 Install soffit and fascia cladding as indicated.
- .9 Attach components in manner not restricting thermal movement. Comply with manufacturer's instructions.

- a. Install screws, centered in fasteners holes, at right angle to cladding, using moderate torque. Do not angle the screws.
 - b. All cladding joints to be perfectly aligned and abutted.
 - c. In order to ensure sufficient material expansion, always leave 1/8" between each subsequent piece. When laying a new piece, always start by installing a screw in the first fastener hole.
- .10 The use of a specialized DISTINCTION GUILLOTINE is recommended by the manufacturer to execute any needed cuts. As per manufacturer's instructions, only use undamaged off-cuts, for which the overlap notch is preserved, to start new rows.
 - .1 Do not use off-cuts smaller than 16" (405mm).
- .11 Always apply touch-up paint on all cuts, visible or not. Dab touch-up paints on surface scratches.
- .12 Remove protective wrap and conduct a visual inspection after each strip installation. Proceed with a detailed visual inspection every 3rd or 4th row in order to detect defects. Immediately correct substandard work or any condition that could void the manufacturer's warranty.
 - .1 Do not attempt to remove the protective wrap under 0°C.
- .13 Caulk junctions with adjoining work with sealant. Do work in accordance with Section [07900 - Joint Sealers].

3.2 NUANCE SERIES/WOOD SHADE SERIES (6-HUE) INSTALLATION

- .1 The Wood Nuance paint systems mimics wood. Each box contains 2 pieces for each of the six hues and all pieces are numbered from 1 to 6 on the fastening strip.
- .2 Use a random pattern when installing the 6 numbered / different hue pieces.
- .3 Always perform a pattern inspection. Every 3rd or 4th row, step back to observe and correct any visual discrepancies in the pattern or correct pattern repetitions.
- .4 In order to get a wood siding effect, always break installation pattern, both horizontally and vertically and create joints centered on the furring strips.

3.3 OPENINGS

- .1 Install manufacturer-supplied trims around openings as per manufacturer's instructions.
- .2 When notching pieces, to fit on the top or at the bottom of openings, keep an additional ½" (13mm) to fold a 45 degree bracing crease.

END OF SECTION

Built Up Bituminous Roofing

PART 1 – GENERAL

1.1 STANDARDS

1. Perform work to applicable standard in:
 - Roof membrane manufacturer printed instructions [current edition].
 - Canadian Roofing Contractors Association [CRCA] Specification Manual [current edition].
 - Ontario Building Code.
 - All applicable rules, regulations and directives as established by the local municipality.
 - Current requirements of the Ontario Fire Marshall Office.

1.2 REFERENCES

1. CGSB-37-GP-56M / ASTM D6164 / ASTM 6163 - Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing.
 - CGSB 37-GP-9M / ASTM D41 - Primer, Asphalt for Asphalt Roofing, Dampproofing and Waterproofing.
2. CSA 123.4 / Roofing Asphalt
3. CAN/ULC-S704 - Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
4. CAN/ULC-S107 – Fire Test of Roof Covering.
5. CAN/CSA A123.21 – Dynamic Wind Uplift Resistance of Roof Membrane Systems.
6. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
7. ASTM C1177- Glass Mat Gypsum Substrate for Use as Sheathing.
8. ASTM C1278 – Fiber Reinforced Gypsum Panels
9. Canadian Roofing Contractors Association (CRCA) – Specification Manual.

1.3 GENERAL ROOF SYSTEM DESCRIPTION

1. New Roof System (mechanically fastened - steel deck)
 - Flood Coat and Ballast
 - 3 Ply glass felt membrane
 - 1ply SBS modified bitumen membrane
 - Asphaltic coverboard
 - Tapered insulation
 - Insulation (2Xlayers) Poly Iso
 - Vapour Retarder - mopped
 - Sheathing Board (mechanically fastened- steel deck)
 - Steel Roof Deck
2. New Roof System (fully adhered- steel deck)
 - Flood Coat and Ballast
 - 3 Ply glass felt membrane
 - 1ply SBS modified bitumen membrane
 - Asphaltic coverboard
 - Tapered insulation
 - Insulation (2Xlayers) Poly Iso
 - Vapour Retarder - mopped
 - Sheathing Board (adhesive- steel deck)
 - Steel Roof Deck

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3. New Roof System (concrete deck)
 - Flood Coat and Ballast
 - 3 Ply glass felt membrane
 - 1ply SBS modified bitumen membrane
 - Asphaltic coverboard
 - Tapered insulation
 - Insulation (2Xlayers) Poly Iso
 - Vapour Retarder - mopped
 - Concrete Roof Deck

4.

1.4 PERFORMANCE REQUIREMENTS

1. Work of this section shall:
 - Prevent infiltration of outside water into the building and into the roof system through the roofing membrane or membrane flashing.
 - Retard the transmission of moisture vapour from the building from passing into the insulation in the roof system.
 - Resist up-lift on fasteners of the roofing to the supporting members which shall be designed for wind load as per NBC.
 - Roof system to be tested to CSA 123.1 to withstand design required uplift pressure.
 - Required wind uplift resistance
 - Corner - 61 psf
 - Edge -31 psf
 - Field -24 psf
 - Assume 12 foot perimeter width

1.5 RELATED WORK

1. Metal Flashing Section 07 62 00

1.6 REFERENCE STANDARDS

1. Perform work to applicable standard in:
 - Roof membrane manufacturer printed instructions [current edition].
 - Canadian Roofing Contractors Association [CRCA] Specification Manual current edition].
 - Ontario Building Code.
 - All applicable rules, regulations and directives as established by the local municipality.
 - Current requirements of the Ontario Fire Marshall Office.
 - The project specifications.

1.7 GUARANTEES AND WARRANTIES

1. Roof Membrane Manufacturer Warranty
 - Provide a written twenty (20) year "roof system warranty" issued by the roof membrane manufacturer. The warranty shall cover the repair; labour and material costs, required to restore roofing system to watertight condition should deficiencies be the result of faulty materials or workmanship. The warranty shall be non-cancelable, include costs for this warranty, future inspections by the manufacturer and all other charges concerning the warranty at no further expense to the Owner.

Built Up Bituminous Roofing**2. Roofing Contractor's Warranty**

- Provide a written warranty stating that the Contractor will warrant to repair, at its own expense, any actual roof leaks or deficiencies in the roofing membrane, flashing membrane and related sheet metal work resulting from faulty workman- ship for a period of 2 [two] years on the roofing membrane and flashing membrane and [one] year on the related sheet metal work after the effective date of the warranty.
- The OIRCA standard form of two-year contract will be acceptable for the Roofing Contractor's Warranty.
- The effective date of the warranties shall be the date of Final Inspection by the Roof Consultant.

1.8 SUBMITTALS

1. Prior to the start of work, the contractor shall make all submittals to the Consultant according to section 01 33 00

1.9 PRODUCT DATA

1. Submit WHMIS MSDS - Material Safety Data Sheets
2. Submit product data sheets for materials. Include:
 - Product characteristics.
 - Performance criteria.
 - Limitations.
3. A specimen copy of the proposed warranties.
4. Written submission from roof membrane manufacturer stating that the Contractor is an approved applicator of the materials to be used
5. Confirmation that roof system has been manufacturer tested to CSA A123.21 – Dynamic Wind Uplift Resistance of Roof Membrane Systems for the design required uplift pressures.

1.10 SHOP DRAWINGS

1. Indicate tapered insulation details.
2. Provide layout for tapered insulation.
3. Shop drawings of all proprietary items to be supplied and installed on this project.

1.11 SAMPLES

1. membrane samples as may be required

1.12 WORKMANSHIP

1. All applications shall be by mechanics skilled in this trade, certified by the roof membrane manufacturer and have a minimum of 5 years experience with the work to be done.
2. Upon completion of the installation, and notification made to the roof membrane manufacturer, The Contractor shall require the manufacturer to perform an inspection in accordance with the Specifications and for the purpose of issuing the required warranty.
3. The Roofing Contractor shall be both, during the bidding period as well as during the installation, officially recognized as an approved Contractor by the roof membrane manufacturer.

1.13 DELIVERY STORAGE AND HANDLING OF MATERIALS

1. Materials must be delivered and stored according to the directions of the manufacturer and the instructions of the owners representative.
2. All materials shall be stored so that the materials are not in contact with the ground.
3. All materials shall be stored so that they are covered sufficiently to be protected from high winds, heavy rain and other environmental contaminants. Manufacturer wrap may not be sufficiently weatherproof to protect materials.

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4. All Materials must be delivered and stored undamaged in original containers with Manufacturers markings, labels, and WHMIS markings intact and legible.
5. All rolled roofing products are to be stored on end, dry, and fully protected from moisture and environmental contamination.
6. All adhesives, caulking, and cements are to be stored protected, and at a temperature above the freezing point.
7. Any materials that are determined, by the Owner's representative or the Consultant, to be damaged or otherwise unsuitable to be installed in the work are to be removed from the job site and replaced immediately at no cost to the Owner.
8. Materials stored on the roof shall not be in contact with the roof and shall be tightly tarped against environmental contaminants. The Contractor shall contact a structural Engineer to determine the loading for storage on the roof deck.
9. Propane tanks shall not be stored on the site overnight or over weekends.

1.14 PROTECTION

1. Cover walls and adjacent work where materials hoisted or used.
2. Use warning signs and barriers. Maintain in good order until completion of work.
3. Clean off drips and smears of bituminous material immediately.
4. Dispose of rain water off substrates and away from face of building until drains or hoppers installed and connected.
5. Protect roof areas from traffic and damage.
6. Do not remove any more roof membrane that can be made waterproof within the same day with consideration to weather conditions and forecasts.
7. Place plywood runways over work to enable movement of material and other traffic.
8. 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.
9. Install insulation promptly to avoid possibility of condensation beneath vapour retarder.

1.15 PREPARATION

1. Before commencing work, the contractor will verify that all environmental and site conditions are suitable for installation of material in accordance with Manufacturer's recommendations and requirements. If there is dispute or discrepancy with this requirement the Consultant shall intermediate to resolve the dispute or discrepancy.
- 2.
3. Assure that substrates are free of voids, faults and/or other deficiencies that would affect the performance of the vapour retarder, insulation, flashing membrane or roof system.
4. All work shall be scheduled and executed without exposing the interior of the building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
5. Commencement of work shall imply acceptance of surfaces, site and all job conditions.

1.16 WORKING CONDITIONS

1. The Roofing Contractor will be allowed to set up his equipment as close to the work as possible but shall allow the Owner, staff, visitors, and the general public proper and reasonable access to the building. Access to kettle area shall be completely isolated from the public by temporary fencing or the equivalent to the satisfaction of the Owner and the Roof Consultant and any local regulations.
2. The Contractor shall not obstruct duly marked, or otherwise, fire access routes, safety lanes or other emergency access to the building or grounds.
3. The Contractor shall take all necessary precautions as to the protection of grounds, property, vehicles, and persons, of Owner, staff, visitors or the general public. The Contractor will include all costs for the provision or required protection, including but not limited safety barriers at equipment and at sidewalks walkways and roadways.

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4. The means and methods of construction are the responsibility of the contractor. It is the contractor's responsibility to ensure equipment used is appropriate for the site conditions and that the equipment is used safely and as it was intended for.

1.17 FIELD QUALITY CONTROL

1. Daily inspections to be carried out throughout this section.
2. All work shall be subject to inspection by Jocelyn Roof Consultants Group inc., who will act on behalf of the Owner. The Contractor shall afford the Consultant or representative all facilities required for the inspection and testing of the work and shall immediately act upon any instruction regarding the work given by the Inspector.
3. The Roof inspection shall in no way relieve the Roofing Contractor from his responsibilities or obligations under the terms of the Contract or the Contract Documents.
4. Upon completion of the project, a final inspection will be required with the installer, the consultant, and the owner's representative.

1.18 FIRE WATCH

1. The Roofing Contractor shall have one-person stay at site for a minimum 3 hours after last torch work is done for the day. This person shall patrol and scan the torched areas for signs of smoke or other indications of smoldering or potential fire.

1.19 PRE-JOB SITE MEETING

1. The Roofing Contractor shall schedule a pre-start site meeting a minimum of two days prior to bringing material on site or starting any work on site. This meeting shall include the Roofing Contractor, Roofing Foreman, Roof Consultant and the Owners representative.

PART 2 - PRODUCTS**2.1 COMPATIBILITY**

1. Assure that all components of the new roof system are compatible one with each other.
2. Where the new roof is in contact with existing materials, assure that all components are compatible.
3. Contaminants such as grease, fats, oils, solvents and gasoline shall not be allowed to come in contact with the new roofing membrane.

2.2 COMPONENTS

1. The components of the Roof System are to be products of the same manufacturer wherever possible,
2. The components of the roof system are to be as indicated on the detail drawings and specified in the Contract Documents.
3. Components to be used that are other than those specified and manufactured by the accepted manufacturer are to be submitted for review and acceptance by the Roof Consultant.

2.3 VAPOUR BARRIER SUPPORT PANELS (for use on metal deck)

1. Description : Gypsum-Fiber Roof Board , [12.5 mm thick].
2. In conformance with: ASTM E 84 and ASTM C 1177
3. Specified product: Dens Deck Prime

2.4 MECHANICAL FASTENERS

1. Sheathing- #12 Drill Point Heavy Duty Fastener. Fasteners shall be long enough to allow a minimum of 3/4" (inch) 20mm penetration into steel deck, 1" (24mm) penetration into wood beam or plank and 3/4" (20mm) penetration through the underside of plywood. Fasteners to be installed with metal plates. Plates shall be 3" (75mm) Galvalume. Plates to be formed to prevent dishing or cupping.

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3. Fasteners to conform to FM4470 standards for corrosion resistance.
- 2.5 **ADHESIVE (areas noted on roof plan with exposed interior metal deck)**
1. To adhere sheathing board to roof deck where fasteners would be visible to the underside.
 2. Description: A highly elastomeric, two components foamable adhesive that can be applied at any temperature and sets in minutes.
 3. Standard- SOPREMA DUOTACK or IKO MILLENIUM
- 2.6 **VAPOUR RETARDER**
1. SBS modified bitumen membrane reinforced with a 95g fiberglass reinforcement in conformance with CGSB 37-GP-56M.
 2. Sanded top and bottom surface suitable for hot asphalt mopping to both sides.
- 2.7 **TERMINATION BAR**
1. Extruded aluminum without sharp edge, purpose made for this application
 2. Profile formed to allow sealant trough at upper edge.
- 2.8 **ASPHALT PRIMER**
1. Asphalt primer to CGSB 37-GP-9Ma
 2. Shall be approved by membrane manufacturer
- 2.9 **FLASHING TAPE**
1. To be used as vapour barrier extensions to wall AVB and as tape to prevent asphalt leaks or flame spread.
 2. SBS modified self adhesive flashing tape, sanded surface.
 3. Cut to 150mm "6" widths
- 2.10 **INSULATION**
1. Closed cell polyisocyanurate foam, manufactured using HCFC free blowing agents and integrally laminated to heavy, fibre reinforced facer.
 2. Meets requirements of CAN/ULC-S704.
 3. Insulation boards 1200mm x 1200mm (4'x4') x 38mm (2.0") thick.
 4. Base Insulation to be two layers eg. 2 x 2.0" = 4".0"
 5. Refer to Drawings for insulation thickness totals
- 2.11 **TAPERED INSULATION**
1. Provide premanufactured tapered polyisocyanurate foam board insulation sumps at all roof drains.
 2. Poly-Iso Foam insulation – inorganic glass fiber facer
 3. Insulation sump to at all drains,
 4. 2400mm x 2400 mm (8' x 8') . Sump to provide 2% slope to drain.
 5. 4800mmx4800 mm (16'x16'). Sump to provide 1% slope to drain.
 6. Backslope: Provide pre-manufactured tapered polyisocyanurate foam board insulation where shown.
 7. Taper cut to provide slopes to drain on computer-controlled machine, sequence packed with detail instructions. Meets requirements of CAN/ULC-S704 .
 8. Crickets and back slope to have minimum 2% slope unless otherwise called out.
- 2.12 **PROTECTION BOARD**
1. Asphaltic core board, 1/8" (3.0mm) thick semi rigid, multi-ply roofing substrate board IKO Protection Board, or Soprema Sopraboard

Built Up Bituminous Roofing**2.13 CANT STRIP**

1. Rigid wool fibre cant strip with bitumen saturated sanded surface for mop application
2. Torch safe 4" triangular support to provide 45-degree transition at supported perimeter.

2.14 BUILT UP MEMBRANE

1. Four ply built-up conventional asphalt and membrane roof system. With an SBS modified base sheet and 3 ply of fiberglass felt.
2. Base Ply Membrane
3. SBS modified, sheet membrane with a non-woven glass fiber reinforcement of 95 g/m2 meeting CGSB 37-GP-56M. Top and bottom sanded surface.
4. Roofing Felt Ply
5. Roofing felt to be 3 Ply - Type IV asphalt coated fiberglass felts, meeting ASTM D 2178, TYPE IV.

2.15 MEMBRANE FLASHINGS

1. Membrane flashing will be a 2 ply system consisting of one ply SBS modified bitumen base sheet and one ply of mineral surfaced SBS modified bitumen cap sheet. Base Sheet shall be mopping grade, and Cap Sheet shall be torch grade.
2. Base sheet: shall be 180 g/m2 polyester reinforced SBS modified bitumen base sheet. Sanded base for hot mop installation and thermo fusible top surface.
3. Base sheet where mopping is not possible: shall be 180 g/m2 polyester reinforced SBS modified bitumen base sheet. Self adhesive base for pressure application.
4. Cap Sheet: shall be 250 g/m2 non-woven polyester reinforced SBS granulated cap sheet. Torch grade.

2.16 ROOFING ASPHALT

1. Field: To be Type II oxidized bitumen mopping asphalt conforming to CSA Standard A123.4-M.
2. Flashings and slope greater than slopes greater than To be Type III oxidized bitumen mopping asphalt conforming to CSA Standard A123.4-M.

2.17 ROOF GRAVEL

1. Gravel shall be commercial grade, washed pea gravel
2. Average 3/8" (10mm) gravel ranging sized from 5mm to 20mm.

2.18 ROOF TOP WALKWAYS AND SPLASHPADS

1. Standard Concrete paver supported by 1" XPS insulation blocks
2. Provide walkways as splashpads for downspouts and under supports for roof top equipment.
3. Provide walkway (3 pavers) on gas line side of roof top units.

2.19 PRIMER

1. Asphalt primer to CGSB 37-GP-9Ma
2. Shall be approved by membrane manufacturer

2.20 MASTIC SEALER

1. SBS polymer modified mastic. Meeting CAN/CGSB-37.5-M89 and ASTM D4586 standards

2.21 SEALANT

1. Modified polyurethane joint sealant.
2. Shall be approved by adjacent materials manufacturer.
3. Tremco Dymonic or equivalent

2.22 PLASTIC CEMENT

1. SBS polymer modified mastic. Meeting CAN/CGSB-37.5-M89 and ASTM D4586 standards.

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2. Wherever possible mastic sealant should be supplied by the membrane manufacture.
 3. Soprema Sopramastic or equivalent.
- 2.23 **POURABLE SEALANT**
1. Pourable urethane or polyether pitch pan fill
 2. 100% solids -no shrink sealer.
- 2.24 **MECHANICAL ELECTRICAL FLASHING**
1. Mechanical/Electrical Flashing: as a standard for acceptance - AMS model MEFA, 12" (305 mm) high c/w Gooseneck Assembly with multiple wire sleeves
 2. Use for all electrical and mechanical penetrations through the roof membrane
 3. Where prefabricated flashing is not suitable for the application; a fully soldered site fabricated, insulated box with separate lid to provide hood for side feeding required penetrations. Opening will be sealed to prevent water or insect access.
- 2.25 **VENT STACK FLASHINGS**
1. Insulated one piece spun aluminum sleeve and base flange.
 2. Removable self sealing vandal proof cap.
 3. Provide full seal over insulation before cap attached
- 2.26 **B VENTS AND TALL CONES**
1. B-vents and tall cones to be spun aluminum with base flange and threaded adjustable rainskirts.
 2. Throat of B Vent to fit pipe penetration. Seal around rainskirt.
- 2.27 **ROOF DRAINS**
1. Platinum Roofing Products Premium Aluminum Drain or approved equal.
 2. All components made from 6063 aluminum,
 3. Cast aluminum flip-top dome with powder coated finish
 4. Stainless steel under deck clamping ring.

PART 3 - EXECUTION

- 3.1 **PRECAUTIONARY NOTES**
1. The Roofing Contractor shall co-ordinate the installation so that each area is made watertight at the end of each work period.
 2. All material is to be installed to meet manufacturer recommendations and printed literature.
- 3.2 **ROOF DECK**
1. The roof deck shall be smooth, dry, and clean; free of ridges or loose areas and sharp edges. The Roofing Contractor shall ensure that the deck is tight and secure to the underlying frame work prior to starting installation of new roof system. The Consultant should be notified immediately and in writing of any defects.
 2. There shall be no standing water or moisture on the deck. All dust, debris, ice, snow or water shall be removed from the deck.
- 3.3 **ROUGH CARPENTRY**
1. All curbs, sleepers and bases shall be raised so that the top edge of the curb, sleeper or base is a minimum of 12 inches above the level of the roof.
 2. Raise perimeter wood blocking by 4.5".
 3. Ensure that all wood blocking has been installed square and secured to roof deck.
 4. All parapets to be square and slope toward the roof.

Built Up Bituminous Roofing**3.4 FLASHING TAPE**

1. Apply flashing tape to all joints and around all roof deck penetrations as necessary to protect building interior from potential asphalt dripping and to protect from flame when torching flashings.
2. Apply Flashing tape to tie in roof AVB to wall AVB where necessary for compatibility.

3.5 DECK SHEATHING – Mechanically Fastened

1. Install panels staggered with 4' offset between end joints.
2. Install Dens-Deck Prime to deck with fasteners installed per manufacturer specifications according to system. Minimum 1 fastener every 4 square feet.
3. Minimum 8 fasteners per full sheet for field panels, increase pattern to 12 fasteners for each perimeter panel and 16 for each corner panel. (perimeter calculated, w/ minimum 10' depth)

3.6 DECK SHEATHING – Adhesive

1. Install panels staggered with 4' offset between end joints.
2. Install Dens-Deck Prime to deck with fasteners installed per manufacturer specifications. Apply adhesive in continuous 1/2" -3/4" ribbons to top of deck flute.
3. Adhesive should be applied at full ribbons maximum spread 6" o.c

3.7 ASPHALT PRIMER

1. Apply asphalt primer to all concrete and masonry surfaces that are to receive applications of hot asphalt.
2. Sheathing board must also be primed before application of vapour barrier.
3. Apply primer at manufacturer's application rate and curing instructions.
4. Re-prime all surfaces that become contaminated with dust or marred due to their exposure to roof traffic or weather.

3.8 VAPOUR RETARDER

1. Apply vapour barrier according to manufacturer's specifications.
2. All gaps or cracks in the roof deck, including openings around vent stacks and parapet bases, should be sealed with self adhesive membrane before vapour barrier is installed.
3. Shingling of the membrane rolls shall begin at the roof drains or the low point of the roof.
4. Lap side joints minimum 3 1/2" (inches) 90 mm and end joints 6" (inches) 152 mm. Stagger end joints a minimum of 12" (inches) 304 mm.
5. Install the membrane in hot type III asphalt applied at the rate of 25lbs (pounds) per 100 square feet (1.2 kg/m2).
6. No tears, rips or other perforations will be allowed in the vapour retarder. Seal all joints with a torch and a rounded end trowel
7. Vapour retarder shall be sealed with roof cement or sealant at all roof penetrations.
8. Vapour retarder shall be carried to the top of the cant strip; and/or to meet any wall air/vapour barrier as designed unless dictated otherwise by the Consultant.
9. Vapour retarder shall be extended up the vertical surface to surround the edge of the insulation.

3.9 BASE INSULATION

1. Install Insulation in full and complete mopping of asphalt. 20lbs (pounds) per 100 square feet (1.2 kg/m2).
2. Place insulation in required position with all edges well-fitting to neighboring boards but not putting pressure on other boards.
3. Gaps in insulation greater than 1/4" must be filled with similar insulation material.
4. Insulation boards should be in staggered rows with staggered laps.

3.10 TAPERED INSULATION

1. Install tapered insulation according to approved shop drawings.

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2. Insulation to provide complete slope to drainage provisions.
 3. Install Insulation in full and complete mopping of asphalt. 20lbs (pounds) per 100 square feet (1.2 kg/m²).
 4. Place insulation in required position with all edges well-fitting to neighboring boards but not putting pressure on other boards.
 5. Insulation slope must be continuous without vertical variations greater than ¼".
- 3.11 **INSULATION COVER BOARD**
1. Insulation protection board shall be mopped in place over base and tapered insulation.
 2. Cover board edges shall be staggered against insulation edges and joints shall not line up.
 3. Coverboard edges to be butted tight without overlapping each other
- 3.12 **ROOF DRAINS**
1. All roof drains shall be set into a layer of plastic cement and reinforced with an additional layer 3'x3' of base sheet. Flanges of the roof drains shall be primed with a full coat of bitumastic paint and allowed to dry before installation.
- 3.13 **MEMBRANE BASE PLY**
1. Install Membrane Base ply to manufacturers' instructions.
 2. Embed base ply into uniform solid mopping of hot Type III asphalt, using a nominal 25 lbs per 100 sq ft per ply.
 3. Shingling of the roofing plies shall begin at the roof drains or the low point of the roof.
 4. Lap side joints minimum 3 ½" (inches) 90 mm and end joints 6" (inches) 152 mm. Stagger end joints a minimum of 12" (inches) 304 mm.
 5. All overlap edges to be fully adhered to the membrane beneath. No creases, voids or fishmouths.
 6. Reinforce around all projections and drains with an additional layer of base sheet.
- 3.14 **ROOFING MEMBRANE**
1. Embed 3 plies of specified roofing felt in shingle fashion into uniform solid mopping of hot Type III asphalt, using a nominal 25 lbs per 100 sq ft per ply.
 2. Shingling of the roofing plies shall begin at the roof drains or the low point of the roof perpendicular to the slope.
 3. Install three starter strip plies, each successive roll will overlap 684 mm (27")
 4. Roofing felt should be rolled in and firmly embedded into the bitumen. During application, embedding may be assured by using a squeegee after each ply.
 5. Any voids or fish-mouths in fiberglass felts must be cut out and covered with a minimum additional two plies mopped in.
 6. Roof areas will not be graveled without the approval of the Consultant.
- 3.15 **MEMBRANE FLASHING**
1. The 4 plies of roofing membrane shall be terminated at the top of the cant strip.
 2. The first ply of membrane flashing, modified bitumen base sheet, shall be mopped in place starting 6 inches beyond the toe of the cant, on the field of the roof and extending onto the cant up the vertical, curb, or eaves edge. The first ply shall be terminated; 1.5 inches below a reglet; at the top outside corner of a curb; or at the top of a cant at an eaves edge.
 3. The top ply of membrane flashing, modified bitumen cap sheet, shall be torched in place over the base sheet starting 3 inches beyond the base sheet and extending to the underside of a reglet and the top inside corner of a curb. At eaves edges the cap sheet shall be turned down the fascia 1.5 inches.
 4. All membrane flashings shall be set into full, even, and uniform mopping of Type III asphalt.
 5. Membrane flashings shall be mechanically fastened with round top masonry nails, or round top cap nails depending on whether substrate is masonry or wood.
 6. Round top nails shall be 1.5 inches long and shall be galvanized for corrosion resistance.

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7. Membrane flashings terminating on a vertical surface shall be secured with termination bar and screws spaced at most 12" o.c and the upper terminus sealed with Mastic.
8. On parapets or walls higher than 15 inches termination bars will be mechanically fastened to the wall or parapet to support and secure the membrane flashing.

3.16 SURFACING

1. Asphalt flood coat for gravel shall be applied at the rate of 2.9 kg/m² (60 lbs. per 100 sq. ft). There shall be no voids or dry spots prior to the application of aggregate. Any non-adhered gravel shall be re-poured.
2. Commercial grade, washed, opaque 10 mm to 16 mm r gravel should be used. No more than 10% of any lot should be outside these size requirements.
3. Embed not less than 19.5 kg/m² [400 lbs per 100 sq ft] of gravel into Type III asphalt.
4. Include at AC condenser units and for 6' at the gas line side of all roof top units.

3.17 SEALING

1. Apply sealant to all reglets upon completion of flashings, at the junction of the metal flashing return, and adjacent building members.
2. Apply sealant where shown or required by common good roofing practice.

3.18 WALKWAY

1. Install walkway where noted on the roof plan and at access points, doors, base and top of stairs and ladders.
2. Provide walkways at all ladder and hatch access points.
3. Install at base and top of ladders.

End of Section

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

1. PART 1 General

1.1. STANDARDS

1.1.1. Perform work to applicable standard in:

Roof membrane manufacturer printed instructions [current edition].
 Canadian Roofing Contractors Association [CRCA] Specification Manual [current edition].
 Ontario Building Code.
 All applicable rules, regulations and directives as established by the local municipality.
 Current requirements of the Ontario Fire Marshall Office.

1.2. REFERENCES

FACED POLYISOCYANURATE FOAM	CAN/ULC S704-01 (CAN-51.26-M86
SBS MODIFIED BITUMINOUS MEMBRANE	CGSB 37-GP-56M
ROOFING ASPHALT	CSA 123.4-M1979 TYPE 1,2,3
ASPHALT PRIMER	CGSB 37-GP-9MA 1983
CUTBACK ASPHALT PLASTIC CEMENT	CGSB 37-GP-5MA 1983
RUBBER-ASPHALT SEALING COMPOUND	CAN/CGSB-37.29 .
GLASS MAT GYPSUM SUBSTRATE.	ASTM C 1177(SBS) MODIFIED BITUMINOUS
SHEET MATERIALS USING GLASS FIBER REINFORCEMENTS	ASTM D 6163
(SBS) STYRENE BUTADIENE STYRENE MODIFIED BITUMINOUS SHEET MATERIALS	
USING POLYESTER REINFORCEMENTS	ASTM D 6164,
VAPOUR BARRIER, POLYETHYLENE SHEET	CAN/CGSB 51.34M86

1.3. GENERAL ROOF SYSTEM DESCRIPTION

1. New Roof System (mechanically fastened / steel deck)

SBS Modified bitumen capsheet
 1ply SBS modified bitumen membrane
 Asphaltic coverboard
 Tapered insulation
 Insulation (2Xlayers) Poly Iso (refer to drawings for thickness)
 Vapour Retarder - mopped
 Sheathing Board (mechanically fastened- steel deck)
 Steel Roof Deck

2. New Roof System (adhesive / steel deck)

SBS Modified bitumen capsheet
 1ply SBS modified bitumen membrane
 Asphaltic coverboard
 Tapered insulation
 Insulation (2Xlayers) Poly Iso (refer to drawings for thickness)
 Vapour Retarder - mopped
 Sheathing Board (adhered - steel deck)
 Steel Roof Deck

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

1.3.1. Work of this section shall:

Prevent infiltration of outside water into the building and into the roof system through the roofing membrane or membrane flashing.
Retard the transmission of moisture vapour from the building from passing into the insulation in the roof system.
Resist up-lift on fasteners of the roofing to the supporting members which shall be designed for wind load as per NBC.
Be designed to the wind load pressures for suction imposed and gusting for a return probability of one in thirty years.

1.4 PERFORMANCE REQUIREMENTS

1. Work of this section shall:

- Prevent infiltration of outside water into the building and into the roof system through the roofing membrane or membrane flashing.
- Retard the transmission of moisture vapour from the building from passing into the insulation in the roof system.
- Resist up-lift on fasteners of the roofing to the supporting members which shall be designed for wind load as per NBC.
- Roof system to be tested to CSA 123.1 to withstand design required uplift pressure.
- Required wind uplift resistance
-
- Corner - 61 psf
- Edge -31 psf
- Field -24 psf
- Assume 12 foot perimeter width

1.4. RELATED WORK

1.4.1. METAL FLASHING AND TRIM 076200

1.4.2. Perimeter wood blocking replacement.

1.4.3. Existing perimeter wood blocking to remain unless damaged, rotten or deteriorated.

1.4.4. Contractor is responsible for the lifting and resetting of all mechanical roof top equipment.

1.4.5. The Contractor is responsible for all plumbing / mechanical connections to existing plumbing below the roof deck

1.4.5.1. Where plumbing is not accessible inside ceilings, retrofit mechanical connections will be considered as an acceptable alternative.

1.4.5.2. Contractor is responsible for moving and replacing gas lines as needed to accommodate roof work.

1.5. REFERENCE STANDARDS

1.5.1. Perform work to applicable standard in:

1.5.1.1. Roof membrane manufacturer printed instructions [current edition].

1.5.1.2. Canadian Roofing Contractors Association [CRCA] Specification Manual current edition].

1.5.1.3. Ontario Building Code.

1.5.1.4. All applicable rules, regulations and directives as established by the local municipality.

1.5.1.5. Current requirements of the Ontario Fire Marshall Office.

1.5.1.6. The project specifications.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

1.6. GUARANTEES AND WARRANTIES

1.6.1. ROOF MEMBRANE MANUFACTURER WARRANTY

Provide a written fifteen (15) year "roof system labour and workmanship warranty" issued by the roof membrane manufacturer. The warranty shall cover the repair; labour and material costs, required to restore roofing system to watertight condition should deficiencies be the result of faulty materials or workmanship. The warranty shall be non-cancelable, include costs for this warranty, future inspections by the manufacturer and all other charges concerning the warranty at no further expense to the Owner.

1.6.2. ROOFING CONTRACTOR'S WARRANTY

Provide a written warranty stating that the Contractor will warrant to repair, at its own expense, any actual roof leaks or deficiencies in the roofing membrane, flashing membrane and related sheet metal work resulting from faulty workman- ship for a period of 2 [two] years on the roofing membrane and flashing membrane and [one] year on the related sheet metal work after the effective date of the warranty.

1.6.3. The OIRCA standard form of two-year contract will be acceptable for the Roofing Contractor's Warranty.

1.6.4. The effective date of the warranties shall be the date of Final Inspection by the Roof Consultant.

1.7. SUBMITTALS

1.7.1. Prior to the start of work, the Roofing Contractor shall make all submittals to the Consultant.

1.7.2. PRODUCT DATA

1.7.2.1. Submit WHMIS MSDS - Material Safety Data Sheets

1.7.2.2. Submit product data sheets for materials. Include:

Product characteristics.

Performance criteria.

Limitations.

1.7.3. ADMINISTRATIVE

1.7.3.1. Workers' Safety and Insurance Board (WSIB) certificate.

1.7.3.2. All required Insurance Certificate or Certificates.

1.7.3.3. A specimen copy of the Employer Safety Policy as dictated and required by Ontario legislation and regulations.

1.7.3.4. A certified copy of the "Notice of Project" as required by the Ontario Department of Labour.

1.7.3.5. A specimen copy of the proposed warranties.

1.7.3.6. Written submission from roof membrane manufacturer stating that the Contractor is an approved applicator of the materials to be used

1.7.4. SHOP DRAWINGS

1.7.4.1. Indicate tapered insulation details.

1.7.4.2. Provide layout for tapered insulation.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

1.7.4.3. Shop drawings of all proprietary items to be supplied and installed on this project.

1.7.5. SCHEDULE

1.7.5.1. Contractor to provide a proposed schedule including expected start and finish dates

1.8. WORKMANSHIP

- 1.8.1. All applications shall be by mechanics skilled in this trade, certified by the roof membrane manufacturer and have a minimum of 5 years experience with the work to be done.
- 1.8.2. Upon completion of the installation, and notification made to the roof membrane manufacturer, The Contractor shall require the manufacturer to perform an inspection in accordance with the Specifications and for the purpose of issuing the required warranty.
- 1.8.3. The Roofing Contractor shall be both, during the bidding period as well as during the installation, officially recognized as an approved Contractor by the roof membrane manufacturer.

1.9. DELIVERY STORAGE AND HANDLING OF MATERIALS

- 1.9.1. Materials must be delivered and stored according to the directions of the manufacturer and the instructions of the owners representative.
- 1.9.2. All materials shall be stored so that the materials are not in contact with the ground.
- 1.9.3. All materials shall be stored so that they are covered sufficiently to be protected from high winds, heavy rain and other environmental contaminants. Manufacturer wrap may not be sufficiently weatherproof to protect materials.
- 1.9.4. All Materials must be delivered and stored undamaged in original containers with Manufacturers markings, labels, and WHMIS markings intact and legible.
- 1.9.5. All rolled roofing products are to be stored on end, dry, and fully protected from moisture and environmental contamination.
- 1.9.6. All adhesives, caulking, and cements are to be stored protected, and at a temperature above the freezing point.
- 1.9.7. Any materials that are determined, by the Owner's representative or the Roof Consultant, to be damaged or otherwise unsuitable to be installed in the work are to be removed from the job site and replaced immediately at no cost to the Owner.
- 1.9.8. Materials stored on the roof shall not be in contact with the roof and shall be tightly tarped against environmental contaminants. The Roofing Contractor shall contact a structural Engineer to determine the loading for storage on the roof deck.
- 1.9.9. Propane tanks shall not be stored on the site overnight or over weekends.
- 1.9.10. Care shall be taken of the property of the Owner, including landscaped areas and paved areas..
- 1.9.11. The Contractor is responsible for any and all damage to asphalt paving; concrete walks and sodded areas including playing fields, gardens, walkways, side walks, lawns etc.

1.10. PROTECTION

- 1.10.1. Cover walls and adjacent work where materials hoisted or used.
- 1.10.2. Use warning signs and barriers. Maintain in good order until completion of work.
- 1.10.3. Clean off drips and smears of bituminous material immediately.
- 1.10.4. Protect roof areas from traffic and damage. Place plywood runways over work to enable movement of material and other traffic. Dispose of rain water off substrates and away from face of building until drains or hoppers installed and connected.
- 1.10.5. Do not remove any more roof membrane that can be made waterproof within the same day with consideration to weather conditions and forecasts.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

- 1.10.6. 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.
- 1.10.7. Install insulation promptly to avoid possibility of condensation beneath vapour retarder.
- 1.10.8. Interior spaces must be adequately protected. Contractor is responsible for any damages to interior space, or furnishings during the project.
- 1.10.9. Interior spaces should be reviewed before tear off. Sensitive equipment including computers, tools machinery, etc. should be given special consideration and adequate measures must be taken to protect from moisture, dust and debris.
- 1.10.10. Gymnasium floors should be protected with tarps to protect hardwood before roof materials are torn off. Coordinate interior protection with caretaking staff.

1.11. PREPARATION

- 1.11.1. Before commencing work, ensure environmental and site conditions are suitable for installation of material in accordance with Manufacturer's recommendations and requirements; and to the requirements and recommendations of the Consultant. If there is dispute or discrepancy with this requirement the Consultant shall intermediate to resolve the dispute or discrepancy.
- 1.11.2. Assure that substrates are free of voids, faults and/or other deficiencies that would affect the performance of the vapour retarder, insulation, flashing membrane or roof system.
- 1.11.3. On steel deck areas the Contractor shall clean all debris from the flutes prior to installation of new roofing system.
- 1.11.4. The Consultant must be notified in writing or by fax of unsuitable surfaces or conditions.
- 1.11.5. All work shall be scheduled and executed without exposing the interior of the building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
- 1.11.6. Commencement of work shall imply acceptance of surfaces, site and all job conditions.

1.12. WORKING CONDITIONS

- 1.12.1. The Roofing Contractor will be allowed to set up his equipment as close to the work as possible but shall allow the Owner, staff, students, visitors, and the general public proper and reasonable access to the building. Access to kettle area shall be completely isolated from the public by temporary fencing or the equivalent to the satisfaction of the Owner and the Roof Consultant and any local regulations.
- 1.12.2. The Contractor shall not obstruct duly marked, or otherwise, fire access routes, safety lanes or other emergency access to the building or grounds.
- 1.12.3. The Contractor shall take all necessary precautions as to the protection of grounds, property, vehicles, and persons, of Owner, staff, students, visitors or the general public. The Contractor will include all costs for the provision or required protection, including but not limited safety barriers at equipment and at sidewalks walkways and roadways.
- 1.12.4. The Owner will provide reasonable access to water and electrical facilities to assist in the execution of the work. The Owner will not provide washroom facilities for the employees of the Contractor.
- 1.12.5. The means and methods of construction are the responsibility of the contractor. It is the contractor's responsibility to ensure equipment used is appropriate for the site conditions and that the equipment is used safely and as it was intended for.

1.13. FIELD QUALITY CONTROL

- 1.13.1. Daily inspections to be carried out throughout this section.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

- 1.13.2. All work shall be subject to inspection by Jocelyn Roof Consultants Group inc., who will act on behalf of the Owner. The Contractor shall afford the Consultant or representative all facilities required for the inspection and testing of the work and shall immediately act upon any instruction regarding the work given by the Inspector.
- 1.13.3. Payment for all inspection work is to be by the Owner.
- 1.13.4. The Roof inspection shall in no way relieve the Roofing Contractor from his responsibilities or obligations under the terms of the Contract or the Contract Documents.
- 1.13.5. The Roofing Contractor shall notify the roof inspection company a minimum of 24 hours prior to starting the work, restarts or any other interruption in the work.
- 1.13.6. If the Inspector is required to make a wasted trip the cost of the wasted trip or trips will be back-charged to the Contractor.
- 1.13.7. The inspection company will also charge the Roofing Company for extra or additional trips necessitated by poor or faulty workmanship.
- 1.13.8. Upon completion of the project, a final inspection will be required with the installer, the consultant, and the owners representative.

1.14. FIRE WATCH

- 1.14.1. The Roofing Contractor shall have one-person stay at site for a minimum 3 hours after last torch work is done for the day. This person shall patrol and scan the torched areas for signs of smoke or other indications of smoldering or potential fire.

1.15. PRE-JOB SITE MEETING

The Roofing Contractor shall schedule a pre-start site meeting a minimum of two days prior to bringing material on site or starting any work on site. This meeting shall include the Roofing Contractor, Roofing Foreman, Roof Consultant and the Area Maintenance Supervisor of the School Board.

2 PRODUCTS

2.1 VAPOUR BARRIER SUPPORT PANELS (for use on metal deck)

- .1 Description : Gypsum-Fiber Roof Board , [12.5 mm thick].
- .2 In conformance with: ASTM E 84 and ASTM C 1177
- .3 Specified product: Dens Deck Prime

2.2 VAPOUR BARRIER

.1 Modified Bitumen Vapour Barrier

- .1 The SBS modified bitumen membrane shall be reinforced with polyester. The upper surface is sanded, the underface is covered with a thermofusible plastic film.
- .2 In conformance with: CAN/CGSB 37.56-M (9th draft).

.2 Self Adhesive Modified Bitumen Vapour Barrier (where applicaton on wood or steel deck does not include mechanical fasteners)

- .1 Self adhesive AVB for use on steel deck
- .2 Conforming to CAN2 -51.34M
- .3 High Density polyethelene cross laminated film top surface

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

- .4 Self adhesive underside with release film

.3 **Vapour barrier continuity strip:**

- .1 Description: waterproofing membrane with composite reinforcement and SBS modified bitumen. The upper surface is sanded and the underface is self-adhesive.

2.3 **INSULATION**

.1 **Polyisocyanurate insulation**

- .1 Closed-cell polyisocyanurate foam insulation board laminated on both sides to CAN /ULC – S704
- .2 Insulation boards 1200mmx1200mm (4'x4') for adhesive application.
- .3 Insulation thickness is to be - 2 layers of 2" board unless otherwise noted on the drawings or scope of work.

.2 **Tapered Insulation Panel**

- .1 Tapered insulation panel made of polyisocyanurate designed to create a **2** percent (%) slope to the roof system.

.3 **Sump insulation panel for drain location**

- .1 Sump insulation panel made of [polyisocyanurate] designed to facilitate proper drainage around drain.
- .2 Tapered sumps to provide gradual 2% slope over 4' to drain. Sump size = 8'x8'

2.4 **INSULATION OVERLAY**

- .1 1/4" (6.35mm) thick semi rigid, multi-ply roofing substrate board, composed of mineral fortified asphaltic core between two asphalt saturated glass fibre mats.

2.5 **MEMBRANES**

.1 **Base Sheet Membrane**

- .1 Membrane composed of SBS modified bitumen and non-woven polyester reinforcement. The surface is covered with a thermofusible plastic film and the underface is covered with a thermofusible plastic film. The surface shall be marked with three (3) chalk lines to ensure proper roll alignment.
- .2 In conformance with: CGSB 37.56-M

.2 **Membrane for Flashings and Parapets.**

- .1 Membrane composed of SBS modified bitumen and non-woven polyester reinforcement. The surface is covered with a thermofusible plastic film and the underface is covered with a thermofusible plastic film. The surface shall be marked with three (3) chalk lines to ensure proper roll alignment.
- .2 In conformance with: CGSB 37.56-M

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

.3 Self Adhesive Base Sheet Membrane for Combustible Surface and protection around penetrations.

- .1 Description: Membrane composed of SBS modified bitumen and non-woven polyester reinforcement. The surface is covered with a thermofusible plastic film and the underface is covered with a thermofusible plastic film. The surface shall be marked with three (3) chalk lines to ensure proper roll alignment.

.4 Roofing Cap Sheet Membrane for Field Surfaces

- .1 Roofing membrane composed of SBS modified bitumen with a 250 g polyester reinforcement and elastomeric bitumen. The surface is protected by coloured granules. The underface is covered with a thermofusible plastic film.

.5 Roofing Cap Sheet Membrane for Flashings and Parapets

- .1 Roofing membrane composed of SBS modified bitumen with a 250 g polyester reinforcement and elastomeric bitumen. The surface is protected by coloured granules. The underface is covered with a thermofusible plastic film.

2.6 ACCESSORY MEMBRANES

.1 Flame-stop membrane

- .1 Description: Self-adhesive membrane composed of a reinforced glass mat and SBS modified bitumen designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes.

2.7 PRIMER

.1 Primer for heat-welded membranes

- .1 Description: Made of bitumen, volatile solvents and adhesive enhancing additives. Used as primer to enhance the adhesion of torch-applied waterproofing membranes.

.2 Primer for self-adhesive membranes

- .1 [Description: Composed of SBS synthetic rubber, volatile solvents, adhesive enhancing resins and volatile solvent. Used as primer to enhance the adhesion of self-adhesive membranes.]

2.8 INSULATION ADHESIVE

- .1 Description: A highly elastomeric, two components foamable adhesive that can be applied at any temperature and sets in minutes.
- .2 Standard of Acceptance – Soprema Duotack

2.9 INSULATION FASTENERS

Description: pre-assembled fasteners with #14 drill point self-tapping screws, with 75mm (3") diameter galvalume plate in diameter.

In conformance with: FM 4470 Approvals standard.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

Specified products: #14 HD Roofing Fasteners

2.10 WATERPROOFING MASTIC

- .1 Description: Multi-purpose solvent-based mastic, containing SBS modified bitumen fibres with aluminium pigments and mineral fillers.

2.11 PITCH POCKET FILLER

- .1 Description: Polyurethane pre-fabricated pitch pocket system, in various size, with compounds that bond together, with solventless mastic and with one component elastomeric sealant.

2.12 SEALING PRODUCT

- .1 Description: Bitumen/polyurethane waterproofing mono-component resin and polyester reinforcements.

2.13 ROOF MEMBRANE WALKWAYS

- .1 Description: Waterproofing membrane composed of SBS modified bitumen and non-woven polyester reinforcement, used to protect membranes subjected to excessive foot traffic. The top face is covered with black granules; the underface is protected by a thermofusible plastic film.
- .2 In conformance with: CGSB 37.56-M (9th Draft).

2.14 ROOF DRAINS

- .1 Platinum Roofing Products Premium Aluminum Drain or approved equal.
- .2 All components made from 6063 aluminum,
- .3 Cast aluminum flip-top dome with powder coated finish
- .4 Stainless steel under deck clamping ring.

2.15 MECHANICAL ELECTRICAL FLASHING

- .1 Mechanical/Electrical Flashing: AMS model MEFA, 12" (305 mm) high c/w Gooseneck Assembly with multiple wire sleeves
- .2 Use for all electrical and mechanical penetrations through the roof membrane

2.16 VENT STACK FLASHINGS

- .1 Insulated spun aluminium sleeve and base flange.
- .2 Removable self-sealing cap.
- .3 thaler SJ 26/27 or equivalentMechanical/Electrical Flashing: AMS model MEFA, 12" (305 mm) high c/w Gooseneck Assembly with multiple wire sleeves

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

2.17 GAS LINE SUPPORTS

- .1 Gas line supports to include roller to allow for pipe movement, and galvanized pipe strap over gas line.
- .2 Supports to provide adjustable height and manufacturer supplied bas.
- .3 Sized and spaced as required by code.

3 EXECUTION

3.1 SURFACE EXAMINATION AND PREPARATION

- .1 Surface examination and preparation must be completed in conformance with manufacturer's instructions and recommendations.
- .2 Before roofing work begins, the owner's representative and roofing foreman will inspect and approve deck conditions (including slopes and wood blocking) as well as upstands and parapets, construction joints, roof drains, plumbing vents, ventilation outlets and others. If necessary, additional work may be required by the contractor so that required corrections can be made. The start of roofing work will mean roofing conditions have been accepted for work completion.
- .3 Do not begin any work before surfaces are smooth, dry, and free of ice and debris. Use of calcium or salt is forbidden for ice or snow removal.
- .4 Be sure plumbing, carpentry and all other work has been duly completed.
- .5 No materials will be installed during rain or snowfall.

3.2 METHOD OF INSTALLATION

- .1 Roofing work must be completed in a continuous fashion as areas prepared and weather conditions permit.
- .2 Seal all seams that are not covered by a cap sheet membrane in the same day. The cap sheet cannot be installed if any moisture is present at/in the base sheet seams.
- .3 Ensure waterproofing conditions for roofs at all times, including protection during installation work by other trades and progressive protection as work is completed (e.g. vents, drains, etc.).

3.3 SITE PROTECTION

- .1 Protect finished work to avoid damage during roof installation and material transportation. Install protective boardwalks over installed roofing materials to enable passage of people and products. Assume full responsibility for any damage.

3.4 PREPARATION WORK - METAL DECKING

- .1 Review deck for rust or corrosion and report to Roof Consultant.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

- .2 Confirm metal deck is not visible from interior – use adhesive where visible and as noted on roof plan

3.5 PREPARATION WORK – CONCRETE DECK

- .1 Prepare the surfaces according to manufacturers recommendations.
- .2 Any loose or damaged areas are to be reported to the Consultant for review before proceeding.

3.6 VAPOUR BARRIER INSTALLATION ON CONCRETE DECK

- .1 Remove existing membrane materials.
- .2 Prime existing substrate with applicable primer
- .3 Protect any openings or gaps in the concrete with self adhesive flame stop membrane.
- .4 Mop new vapour retarder in hot asphalt.

3.7 VAPOUR BARRIER SUPPORT PANELS INSTALLATION ON STEEL DECK

- .1 Screw onto the steel deck's upper rib surfaces at a rate of 8 mechanical fasteners per board, increasing by 50% at perimeter and 75% in corners.
- .2 Cut boards so edges rest on centre of upper ribs. Cut straight lines with adequate tools.
- .3 Where slopes change, boards will be cleanly cut (avoid breaking boards) to acquire deck shape. Place boards perpendicular to deck ribs for continuous support at extremities.
- .4 Board joints will be staggered, at half-length, and perfectly butted. [Joints will be sealed with heat-resistant tape in both directions to prevent any asphalt leakage in finished areas.]

3.8 DECK SHEATHING – Adhesive

- .1 Install panels staggered with 4' offset between end joints.
- .2 Install Dens-Deck Prime to deck with fasteners installed per manufacturer specifications . Apply adhesive in continuous 1/2" -3/4" ribbons to top of deck flute.
- .3 Adhesive should be applied at full ribbons maximum spread 6" o.c

3.9 APPLICATION PRIMER

- .1 Roofing substrates of wood, metal, concrete, masonry or gypsum board surfaces will receive a coat of asphalt primer at a rate of .15 to .25 L/sq.m.. All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Cover primed surfaces with roofing membrane as soon as possible (same day coverage for self-adhesive membranes).

3.10 APPLICATION OF TORCH-APPLIED VAPOUR BARRIER

- .1 Primer must be dry prior installation of the vapour barrier membrane.
- .2 Starting at the lowest point of the roof, the vapour barrier membrane must be heat-welded onto the substrate in conformance with manufacturer's instructions and recommendations.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

- .3 Overlap adjacent membranes by 75 mm (3 in). End lap joints must be 150 mm (6 in). Stagger the end laps a minimum of 300 mm (12 in).
- .4 The roof vapour barrier must meet and overlap the air/vapour barrier on adjoining walls to ensure total continuity.
- .5 Install vapour barrier membrane at insulation perimeters and around each element, piercing the insulation to ensure sealed connections with base sheet at upstands.

3.11 INSTALLATION OF INSULATION – BITUMEN

- .1 Install Insulation in full and complete mopping of asphalt. 20lbs (pounds) per 100 square feet (1.2 kg/m²).
- .2 Place insulation in required position with all edges well-fitting to neighboring boards but not putting pressure on other boards.
- .3 Gaps in insulation greater than 1/4" must be filled with similar insulation material.
- .4 Insulation boards should be in staggered rows with staggered laps.

3.12 SUMP INSULATION PANEL INSTALLATION

- .1 Install sump insulation panel in conformance with manufacturer's instructions and recommendations
- .2 All vertical joints between level boards and sloped modules will be staggered.

3.13 INSTALLATION OF FLAME-STOP MEMBRANES

- .1 Adhere the membrane directly onto an approved substrate by peeling back the silicone release film. SOPRAGUARD TAPE is designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes.
- .2 Unroll the flame-stop membrane onto the insulation without adhering, being careful to overlap adjacent strips to ensure that the flame will not come in contact with the insulation.

3.14 BASE SHEET FLASHING INSTALLATION (HEAT-WELDED)

- .1 Apply base sheet flashing only after primer coat is dry.
- .2 Cut off corners at end laps to be covered by the next roll.
- .3 Overlap side laps by along lines provided for this purpose, and overlap end laps by 150 mm (6 in) Stagger end joints by a minimum of 300 mm (12 in).
- .4 This base sheet membrane must be welded directly to the prepared surface, proceeding from top to bottom, using a propane torch.
- .5 Avoid the formation of wrinkles, voids or fishmouths.

3.15 INSTALLATION OF REINFORCED GUSSETS

- .1 Install a reinforcing gusset in all inside and outside corners.
- .2 Heat-weld the gussets in place after installing base sheet membrane.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

3.16 INSTALLATION OF HEAT-WELDED REINFORCEMENTS

- .1 Install reinforcements specified for various roof surfaces according to the following instructions and illustrations of membrane manufacturer.

3.17 ROOFING CAP SHEET INSTALLATION (TORCH-APPLIED MEMBRANE)

- .1 Begin with double-selvage starter roll. If starter roll is not used, side laps covered in granules must be degranulated by embedding side laps in torch-heated bitumen over a 75 mm (3 in) width.
- .2 Starting at drain, Unroll the cap sheet membrane on the base sheet without adhering, taking care to align the first strip parallel to the edge of the roof.
- .3 Cut off corners at end laps to be covered by the next roll.
- .4 Overlap side laps by along lines provided for this purpose, and overlap end laps by 150 mm (6 in) Stagger end joints by a minimum of 300 mm (12 in).
- .5 During installation, be careful not to overheat the membrane.
- .6 Avoid the formation of wrinkles, voids or fishmouths.
- .7 Conserve membrane's appearance. Avoid walking over finished surfaces; use protective walkways as needed.

3.18 INSTALLATION OF HEAT-WELDED CAP SHEETS ON UPSTANDS AND PARAPETS

- .1 This cap sheet must be installed in one-metre-wide strips.
- .2 Overlap side laps by along lines provided for this purpose, and overlap end laps by 150 mm (6 in). The side joints must overlap and must be staggered by at least 100 mm (4 in) with respect to the joints of the cap sheet on the field surface, to avoid areas of excessive membrane thickness.
- .3 Cut off corners at end laps to be covered by the next roll.
- .4 Use a chalk line to draw a straight line on the field surface 150 mm (6 in) from the upstands and parapets.
- .5 Use a propane torch and round-nose trowel to embed the surface granules in the layer of hot bitumen starting from the chalk line on the field surface to the bottom edge of the upstand or parapet as well as on the granulated vertical surfaces that are to be overlapped.
- .6 This cap sheet will be heat-welded directly to the base sheet membrane, proceeding from bottom to top.
- .7 Avoid the formation of wrinkles, voids or fishmouths.
- .8 During installation, be careful not to overheat the membrane.

3.19 MEMBRANE WALKWAY INSTALLATION

- .1 Install membrane walkways respecting requirements previously stipulated for cap sheet installation.
- .2 Degranulate 6" inside perimeter of area to be covered w/ walkway.
- .3 Apply primer to cap sheet before installing walkways.

2 PLY MODIFIED BITUMEN ROOF MEMBRANE

- .4 Walkways required at all roof access points including doors and hatches.
- .5 Provide walkways around HVAC units requiring maintenance access.

3.20 ROOF DRAINS

- .1 Insulation and coverboard to be neatly cut around drains and plumbing stacks etc.
- .2 Roof drains are to be set in a layer of plastic cement on the base sheet and reinforced an additional layer of base sheet.
- .3 Flanges of the roof drains are to be primed with bitumastic paint and allowed to dry before installing.

3.21 WATERPROOFING FOR VARIOUS DETAILS

- .1 Install waterproofing membranes in conformance with various roofing details illustrated in the manufacturer's manual instructions and recommendations.

3.22 SEALING

- .1 Apply sealant to all reglets upon complete of flashing, at the junction of the metal flashing return and adjacent building members.
- .2 Apply sealant where shown or required by common good roofing practice.

End of Section

PART 1 - GENERAL

- | | |
|--------------------------------|---|
| 1.1 DESCRIPTION | <ul style="list-style-type: none">.1 General Requirements: Division 1, General Requirements, is part of this specification and shall apply as if repeated here..2 Work furnished and included: All labour and materials necessary to supply and install the Standing Seam Metal Siding (pre-finished metal siding system) in accordance with this specification including:<ul style="list-style-type: none">.1 Solid substrate behind standing seam siding as noted herein..2 Waterproofing membrane on solid substrate..3 Exterior standing seam metal siding system..4 All finishing accessories including flashings, closures, trims etc..3 Related work not included:<ul style="list-style-type: none">.1 Framing members required to support the standing seam metal siding system. |
| 1.2 Standards | <ul style="list-style-type: none">.1 Design of cladding system in accordance to the latest edition of:<ul style="list-style-type: none">.1 CSA-S136 for the design of Cold Formed Steel Structural Members..2 Canadian Sheet Steel Building Institute Standards 10M and 20M..3 National Building Code of Canada latest edition. |
| 1.3 Quality Assurance | <ul style="list-style-type: none">.1 Manufacturer of siding system, and installer shall demonstrate at least five years experience in projects similar in scope..2 This section establishes the standard of quality required for the complete metal roof system. Proposed substitutions must meet this standard, and will be considered as follows:<ul style="list-style-type: none">a) A written request for approval of a substitution is received at least ten (10) days prior to tender closing.b) 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. |
| 1.4 Design Requirements | <ul style="list-style-type: none">.1 Design siding system to resist:<ul style="list-style-type: none">.1 Snow loads and rain load, expected in this geographical region NBCC climatic data, 50 year probability.2 Wind loads, positive and negative, expected in this |

geographical region NBCC climatic data, 50 year probability

- .2 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and night time sky heat loss.
 - a) Temperature Change (Range): 20 deg C, ambient; 40 deg C, material surfaces.
- 1.5 Samples**
 - .1 Submit samples of specified product colour for review by the Architect for approval prior to fabrication.
- 1.6 Shop Drawings**
 - .1 Submit shop drawings in accordance with specifications elsewhere herein.
- 1.7 Maintenance Data**
 - .1 Provide maintenance data for cleaning and maintenance of panel finishes for incorporation into manual specified in Section 01730.
- 1.8 Product Delivery, Handling and Storage**
 - .1 Store components and materials in accordance with panel manufacturer's recommendations and protect from elements.
 - .2 Protect prefinished steel during fabrication, transportation, site storage and erection, in accordance with CSSBI Standards.
- 1.9 Guarantee**
 - .1 For work in this section, warranty by installer against defects or deficiencies in materials and/or workmanship shall be for a period of one year from date of substantial completion.
- 1.10 Warranty**
 - .1 Provide a manufacturer's written warranty covering failure of factory-applied exterior finish within the warranty period. Warranty period for finish: 30 years after the date of Substantial Completion. The values below are based on normal environments and exclude any aggressive atmospheric conditions.
 - a) The specified finish will not crack, chip, peel (lose adhesion) or chalk for thirty (30) years from date of installation. This does not include minute fracturing that may occur during the normal fabrication process. Finish will not chalk in excess of a number six (6) rating, in accordance with ASTM D-4214-98 method D659 at any

time for 30 years from date of installation; will not change colour more than eight (8.0) dE units as determined by ASTM method D-2244-02 at any time for 25 years from date of installation.

PART 2 – PRODUCTS

2.1 Roofing System:

.1

Standing Seam Metal Siding (SSMS) System:

SSMS to be:

Agway 'Standing Seam AR-38'. Siding to be on Solid Substrate throughout including:

- a) Full Underlayment: Solid substrate comprised of continuous 3/4" plywood fully finished with Blueskin peel and stick water-resistant membrane. Underlayment system (comprised of solid-substrate and membrane) shall be in full accordance with manufacturer's recommendations for the intended application and environmental conditions.
- b) Thermally responsive (expansion) clips to be fabricated from a minimum of 0.61 mm (0.018") steel, with minimum Z275 galvanized coating designed to accommodate expansion and contraction of the roof sheet.
- c) Siding Fasteners: As specified by manufacturer, to resist wind deflection and all related environmental forces. Fasteners to be concealed throughout (typical).
- d) **SSMS Material Specifics:**

Profile: Agway 'Standing Seam AR-38' with 1.5" seam upstand [concealed fastener installation]

Sheet: Z275 galvanized (zinc-coated hot-dip galvanized) sheet steel conforming to ASTM A653M; microcrystalline zinc phosphate pre-treatment following hot dip-galvanizing; panel structural quality Grade 230 having a nominal thickness of 22 gauge

Finish: Agway QC 11080 Bright Silver [on exterior finished face]; standard factory paint finish at interior panel face

Seams: Continuously rolled seams in fully-closed I-Style seam [180° flat rolled seam]

Widths: 3 panel widths are to be supplied and installed in the standard sequence [pattern repeat] indicated on the drawings. 3 panels widths:

- 20" [manufacturer standard width,

- factory-supplied press-breaking]
 - 28" [custom width produced by factory-supplied press-breaking]
 - 12" [custom width produced by factory-supplied press-breaking]
- Clips: Agway-supplied and recommended hold-down clips in types and quantities suited to the intended application [as/if required].

2.2 Panel Interior: .1 Interior Coating: WeatherX

2.3 Panel Exterior: .1 **Exterior Finish at Standing Seam Metal Siding:**

Exterior finish at all standing seam metal siding to be Arcelor Mittal 'Perspectra Plus Series' [silicone-modified polyester topcoat] conforming to the following standards

film thickness: 1.0 mils (ASTM D5796)

film cure: ASTMD5402

film hardness: ASTM D3363

film adhesion: ASTM D4145

film gloss: ASTM D523

film flexibility: ASTM D4145

adhesion impact: ASTM D2794

humidity resistance: ASTM D2247

chalking resistance: ASTM D4214 Method A [30 years]

Colour for all exterior prefinished metal standing seam metal siding [SSMS] and related components, accessories and associated trims to be:

QC 11080 Bright Silver

2.4 Siding Accessories .1 **Siding Flashings and Trims:** Supply and install compatible metal flashings and trims in full accordance with the siding manufacturer's recommendations for the intended application (and/or configurations illustrated on Architectural drawings) and for a complete installation ensuring:

- water-tightness
- positive shedding of water away from building face [via drip edges and diverter trims to suit]
- finished trimming of all corners and edges to provide protection from sharp metal edges, metal profile protrusions et.

Trims and flashings may include all required base drips, top caps, bottom trims, inside and outside corner flashings, locking strips, caps etc. and all other shapes (custom formed to suit) to ensure waterproof integrity and performance of the installed system. All trims directly related to and

contiguous with the siding system are to be colour matched the siding material.

All trim colours are to be pre-finished to match SSMS in colour:

QC 11080 Bright Silver

- .2 Closures: Foam and metal closures to suit profiles selected, to manufacturer's recommendations.
- .3 Sealants: In accordance with manufacturer's recommendation and related Divisions herein.

2.5 Fabrication

- .1 Fabricate roof components to comply with dimensions, profiles, gauges and details as shown on the shop drawings, including fascia and soffit panels and all companion flashings and trims to suit.
- .2 Fabricate all components of the system in the factory, ready for field installation.
- .3 Provide roof accessories in longest practical lengths to minimize field lapping of joints. All roof panels are to be single lengths per run, free of horizontal joints opposite the direction of roof drainage.

PART 3 – EXECUTION

3.1 Examination

- .1 Examine work of other Sections upon which work of this Section depends.
- .2 Report all discrepancies to consultant before beginning work on the roof system.

3.2 Installation

- .1 Siding Substrates and Attachments:
 - .1 Underlayment: Install $\frac{3}{4}$ " exterior grade plywood c/w Blueskin water-proof underlayment fully adhered to substrate according to manufacturer's recommendations. . Ensure all joints are properly lapped and sealed.
 - .2 Clip System: Attach manufacturer-supplied hold down clips and related fasteners as recommended by the manufacturer for the intended application.
- .2 Siding System Accessories & Installation:
 - .1 Install SSMS panels with panel support clips and rust-proof concealed fasteners as required, using manufacturer's proper [recommended] construction procedure for the intended application.
 - .2 Install the seam-cap at all side laps as shown on the approved shop drawings. Add sealant as required to

resist water entry.

- .3 Where indicated on approved shop drawings, secure the end-lap of SSMS sheets in accordance with the manufacturers specifications and details to provide a weather-tight seal.
- .4 Provide notched, formed and interlocked closures at all joints and at all changes of panel facing planes, ensuring that they are sealed against weather penetration throughout. All panels to be seamed with 180 degree seams, 1.5" high formed by hand-seaming or power-seaming to suit.
- .5 Ensure that all vertical seams in metal siding are true and plumb throughout except where indicated otherwise.
- .6 Outside corners of SSMS is intended to join without the use of 'raised' corner trim cap flashings [over top of seams]. Fabricate outside corner joints to present as minimally as possible while maintaining performance requirements.
- .7 Provide specialty panel shapes [including tapered] panels as required to suit the intended application and forms indicated on the architectural drawings.
- .8 Coordinate SSMS fabrication and installation to accommodate all rainware items indicated on drawings and as specified elsewhere herein. Ensure that rainware gutters fit tight, flush and close to finished panel faces where possible.

3.3 Clean-up

- .1 Clean exposed panel surfaces in accordance with manufacturer's instructions.
- .2 Repair and touch up with colour matching high grade enamel minor surface damage, only where permitted by the Architect and only where appearance after touch-up is acceptable to Architect.
- .3 Replace damaged panels and components that, in opinion of the Architect, cannot be satisfactorily repaired.

END OF SECTION 07613

PART 1 - GENERAL

1.1 General

Division One, General requirements, is part of this section and shall apply as if repeated here.

**1.2 Description
of Work**

Provide all labour, materials and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:

- .1 The protection of the interior and exterior surfaces of the building to be worked on and any equipment on or under the roof surface(s) and/or adjacent to areas of metal siding.
- .2 Fabrication, supply and installation of prefinished metal flashing at parapets, wall reglets, cant strips, flat roof edging, scuppers, junctures of metal siding with dissimilar cladding items etc.
- .3 Sealing of all flashing reglets, end seams and mitres.
- .4 Fabrication and supply of prefinished through-wall metal flashing to mason to be installed under section. Masonry Section 04220. Coordination shall take place between these two trades.
- .5 Maintaining a clean work area and final clean-up of the site upon completion of the roofing.
- .6 Fabrication, supply and installation of pre-finished metal rainware systems including gutters, downspouts, scuppers and all related accessories for a complete installation.

1.3 Related Work

- | | | |
|----|----------------------------|---------------|
| .1 | Built-up Roofing System | Section 07510 |
| .2 | Prefinished Metal Siding | Section 07465 |
| .3 | Standing Seam Metal Siding | Section 07613 |
| .4 | Building Sealants | Section 07900 |
| .5 | Aluminum Composite Panels | Section 07420 |

1.4 Approval

- .1 Submit samples of materials and profiles for Architect's and Consultant's approval before fabrication.

PART 2 - PRODUCTS

2.1 Materials

.1 PRE-FINISHED METAL FLASHING [PMF-#]:

Fabricate flashings [denoted as PMF on drawings] from min. 24 gauge thick zinc-coated steel, to ASTM-A446 Grade "A" with G90 zinc coating. Break-shape stock throughout custom-shaped to required sizes and configurations as shown on Architectural drawings and/or as required on site. All products as supplied by Agway Metals.

Metal Standards: CGSB 93-GP-4M, CSA S136-01

Finish Coating Standards: Class F1S (finished 1 side)

Colours:

PMF-1: QC 11078 Light Pewter
typical location: above ACP and VMS

PMF-2: QC 11080 Bright Silver
typical location: above SSMS

Flashing colour locations are to be as noted on Architectural Drawings.

.2 PRE-FINISHED METAL RAINWARE [RW]:

Fabricate prefinished metal rainware items including rainwater leaders, scuppers, gutters/troughs, elbows, pipe straps, support brackets etc. to suit requirements shown on Architectural drawings. All items are to be Agway 1500 Series Eavestroughs components fabricated from 22 gauge zinc-coated steel, to ASTM-A446 Grade "A" with G90 zinc coating. Rainware system is to be comprised of all related 1500-Series components and accessories including eavetroughs/gutters, leaders/downspouts, end caps, drop-in outlets, mounting brackets, scuppers, pre-manufactured outside corners, elbows, pipe straps, pipe brackets, gutter mounting brackets, gutter top-straps, manufacturer recommended sealants etc. all as required for a complete installation and for the required configurations.

All rainware components are to be finished in colour QC 11080 Bright Silver to match adjacent standing seam metal siding.

All rainware components to be securely anchored to the building using rust-proof fasteners throughout.

Rain-water leaders/downspouts are to be 5" wide x 4" deep in closed or open profile as required for the intended application or as selected by the Architect in the shop drawings.

Pre-finished metal gutters are to be 6" high x 5" deep in profile #1580 or 1581 as required for the intended application. Gutters are to be supplied in longest practical lengths throughout. Supply and install stabilizing cross-straps at top of gutter at 1500mm on centre max. Ensure that gutters are sufficiently anchored to building to accommodate volume of run-off generated by adjacent roof surfaces.

.2 Fasteners: Screws will be weather guard hex head with 13mm

(1/2") dome and neoprene washers. Nails - non-ferrous compatible with materials being installed.

- .3 Caulking: Polyurethane, conforming to CGSB 19-gp-24, colour matched to flashing colours throughout
- .4 Underlay: Smooth, unsaturated quality resin sized paper weighing not less than 0.3kg/sq.m. (6 lbs/sq.).
- .6 Bitumen Paint: To conform to CGSB 1-Gp-108C.
- .7 Joint Filler: Extruded polyethylene, closed cell Shore A Hardness 20, tensile strength 20 to 30 psi (140 to 210 kilo pascals).
- .8 Prefinished through wall metal flashing: Supply to the masonry contractor 26 gauge flashing as per item .1 to the profile required for installation by the masonry contractor.

PART 3 - EXECUTION

3.0 Fabrication

- .1 Fabricate all possible work in shop in 2450mm (8'-0") lengths min. by brake-forming, bench cutting, drilling and shaping. Ensure shaping of all sheet metal to custom profiles shown on drawings.
- .2 Form bends with straight sharp lines and angles into true planes, free from twists, buckles, dents and other visual distortions. Double-back exposed metal edges at least 13mm (1/2"). Raw [cut and/or un-rolled] edges will not be permitted.
- .3 Supply all accessories required for installation of sheet metal work of this section. Fabricate accessories of same material as work with which they will be used.

3.1 Installation

- .1 Install sheet metal flashing at coping, wall expansion joints and curbs as shown on the drawings, or as otherwise required, for building components which penetrate roofs, and for which flashing are not specified in the work of other sections.
- .2 Sheet metal work shall be installed to properly cover the area to be protected and be watertight under all service and weather conditions. Install in a uniform manner, level, true to line, free of dents, warping and distortion.
- .3 Back-paint at the rate of 0.12 L/sq.m (0.25 gal/sq.) with bituminous paint, sheet metal that comes into contact with another kind of metal, masonry or concrete.
- .4 Install sheet metal with concealed fasteners at lock joints. Exposed fastenings will be permitted only with the approval of the Architect. Space all fasteners evenly in an approved manner. Use lead plugs and screw with rubber washers where metal flashing are installed over concrete or masonry.
- .5 Install underlay under sheet metal installed directly over concrete or masonry surfaces. Overlap joints 100mm (4") and turn up 150mm (6") at

edges where horizontal surfaces intersect vertical planes.

- .6 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. Make corners by means of raised seams. Lock seam and caulk. Do not use pop rivets.
- .7 Slope all metal for positive drainage of water away from building and/or towards drains. Do not form open joints or pockets that fail to drain water.
- .8 Caulk all open sheet metal joints.
- .9 Wedge flashing into reglets joints with lead wedges at 300mm (12") o.c. at reglets wider than 9mm (3/8") and deeper than 19mm (3/4") provide polyethylene rod 25% wider than joint width. Prime and caulk all joints to ensure positive waterproof seal.
- .10 Ensure that raw metal edges do not come into contact with roofing membrane.
- .11 Install all rainware with downspout locations and quantities suited to the related rain run-off volumes. Ensure that gutters are installed to provide positive drainage to all downspouts. Downspouts are to be fitted with leaders evacuating water away from building walls and towards adjacent drainage pathways [or adjacent roof drains as applicable]. Ensure that topside of gutter are fitted with stabilizing cross-straps at 1500mm o.c. max.

3.2 Finish

- .1 Prepare and touch up all scratches on pre-painted finish with matching paint (as recommended by pre-finished metal manufacturer) to the satisfaction of the Architect and Consultant.
- .2 Remove flux residue completely from surfaces and crevices. Remove fibre deposits or protection and wash metals left unpainted and exposed to view as specified by the metal manufacturer.

**3.3 Field Quality
Control**

- .1 Include in work of this section supervision of roof flashing by roofing inspection company engaged for supervision of membrane roofing installation.
- .2 Inspection procedures specified shall govern for this Section also.

END OF SECTION 07620

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

1.02 SUMMARY

- A. Section includes the supply and installation of intumescent fire-resistive coatings applied to primary and secondary structural steel members to provide specified fire-resistance ratings.

In all circumstances, the following items require the noted fire-resistance ratings throughout the project:

- a) 1 hour fire-resistance rating on all **structural steel components comprising part of floor assemblies**
- b) 1 hour fire-resistance rating on **structural steel items located in loadbearing walls/wall assemblies** [including exposed steel lintels above windows and similar openings in structural wall assemblies etc.]
- c) 1 hour fire-resistance rating on **loadbearing steel columns** [supporting items above]
- d) 1 hour fire-resistance rating on all **steel components comprising part of stair treads, risers and landings [i.e. stair floor items]**
- e) 1 hour fire-resistance rating on all **steel components comprising part of ramp runs and landings [i.e. ramp floor items]**

1.03 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

- 1. Section 01 40 00 – Quality Assurance
- 2. Section 05 12 00 – Structural Steel Framing
- 3. Section 05 50 00 – Metal Fabrications
- 4. Section 07 80 00 – Firestopping
- 5. Section 09 20 00 – Plaster and Gypsum Board
- 6. Section 09 90 00 – Painting and Coatings

1.04 REFERENCE STANDARDS

- 1. 40 CFR 59, Subpart D – National Volatile Organic Compound Emission Standards for Architectural Coatings
- 2. ASTM D2240 - Standard Test Method for Rubber Property — Durometer Hardness
- 3. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation — Impact Resistance
- 4. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser — Abrasion Resistance
- 5. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers — Bond Strength
- 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

7. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
8. National Fire Protection Association, NFPA 251
9. Underwriters Laboratories Inc. (UL) ANSI/UL263
10. Underwriters Laboratories of Canada (ULC) CAN/ULC S101-M
11. Association of the Wall and Ceiling Industry, AWCI Technical Manual 12-B, current edition.

1.05 SUBMITTALS

- A. Product data and application instructions for each intumescent coating indicated on drawings and Finish Schedule.
- B. Product certificates from manufacturer documenting intumescent coatings comply with specified requirements including those for fire test response characteristics and compatibility with adhesives, primers, and other surface coatings on substrates indicated to receive intumescent coatings.
- C. Fire Resistance Rating Listings: UL, ULC, or other accredited testing agency indicating type and size of steel member to receive intumescent coatings and minimum dry thickness (mils) to achieve specified fire resistance rating.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company responsible for the manufacture of fire protection materials with local direct technical employee(s) (as distinct from distributors or authorized agents) readily available at the project site. Intumescent coatings shall be manufactured under the follow-up services program of Underwriter's Laboratories (UL) or UL Canada (ULC) and bear the UL (and/or ULC) label (mark). Manufacturer's technical representative to be on site during start of installation and be generally available on site as requested during the application process.
- B. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by the intumescent coatings manufacturer as having the necessary training to install manufacturer's products, and otherwise have the experience and staff to properly perform the installation. Installer shall be trained by the intumescent coatings manufacturer's direct employee(s) (not by distributors or authorized agents).
- C. Installation: Verify steel members have been properly prepared, including the use of a compatible primer, and install intumescent coatings in accordance with manufacturer's written recommendations published in their product technical literature and/or provided by manufacturer.
- D. Product Identification: Label packages (pail or bucket) with manufacturer name, product name, expiration date, freeze tag, UL or ULC label (mark).
- E. Special Inspection: Owner to employ a qualified independent inspection and testing agency to perform field quality control testing services in accordance with AWCI Technical Manual 12-B, local building code and Authority Having Jurisdiction requirements.
- F. Inspection and Testing Agency Qualifications: ASTM E329-09, "Standard Specification for Agencies Engaged in Construction Inspection and Testing" and AWCI Technical Manual 12-B.

- G. Field Constructed Mockups: Prior to installing intumescent coatings, Installer shall apply products specified for exposed applications to demonstrate aesthetic qualities and workmanship. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
1. Location: As indicated on drawings.
 2. Extent of Mockups: Approximately 5 sq. ft. of surface for each product indicated.
 3. Notify architect one week in advance of the dates and times when mockups will be built.
 4. Obtain architect's written acceptance of mockups before start of actual unit of work.
 5. Retain and maintain mockups during construction in undisturbed condition as a standard for judging completed units of work.
 - a. Accepted mockups in undisturbed condition at time of substantial completion may become part of completed unit of work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with manufacturer's labels intact and legible.
- B. Install intumescent coatings prior to expiration date included on packaging. Properly discard expired product.
- C. Store intumescent coatings protected from direct sunlight and maintained at a temperature as specified by the manufacturer. The product must not be frozen, or stored at freezing temperatures. Verify proper storage of material as indicated by the freeze indicator label attached to the pail. Identify and label material damaged due to improper storage, remove from Project site and properly discard.

1.08 PROJECT CONDITIONS

- A. Environmental Conditions:
1. Do not install intumescent coatings when ambient or substrate temperatures are, or prior to full cure will be, outside the manufacturer's recommended installation temperatures, unless temporary protection and heating/cooling is provided to maintain temperatures within the prescribed range for the period specified by the manufacturer.
 2. Do not install intumescent coatings when relative humidity is outside the limits established by the manufacturer. Consult manufacturer to determine precautions that may be implemented to prevent condensation from forming on the steel during application of fireproofing.
- B. Ventilation: Ventilate areas where intumescent coatings will be installed by natural means or, where this is inadequate, forced air circulation during and after application until fireproofing dries thoroughly.

1.9 SEQUENCING

- A. Sequence and coordinate application of intumescent coatings with related work specified in other Sections to comply with the following requirements:

1. Coordinate installation of intumescent coatings with other items of work that may interfere with proper installation of coatings.
2. Do not begin applying intumescent coatings until clips, hangers, supports, and other welded connections have been installed. Intumescent coatings manufacturer must approve in writing any clips, hangers, supports or connections that may be installed over coating using mechanical or adhesive devices.
3. Provide temporary enclosures as necessary to prevent deterioration of intumescent coatings due to exposure to unfavorable environmental conditions.
4. Take appropriate steps to avoid abrasion and other damage to the applied intumescent coatings during construction operations.
5. Do not protect or conceal structural members to which intumescent coatings have been applied until each area has been inspected, tested, and corrections have been made to any deficient areas.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Design: Provide intumescent thin-film fire protection systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).

2.2 MATERIALS

- A. Fire-Resistive Coatings - Interior: Thin-film intumescent fire protection system for structural steel.
 1. Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with ULC S101 and ULC S102.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hilti, Inc.
 - b. Basis of Design Product:
 1. Fire Finish Steel Protection Spray CFS-SP WB by Hilti, Inc.
 - c. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
 - d. Surface Burning Characteristics: Class A, flame spread/smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84
 - e. VOC Content: Less than 0 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24)
- B. Sealers and Primers: As required by tested and listed assemblies and recommended by intumescent coatings manufacturer to suit specific substrate conditions.

2.3 AUXILIARY FIREPROOFING MATERIALS

- A. General: Provide auxiliary fireproofing materials that are compatible with intumescent coating products and substrates and are approved by UL or other accredited testing

agencies acceptable to authorities having jurisdiction for use in the fire resistive designs indicated.

- B. Substrate Primers: For use on each different substrate, provide primer that complies with the following requirements:
 - 1. Primer shall be approved in writing by manufacturer of intumescent coatings, and applied in full compliance with the primer manufacturer's written instructions. Primer must be fully cured prior to installation of the intumescent coating.
- C. Topcoats: Suitable for application over applied intumescent coatings; of type recommended in writing by intumescent coatings manufacturer for each fire resistance design. Color of topcoat shall be as selected by the architect. Colors shall not be limited to manufacturer's standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cover other work subject to damage from fall out or overspray of intumescent coatings materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintaining adequate ambient conditions for temperature and ventilation.
- B. Clean substrates of substances that could impair bond of thin-film fire resistive material, including oil, grease, dirt, dust, rolling compounds, incompatible primers, and loose mill scale.
- C. Prime substrates with compatible primer approved by the intumescent coatings manufacturer except where compatible shop primer has been applied and is in satisfactory condition to receive intumescent coatings. Primer must be fully cured prior to applying intumescent coatings.
- D. Apply intumescent coatings: Protect intumescent coatings from rain, direct sunlight, high humidity, strong wind (with dirt, dust or sand) during the application and drying phases. Do not apply an additional coat of intumescent coating until previous layer has fully cured.
- E. For applications visible upon completion of project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections that would telegraph through fire resistive products after application.

3.2 INSTALLATION, GENERAL

- A. Coordinate application of intumescent coatings with other construction to allow for proper application and minimize need to repair damage.
- B. Comply with intumescent coatings manufacturer's instructions for mixing materials, application procedures, and types of equipment used to convey and install products, as applicable to the particular conditions of installation and as required to achieve fire resistance ratings indicated.
- C. Coat substrates with primer and allow proper cure time prior to applying intumescent coatings as recommended by intumescent coatings manufacturer for material and application indicated.

- D. Apply intumescent coatings identical to mock-ups.
- E. Coordinate work to ensure that **all steel items as noted in section 1.02 A** [earlier herein] and as shown on the drawings will receive the required intumescent coatings. Review drawings and site conditions as required to ensure that all required items are part of the work.

3.3 INSTALLING INTUMESCENT FIREPROOFING

- A. Apply intumescent coatings in thicknesses required to achieve fire resistance ratings designated for each condition.
- B. Provide a uniform finish complying with description indicated for type of material and matching finish approved for field erected mockup.

3.4 FIELD QUALITY CONTROL

- A. Inspection and Testing Agency: Coordinate installation of fireproofing with owner's independent inspection and testing agency.
- B. Inspection & testing shall be in accordance with AWCI Technical Manual 12-B.
- C. Testing agency will promptly report test results in writing to the installer and architect.
- D. Remove and replace intumescent coatings where test results indicate that fireproofing does not comply with specified requirements for adhesion.
- E. Apply additional intumescent coatings per manufacturer's directions where test results indicate that the thickness does not comply with specified requirements.
- F. Additional Testing: Where intumescent coatings are removed and replaced or repaired, Owner's inspection and testing agency shall perform additional testing to determine compliance with specified requirements.

3.5 CLEANING, REPAIR, AND PROTECTION

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove product over spray and fall out from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Cure intumescent coatings according to manufacturer's recommendations.
- C. Protect intumescent coatings from damage during construction.
- D. Repair or replace work that was not properly protected from damage during construction in accordance with manufacturer's recommendations.
- E. Ensure full curing of intumescent coating prior to application of top coat.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.2 DEFINITIONS

- .1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between fire rated wall and floor assemblies.

1.3 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- .1 Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- .2 Fill any slot gaps between edge of floor slabs and curtain walls.
- .3 Openings between structurally separate sections of wall or floors.
- .4 Gaps between the top of walls and ceilings or roof assemblies.
- .5 Expansion joints in walls and floors.
- .6 Openings and penetrations in fire-rated partitions or walls containing fire doors.
- .7 Openings around structural members which penetrate floors or walls.

1.4 RELATED WORK OF OTHER SECTIONS

- .1 Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - .1 Section 03 30 00 - Cast-In-Place Concrete
 - .2 Section 04 20 00 - Masonry Work
 - .3 Section 07 90 00 - Joint Sealants
 - .4 Section 09 20 00 – Plaster and Gypsum Board
 - .5 Section 09 22 16 – Non-Structural Metal Framing
 - .6 Section 21 00 00 - Fire Suppression
 - .7 Section 22 00 00 – Plumbing
 - .8 Section 23 00 00 - Heating, Ventilating and Air Conditioning
 - .9 Section 26 00 00 – Electrical
 - .10 Section 27 00 00 - Communications

1.5 REFERENCES

- .1 Test Requirements: CAN/ULC-S115 2015 or CAN/ULC-S115: 2018, "STANDARD METHOD OF FIRE TESTS OF FIRESTOP SYSTEMS.
- .2 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN/ULC-S115:2018 under their designation of ULC-S115:2018 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.
- .3 Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-M are given a cUL listing and are published by UL in their "Products Certified for Canada (cUL) Directory". Omega Point Laboratories runs ASTM E-814 and publishes the results annually in their "Omega Point Laboratories Directory".
- .4 Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems". These test requirements provide more guidelines for testing moving joints than that given in CAN/ULC-S115. UL tests that meet the requirements of CAN/ULC-S115 are given a cUL listing and are published by UL in their "Products Certified for Canada (cUL) Directory".
- .5 Canada Green Building Council (CaGBC). LEED Canada V4.0- Building Design and Construction, Interior Design + Construction (ID+C)
Health Canada/ Workplace Hazardous Material Information System (WHMIS).

- .6 Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops.", and ASTM E2393 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .7 Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus".
- .8 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- .9 CAN/ULC-S102:2018, Standard Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S101 Fire Endurance Tests of Building Construction and Materials.
- .10 ASTM D6904, "Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry".
- .11 ASTM C 679, "Standard Test Method for Tack-Free Time of Elastomeric Sealants".
- .12 All major building codes: NBC and OBC.
- .13 NFPA 101 - Life Safety Code.
- .14 Canadian Electrical Code

1.6 QUALITY ASSURANCE

- .1 Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.
- .2 Firestop System installation must meet requirements of CAN/ULC-S115:2018 tested assemblies that provide a fire rating as shown in Section 2.1 Clauses 4, 5, 6 & 7 below.
- .3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- .4 Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- .5 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council

1.7 SUBMITTALS

- .1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.
- .2 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- .3 Submit material safety data sheets provided with product delivered to job-site.
- .4 Submit shop drawings in accordance with Section 01 33 00- Submittals:
Submit complete cUL, ULC or equivalent approved systems for all applications.
- .5 Submit certificate by firestopping manufacturer that the products supplied comply with LEED requirements for indoor environmental quality credit including printed statement of VOC.

1.8 INSTALLER QUALIFICATIONS

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- .2 Installer shall have not less than 3 years of experience with fire stop installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

- .1 Do not use materials that contain flammable solvents.
- .2 Scheduling
 - .1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
 - .2 Schedule installation of Drop-In firestop devices after placement of concrete but before installation of the pipe penetration. Diameter of sleeved or cored hole to match the listed system for the device
 - .3 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
 - .4 Schedule installation of preformed joint materials to be installed with the metal framing
- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- .5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 Provide a fire-rated cable pathway device whenever single and/or bundled low-voltage cables penetrate fire rated concrete, masonry and drywall walls and floors, where frequent cable additions and changes may occur. The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The device shall be capable of being easily ganged together with any combination of compatible sleeves using gang plate systems. The fire-rated cable management device shall consist of a bare metal housing and frame(s) to enable grounding for electrical continuity. The device shall provide airflow containment sufficient to achieve the L-Rating requirements of the barrier type.
 - .1 Round fire-rated cable management device: The device shall consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating. Install device per the manufacturer's published installation instructions.
 - .2 Rectangular fire-rated cable management device: The device shall consist of a rectangular galvanized steel sleeve with a symmetrical half-shell design for retrofit capabilities. The device shall consist of an inner and outer layer of brushes on both ends of the device sufficient to achieve the L-Rating. The device shall be capable of being easily ganged together using gang plate or floor grid systems with ganging clips. Install device per the manufacturer's published installation instructions.
- .4 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .5 Penetrations in firewall or a horizontal fire separation above a garage: Provide firestopping with ratings determined in accordance with CAN/ULC-S115. provide a firestop system with a "FT" Rating as determined by cUL which is equal to the fire resistance rating of the construction being penetrated.

- .6 Penetrations by polypropylene pipes through any fire separation required to have a fire resistance rating shall be protected by a firestop system with an "FT" rating.
- .7 W-Rating: Class 1 rating in accordance with water leakage test per UL1479.
- .8 Provide a firestop system with an Assembly Rating as determined by ULC-S115 which is equal to the time rating of construction joint assembly.
- .9 Penetrations or joints in Smoke Barriers: Provide firestopping with ratings determined in accordance with CAN/ULC-S115.
 - .1 L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening or joints at both ambient and elevated temperatures.
- .10 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.
- .11 Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance with through penetration firestop systems and joint systems listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:
 - .1 Basis of Design:
Hilti (Canada) Corporation, Oakville, Ontario 1-800-363-4458 www.hilti.ca
 - .2 Substitution requests shall be considered in accordance with contract provisions

2.3 MATERIALS

- .1 Use only firestop products that have been cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Accessories: provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:
 - .1 Permanent forming, damming and backing material.
 - .2 Temporary forming material.
- .3 Pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
 - .1 Hilti Tub Box Kit (CP 681) for use with tub installations.
 - .2 Hilti Cast-In Place Firestop Device (CP 680- P/PX) for use with combustible pipe
 - .3 Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - .4 Hilti Firestop Speed Sleeve (CP 653 BA) for use with cable penetrations.
 - .5 Hilti Firestop Speed Sleeve (CFS-SL GA L) for use with cable penetrations.
 - .6 Hilti Modular Firestop Sleeve System (CFS-MSL) for use with new and existing cable penetrations in walls and floors.
 - .7 Hilti CFS-MSL Modular Sleeve
 - .8 Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - .9 Hilti Cast-in Firestop sleeve (CFS-CID MD P) and (CFS-CID MD M) for use with combustible and noncombustible pipes through metal deck.
- .4 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - .2 Hilti Fire Foam (CP 620)/(CP 660)
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- .5 Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - .1 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .2 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

- .3 Hilti Flexible Firestop Sealant (CP 606)
- .4 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- .6 Sealants or sprays for use with fire-rated construction joints and other gaps, the following products are acceptable:
 - .1 Hilti Firestop Joint Spray (CFS-SP WB)
 - .2 Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .6 Hilti Bottom of Wall sealant (CP 605)
- .7 Pre-formed materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
 - .1 Hilti Top Track Seal (CFS-TTS)
 - .2 Hilti Top Track Seal for Metal deck (CFS-TTS MD)
- .8 Pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material.
 - .1 Hilti Speed Plugs (CP 777)
 - .2 Hilti Speed Strips (CP 767)
- .9 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- .10 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - .2 Hilti Fire Foam (CP 620)/(660)
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- .11 Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Hilti Firestop Putty Stick (CP 618)
 - .2 Hilti Firestop Plug (CFS-PL)
- .12 Wall opening protective materials for use with cUL. / ULC listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
 - .1 Hilti Firestop Putty Pad (CP 617)
 - .2 Hilti Firestop Box Insert
- .13 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
 - .1 Hilti Firestop Collar (CP 643N)
 - .2 Hilti Wrap Strips (CP 648E/648S)

The firestop system selected shall have been tested at an elevated differential pressure of 50Pa where such pressure is required by the NBC or applicable provincial code.
- .14 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL)
 - .2 Hilti Composite Sheet (CFS-COS)
 - .3 Hilti Firestop Mortar (CP 637)
 - .4 Hilti Fire Foam (CP 620)/(660)
 - .5 Hilti Firestop Board (CP 675T)
- .15 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL)
 - .2 Hilti Firestop Board (CP 675T)
- .16 Re-penetrable, cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:
 - .1 Hilti Modular Firestop Sleeve System (CFS-MSL) for use with new and existing cable penetrations in walls and floors.
 - .1 Hilti CFS-MSL Modular Sleeve

- .2 Hilti CFS-MSL P Modular Sleeve Plate
- .3 Hilti CFS-MSL GPA Adjustable Gangplate
- .4 Hilti CFS-MSL GPR Retrofit Gangplate
- .5 Hilti CFS-MSL GPP Pre-drywall Gangplate
- .6 Hilti CFS-MSL CGL Ganging Clips
- .2 Hilti Speed Sleeve (CP 653 BA) with integrated smoke seal fabric membrane.
- .3 Hilti Firestop Speed Sleeve (CFS-SL GA L) for use with cable penetrations
- .4 Hilti Firestop Cable Collar (CFS-CC)
- .5 Hilti Firestop Sleeve (CFS-SL SK)
- .6 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
- .7 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
- .8 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.
- .17 Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
 - .1 Hilti Firestop Joint Spray (CFS-SP WB)
 - .2 Hilti Flexible Firestop Sealant (CP 606)
 - .3 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .4 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- .18 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
 - .1 Hilti CFS-BL Firestop Block (for walls and floors)
 - .2 Hilti CFS-PL Firestop Plug (for walls and floors)
 - .3 Hilti CP 680 Cast-In Place Firestop Device (for floors only)
- .19 For single or cable bundles up to one inch diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies the following product is acceptable:
 - .1 Hilti CFS-D Firestop Cable Disc
- .20 Pre-formed materials for use as part of a perimeter fire barrier system between fire-resistance-rated floors and exterior wall assemblies, the following products are acceptable:
 - .1 Hilti Preformed Firestop System (CFS-EOS QuickSeal)
- .21 Spray or Sealant materials for use as part of a perimeter fire barrier system between fire-resistance rated floors and exterior wall assemblies, the following products are acceptable:
 - .1 Hilti Firestop Joint Spray (CFS-SP WB)
 - .2 Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
 - .3 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .4 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- .22 For joints and penetrations in non-rated fire separations the following products are acceptable:
 - .1 Hilti CS-S SA LIGHT Smoke and Acoustic sealant
 - .2 Hilti CP 572 Smoke and Acoustic Spray
 - .3 CS-TTS SA Smoke and Acoustic Track Seal

PART 3 – EXECUTION

3.1 PREPARATION

- .1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - .1 Verify penetrations are properly sized and in suitable condition for application of materials.
 - .2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 - .3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 - .4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 - .5 Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

- .1 Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.

- .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- .3 Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- .4 Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

3.3 INSTALLATION

- .1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Intertek Directory of Building Products.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
 - .1 Seal all holes or voids made by penetrations to ensure an air seal.
 - .2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 - .3 Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable code authorities.
- .3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" and ASTM E-2393, "Standard Practice for On-Site Inspection of Installed Firestop Joint Systems". or another recognized standard.
- .4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- .5 Manufacturer's Field Services: The manufacturer's representative to be present during the first installation of every first firestop system. The manufacturer's representative to provide periodic walk-through. After every site visit the manufacturer's technical representative to submit site reports to indicate application reviewed, location and installer. Contractor to submit site reports by manufacturer to consultant within one week of each visit.

3.5 IDENTIFICATION & DOCUMENTATION

- .1 The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.
- .2 The Documentation Form for through penetrations is to include:
 - .1 A Sequential Location Number
 - .2 The Project Name
 - .3 Date of Installation
 - .4 Detailed description of the penetrations' location
 - .5 Tested System or Engineered Judgment Number
 - .6 Type of assembly penetrated
 - .7 A detailed description of the size and type of penetrating item
 - .8 Size of opening
 - .9 Number of sides of assemblies addressed
 - .10 Hourly rating to be achieved
 - .11 Installers Name
- .3 The Documentation Form for Construction Joints is to include:
 - .1 A Sequential Location Number
 - .2 The Project Name
 - .3 Date of Installation
 - .4 Detailed description of the Construction Joints location
 - .5 Tested System or Engineered Judgment Number
 - .6 Type of Construction Joint

- .7 The Width of the Joint
 - .8 The Lineal Footage of the Joint
 - .9 Number of sides addressed
 - .10 Hourly rating to be achieved
 - .11 Installers Name
 - .4 Copies of these documents are to be provided to the general contractor at the completion of the project.
 - .5 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 - .1 The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Owner of Any Damage."
 - .2 Contractor's Name, address, and phone number.
 - .3 Through-Penetration firestop system designation of applicable testing and inspecting agency.
 - .4 Date of Installation.
 - .5 Through-Penetration firestop system manufacturer's name.
 - .6 Installer's Name.
 - .7 Permanently attach Hilti identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to quickly identify the penetration attributes.
- Acceptable Software: Hilti (Canada) Corporation, Mississauga, Ontario (800) 363-4458 website: www.hilti.ca

3.6 ADJUSTING AND CLEANING

- .1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- .2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.7 LABOR USE TO INSTALL FIRESTOP SYSTEMS

- .1 If firestopping is not assigned to a single-source firestop specialty contractor, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

3.8 SCHEDULE OF COMMON FIRESTOP SYSTEMS

CONCRETE FLOORS			CONCRETE OR BLOCK WALLS		
TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM	TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM
BLANK OPENINGS	1	F-A-0006, C-AJ-0055, C-AJ-0070, C-A-J-0138	BLANK OPENINGS	1	C-AJ-0055, C-AJ-0070
	2	F-A-0006, C-AJ-0055, C-AJ-0070, C-A-J-0138		2	C-AJ-0055, C-AJ-0070
	3	F-A-0006, C-AJ-0055, C-AJ-0086,		3	C-AJ-0055, C-AJ-0086
SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, F-A-1028, F-A-1017	SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, W-J-1067, W-J-1020
	2	C-AJ-1226, F-A-1028, F-A-1017		2	C-AJ-1226, W-J-1067, W-J-1020, W-J-1248
	3	C-AJ-1226, F-A-1017		3	C-AJ-1226, W-J-1041, W-J-1068
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	4	C-BJ-1037, C-BJ-1034, F-A-1091	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	4	C-BJ-1034, C-BJ-1037, W-J-1041, W-J-1042, W-J-1068
	1	F-A-2240, F-A-2025, CA-J-2078, C-AJ-2035, CA-J-2022		1	C-AJ-2109C-AJ-2078, W-J-2332, C-AJ-2024, C-AJ-2035, C-AJ-2022
	2	C-AJ-2035, C-AJ-2022, C-AJ-2021		2	C-AJ-2078, W-J-2332, C-AJ-2024, C-AJ-2035, C-AJ-2022
SINGLE/CABLE BUNDLES	3	C-A-J-2012, C-AJ-2035-F-A-2012		3	CA-J-2035 C-J-2035 C-AJ-2024
	4			4	
	1	F-A-3007, C-AJ-3095, C-AJ-3180, C-AJ-3283	SINGLE/CABLE BUNDLES	1	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
CABLE TRAY	2	F-A-3007, C-AJ-3095, C-AJ-3334, F-A-3060		2	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167, W-J-3189
	3	F-A-3007, C-AJ 3095, C-AJ-3285		3	C-AJ-3095, C-AJ-3180, W-J-3167
SINGLE INSULATED PIPES	1	C-AJ-4034, C-AJ-4071	CABLE TRAY	4	W-J-3050
	2	C-AJ-4034, C-AJ-4071		1	W-J-4027, C-AJ-4034, C-AJ-4071
	3	C-AJ-4034, C-AJ-4035		2	W-J-4027, C-AJ-4034, C-AJ-4071
SINGLE INSULATED PIPES	1	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5048	SINGLE INSULATED PIPES	3	C-AJ-4034, C-AJ-4035
				4	W-J-8007
				1	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042

	2	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5090		2	C-AJ-5090, C-AJ-5091, C-AJ-5061, W-J-5042
	3	F-A 5016, C-AJ-5090, F-A-5018		3	C-AJ-5090, C-AJ-5061
	4	C-BJ-5006		4	C-BJ-5006, W-J-5028
ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, F-A-6002, C-AJ-6036	ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, C-AJ-6036
	2	C-AJ-6006, C-AJ-6017, F-A 6042, C-AJ-6036		2	C-AJ-6006, C-AJ-6017, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017		3	C-AJ-6006, C-AJ-6017
MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, C-AJ-7084	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	2	C-AJ-7046, C-AJ-7051, C-AJ-7084		2	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	3	C-AJ-7046, C-AJ-7051		3	C-AJ-7046, C-AJ-7051
MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	2	C-A-J-7145	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	1	W-J-7029, W-J-7124
				2	W-J-7091, W-J-7112, W-J-7124
MIXED PENETRANTS	1	C-AJ 8099, C-AJ-8056, C-AJ-8143	MIXED PENETRANTS	1	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	2	C-AJ-8099, C-AJ-8056, C-AJ-8143		2	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	3	C-AJ-8099, C-AJ-8056		3	C-AJ 8041, C-AJ 8056, W-J 8007, C-AJ 8099
	4	C-AJ-8095		4	C-AJ 8095, W-J 8007
WOOD FLOORS			GYPSUM WALLS		
TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM	TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM
METAL PIPES OR CONDUIT	1	F-C-1009, F-C-1059, F-C-1168	METAL PIPES OR CONDUIT	1	W-L-1054, W-L-1058, W-L-1164, W-L-1506, W-L-1465
	2	F-C-1009, F-C-1059, F-C-1168		2	W-L-1054, W-L-1058, W-L-1164, W-L-1506, W-L-1465
NON-METALLIC PIPE OR CONDUIT	1	F-C-2011, F-C-2416, , F-C-2007	NON-METALLIC PIPE OR CONDUIT	4	W-L-1110, W-L-1111, W-L-1165
	2			1	W-L-2028, W-L-2061, W-L-2020
SINGLE OR BUNDLED CABLES	1	F-C-3012, F-C-3110, F-C-3074	SINGLE OR BUNDLED CABLES	2	W-L-2028, W-L-2061, W-L-2020
	2	F-C-3012, F-C-3110		4	
INSULATED PIPES	1	F-C-5004, F-C-5037, F-C-5036, F-C-5065	CABLE TRAY	1	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	2	F-C-5004, F-C-5037		2	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	F-C-7013, F-C-7043	INSULATED PIPES	3	W-L-3385, W-L-3277
				4	W-L-3139, W-L-3334
INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	N/A**	INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	W-L-4011, W-L-4060, W-L-4081
	2	N/A**		2	W-L-4011, W-L-4060, W-L-4081
MIXED PENETRANTS	1	F-C-8009, F-C-8014, F-C-8026, F-C-8038	MIXED PENETRANTS	4	W-L 8014
				1	W-L-5028, W-L-5029, W-L-5047
				2	W-L-5028, W-L-5029, W-L-5047
				4	W-L-5073
				1	W-L-7040, W-L-7042, W-L-7155
				2	W-L-7040, W-L-7042, W-L-7155
				1	W-L-7059, W-L-7153, W-L-7156, W-L-7151
				2	W-L-7059, W-L-7153, W-L-7156, W-L-7151
				1	W-L-1095, W-L-8013
				2	W-L-1095, W-L-8013
				4	W-L-8014

Schedule of joint firestop systems. Basis of design: Hilti Canada

Joint Type	F-Rating (Hr)	Hilti Basis of Design cUL System	
		Joint Width Less than or Equal to 2"	Joint Width Greater than 2" Less than or Equal to 6" ⁴
Concrete (Floor to Floor)	1	FF-D-1012, FF-D-1013 ¹	FF-D-1012, FF-D-1013
	2	FF-D-1012, FF-D-1013 ¹	FF-D-1012, FF-D-1013
	3	FF-D-1011, FF-D-1026 ¹	FF-D-1011, FF-D-1026
	4	FF-D-1047	FF-D-1125
Concrete (Edge of Floor Slab to Wall)	1	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	2	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	3	FW-D-1011	FW-D-1011, FW-D-1021
	4	FW-D-1047	FW-D-1092
Concrete or Block Wall to Flat Concrete Floor (Top-of-Wall)	1	N/A**	N/A**
	2	HW-D-0097 ¹	HW-D-1009, HW-D-1045
	3	HW-D-1008 ¹ , HW-D 0268	HW-D-1008
	4	HW-D-1042	HW-D-1103
Concrete or Block Wall to Concrete Over Fluted Metal Deck (Top-of-Wall)	1	HW-D-0098	N/A**
	2	HW-D-0080, HW-D-0081, HW-D-0098	HW-D-1037
	3	N/A**	N/A**
	4	HW-D-0294	N/A**
Gypsum Wall to Flat Concrete Floor (Top-of-Wall)	1	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106,	HW-D-1011, HW-D-1012, HW-1020

		HW-D-0119	
	2	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	3	HW-D-0119	HW-D-1011
Gypsum Shaft Wall to Floor (Top-of-Wall)	2	HW-D-0342 (FLAT CONCRETE) HW-D-0541, HW-D-0542 (CONCRETE OVER METAL DECK)	N/A**
Gypsum Shaft Wall to Concrete Floor (Bottom-of- Wall)	1	BW-S-0023	N/A**
	2	BW-S-0023	N/A**
Gypsum Wall to Concrete Floor (Bottom-of-Wall)	1	BW-S-0001, BW-S-0002	N/A**
	2	BW-S-0001, BW-S-0002,	N/A**
Gypsum Wall to Concrete Over Fluted Metal Deck (Top-of- Wall)	1	HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-0292, HW-D-0295, HW-D-538*	HWD-1011, HWD-1012, HW- 1020
	2	HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-292, HW-D-0295, HW- D0538*	HW-D-1011, HW-D-1012, HW-D-1020
	3	HW-D-0292, HW-D-0295	HWD-1011, HWD-1012, HW- 1020
	4	HW-D-0292, HW-D-0295	N/A**
	2	WW-D-0017, WW-D-0082	WW-D-1080, WW-D-1084
Concrete (Wall to Wall)	3	WW-D-1011', WW-D-0032	WW-D-1011
	4	WW-D-1047	WW-D-1128
Gypsum to Concrete (Wall to Wall)	1	WW-D-0068	N/A**
	2	WW-D-0068	N/A**

* SEE NOTE 3 ** CONTACT HILTI FOR CURRENT cUL-CLASSIFIED SYSTEM OR ENGINEERING JUDGMENT DRAWING: 1-800-363-4458
NOTES:

1. CLASSIFIED SYSTEMS FOR 2" - 6" WIDE JOINTS MAY BE USED FOR JOINTS 2" WIDE AND LESS.
2. CONFIRM THAT MOVEMENT CAPABILITIES OF THE SELECTED cUL SYSTEM MEETS OR EXCEEDS THE SPECIFIED MOVEMENT RANGE OF THE PARTICULAR JOINT.
3. SYSTEMS MARKED WITH ASTERIK (*) ARE SUITABLE FOR TOP-OF-WALL JOINTS WHERE THE FLUTED METAL DECK HAS SPRAY-ON MONOKOTE MK-6/HY FIREPROOFING.
4. VERIFY ALLOWABLE JOINT WIDTH ON SPECIFIC UL SYSTEM DRAWING.

END OF SECTION

PART 1 - GENERAL**1.1 General**

Division One, General Requirements, is part of this section and shall apply as if repeated here.

1.2 Description of Work

Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:

- caulking or sealing in and around all Architectural items and building system components at the building interior and exterior to prevent the penetration of water, air, smoke, fire and any other agents otherwise compromising the operational integrity [and/or longevity] of any related architectural or building components, the building systems, the integrity of the building envelope, the integrity of required smoke seals and fire-stop seals etc.

1.3 Related Work

Shall include the following but not limited to:

- | | | |
|----|-----------------------------------|---------------|
| .1 | Structural Concrete Block Masonry | Section 04220 |
| .2 | Architectural Woodwork | Section 06400 |
| .3 | Metal Flashing & Trim | Section 07620 |
| .4 | Built-up Roofing System | Section 07510 |
| .5 | Steel Doors & Frames | Section 08100 |
| .6 | Painting | Section 09900 |
| .7 | Sealing Around Plumbing Fixtures | Section 15000 |
| .8 | Steel Doors Frames and Screens | Section 08100 |
| .9 | Aluminum Windows | Section 08150 |

1.4 Environmental Conditions

- | | |
|----|--|
| .1 | Sealant and substrate materials to be at temperature recommended by manufacturer for each type of sealant. |
|----|--|

1.5 Samples

- | | |
|----|---|
| .1 | Submit samples, in accordance with Section 01340, of each specified type of compound to be used together with the recommended primers and joint filler proposed to be used. |
|----|---|

Provide samples of available colours for selection by the Architect.

1.6 Warranty

- | | |
|----|---|
| .1 | Contractor hereby warrants that caulking work will not leak, crack, crumble, melt, shrink, run, loose adhesion, or stain adjacent |
|----|---|

surfaces for three years.

1.7 Qualifications

- .1 Only skilled and experienced tradesmen shall carry out the work in this section.
- .2 Report to the Architect any discrepancies or unclear items.

PART 2 - PRODUCTS

2.1 Materials

- .1 Primers: type recommended by sealant manufacturer.
- .2 Joint Fillers:
 - (a) General: compatible with primers and sealants, outsized 30% to 50%.
 - (b) Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.
 - (c) Neoprene or butly rubber: round solid rod, Shore A hardness 70.
 - (d) Polyvinyl chloride or neoprene: extruded tubing with 6mm minimum thick walls.
- .3 Bond breaker: pressure sensitive plastic tape, which will not bond to sealants.
- .4 Joint cleaner: xylol, methylethyleketon or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.
- .5 Vent tubing: 3mm inside diameter extruded polyvinyl chloride tubing.
- .6 Sealants:
 - (a) General Exterior Sealant: single component polyurethane base sealant to meet C.G.S.B. Specification 19GP5M and CAN 2-19-24-M90 such as Sikaflex 1A, Vulkem 116 by Tremco, or approved alternate. Colours to be as selected by the Architect for the intended application.
 - (b) General Interior Sealant: single component sealant to meet C.G.S.B. specification 19GP17M and which can be painted, such as Tremflex 834 by Tremco, an approved alternate.
 - (c) Rubber asphalt sealing compound: one component, black rubberized asphalt: Bakor "570-05".
 - (d) High humidity sealant: one component, coloured, mildew resistant, silicone; Dow "786".
 - (e) Isolation paint: black asphaltic bitumastic paint; Bakor "410-02" or Domtar "Ace of Spades".

- (f) Fire-Stop Caulking: fire-stop caulking [intumescent formulation] is to be selected by the trade as required to meet the fire-resistance ratings shown on the drawings, ensuring conformance to prevailing Building Code and Fire Code requirements. Ensure that fire-stop caulking is used at all locations where fumes and smoke control is required, including at all 0-hour fire-resistance rating locations.

2.2 Preparation

- .1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.
- .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 a compatible cleaner.
- .4 Prepare concrete, masonry and glazed surfaces to sealant manufacturer's instructions.
- .5 Examine joint sizes; minimum width of 6mm (1/4"); maximum width 25mm (1").
- .6 Install joint filler to achieve correct joint depth to width ratio; minimum depth 1/2 width. Joint filler shall be oversized to remain under 25% compression within the joint, at minus 7 degrees C (20 degrees F.); set back in joint to achieve depth to width ratio as above.
- .7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .8 Apply bond breaker tape where required to manufacturer's instructions.
- .9 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

2.3 Application

- .1 Apply sealants, primers, joint fillers and bond breakers to manufacturer's instructions and as required by job conditions.
- .2 Coordinate with work of other sections to determine correct position of sealant application in sequence of work.
- .3 Apply sealants using gun with proper size nozzle. Shape nozzle so as to finish sealant in a neat concave bead.
- .4 Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.
- .5 Exposed sealant shall be smooth, free from ridges, wrinkles, sags,

air pockets and embedded impurities.

- .6 In masonry cavity construction, vent caulked joints from cavity to 3 mm beyond external face of wall by inserting vent tubing at bottom of each joint and maximum of 1500 mm (5') oc vertically. Position tube to drain to exterior.
- .7 Remove excess sealant and droppings using a recommended cleaner without damaging finished surfaces. Remove masking after tooling joints.

2.4 Schedule of Projections

Materials and application to be in accordance with manufacturer's recommendations and verified by their technical representative.

- .1 General exterior sealant: joints between exterior metal door frames and masonry; joints between window frames and siding control and expansion joints; sealing of joints between underside of concrete floor slabs and masonry; continuously at underside of metal sills; around all projections through exterior wall, hose bibs, pipes and the like; around all metal louvers; as per drawings and not necessarily covered herein; locations not filled with trim.
- .2 General Interior Sealant: joints between door frames and masonry; masonry control and expansion joints; between built-in architectural woodwork and adjacent surfaces; control joints in gypsum board assemblies above suspended ceilings where pipes, ducts or other mechanical equipment passes through walls; at any other location indicated on drawings but not described herein; locations not covered by trim; at window sills and all toilet bases.
- .3 Rubber-Asphalt Sealant: around penetrations in foundation wall damp proofing; between roof sleeves and pipes, conduits, etc., penetrating roof; as bed for and between joints in concealed metal flashing; between sheet damp proofing and adjacent concrete and masonry surfaces; etc.
- .4 High Humidity Sealant: joints between plumbing fixtures and surrounding material; joints between mirrors and metal fixtures; etc.
- .5 Isolation paint: back priming of metal flashing; coating aluminum frame and structural components in contact with steel or masonry; priming of metal components built into roof assembly; etc.
- .6 Fire-Resistant Sealants: at the top of all fire-rated wall assemblies [with a 0-hour fire-resistance rating or greater] meeting the underside of the floor or roof structure above ; around the full perimeter of items and/or building system components penetrating all fire-rated floor and wall assemblies throughout [including all items associated with mechanical, electrical, IT, communications, security system etc.]; around the full-perimeter of architectural

SEALANTS

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openings within fire rated wall assemblies [including doors, glazing screens etc.]. Ensure that appropriate fire-stop caulking is supplied in all locations required by prevailing Codes related to the building components and building systems illustrated throughout the entire Architectural and Engineering Drawings package.

END OF SECTION 07900

PART 1 - GENERAL

- | | | |
|--------------------------------|--|---------------|
| 1.1 General | .1 Division One, General requirements, is part of this Section and shall apply as if repeated here. | |
| 1.2 Description of Work | The work shall consist of the following but not limited to: | |
| | .1 Fire-rated and non-rated interior steel doors, door frames and glazing screens as indicated on the drawings. | |
| | .2 Prepare frames with continuous bar reinforcement at head of frames for door closures. | |
| | .3 Prepare frames with continuous bar reinforcement at jambs of frames for continuous piano hinges as shown on Door and Frame schedule. | |
| | .4 Prepare frame and doors to receive electrical wiring and control switches for barrier-free door operators supplied by other sections. | |
| | .5 Prepare frames and doors for intrusion alarms. | |
| | .6 Prepare doors as required to receive electrical wiring for door strikes for card access system. | |
| | .7 All steel frames shall be metric sized for metric concrete block coursing unless noted or required otherwise. | |
| | .8 Steel frame sizes and configurations shall be as indicated in the Door and Frame Schedule Drawings. | |
| 1.3 Related Work | .1 Structural Concrete Block Masonry | Section 04220 |
| | .2 Finish Carpentry | Section 06200 |
| | .3 Finish Hardware | Section 08710 |
| | .4 Sealants | Section 07900 |
| | .5 Glazing | Section 08800 |
| | .6 Painting | Section 09900 |

- ## PART 2 - PRODUCTS

2.1	Manufacturers	.1	Gensteel, Fleming, Assa Abloy, Macotta, Vision or approved alternate.
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|--|---|
| <p>2.2 Construction Standards- Steel Door & Glazing Screen Frames</p> | <p><u>INTERIOR STEEL DOOR FRAMES & GLAZING SCREENS:</u></p> <p>Door and glazing screen frames at the interior of the building [excluding doors within an exterior thermal wall and excluding doors comprising the interior doors of a vestibule or airlock] shall be constructed according to the following:</p> <ul style="list-style-type: none"> • Construction: Pre-formed, corners welded smooth and flush • Frames: 1.3 mm (16 gauge) galvanized steel minimum steel thickness; increase to suit fire-rating requirements] • Floor anchors, channel spreaders and wall anchors: minimum 18 gauge base thickness steel in anchor type to suit the intended application [wall assembly] |
|--|---|

- Hinge Reinforcement: 10 gauge high-frequency metal dual-purpose reinforcement with return bend
- Strike Reinforcement: 18 gauge ASA reinforcement with closed back
- Hardware reinforcing: 6 mm (1/4") steel plate
- Glazing stops: minimum 1.0 mm base thickness galvanized steel, screw-fixed tamperproof
- Glazing [as/if applicable]: see Section 08800
- Fire-Resistance Rating: as per Door Schedule
- Fabrication Standard: conform to ANSI 250.8

.2 **EXTERIOR STEEL DOOR FRAMES & GLAZING SCREENS:**

Door frames at exterior of building [doors within an exterior thermal wall and including doors comprising the interior doors of a vestibule or airlock] shall be constructed according to the following [based upon Gensteel GenFrame DW/MA-12]:

- Construction: Pre-formed, corners welded smooth and flush
- Frames: (2.05 mm) 12 gauge galvanized steel
- Insulation: Thermal Break
- Floor anchors, channel spreaders and wall anchors: minimum 18 gauge base thickness steel in anchor type to suit the intended application [wall assembly]
- Hinge Reinforcement: 10 gauge high-frequency metal dual-purpose reinforcement with return bend
- Strike Reinforcement: 18 gauge ASA reinforcement with closed back
- Hardware reinforcing: 6 mm (1/4") steel plate
- Glazing stops: minimum 1.0 mm base thickness galvanized steel, screw-fixed tamperproof
- Glazing [as/if applicable]: see Section 08800
- Fire-Resistance Rating: as per Door Schedule
- Fabrication Standard: conform to ANSI 250.8

.3 Reinforcing channel: 100 x 40 mm (C4 x 6.25).

.4 Door bumpers: black neoprene double stud

.5 Anchors: Wire "T" masonry or welded in UL type.

**2.3 Construction Standards-
Steel Doors**

.1 Doors shall be of hollow metal construction reinforced and stiffened with sound deadening kraft honeycomb, or rigid polyurethane insulation cores [as noted below, relative to door location and use]. Laminate core to the inside face of the door facing panels.

.2 Doors shall be flush-faced construction, free of face seams. All joints/seams are to be mechanically-interlocked and finished with full continuous welds.

Localized tack-welds with seam filler will not be accepted.

.3 **EXTERIOR DOORS – HEAVY DUTY CONSTRUCTION:**

Exterior Doors [doors within an exterior thermal wall and including doors comprising the interior doors of a vestibule or airlock] shall be fabricated according to the following [based upon Gensteel GenBuilt Plus 14 Series]:

- Door thickness: 1 ¾"
- Facing panels: 14 gauge galvanized steel, flush finish
- Door edges: seamless continuous weld at all facing panels, mechanically inter-locked
- Hinge reinforcement: 10 gauge steel high frequency dual-purpose reinforcement with return bend
- Top Channel: 18 gauge inverted steel channel welded to door skins
- Bottom Channel: 18 gauge inverted steel channel welded to door skins
- Door Closer Reinforcement Box: 18 gauge steel box concealed in door cavity and welded in place
- Hardware Preparation: provide integral preparation for hardware specified [cylinder assembly, mortise assembly or surface-mounted panic/exit device]
- Interior Stiffening: Vertically steel-stiffened core with 0.9 mm (20 ga.) steel ribs at 150 mm o.c.
- Core: Polyurethane insulation, fully filled to max. available R-value between all stiffeners
- Glazing stops: minimum 1.0 mm base thickness galvanized steel, screw-fixed tamperproof
- Glazing [as/if applicable]: see Section 08800
- Fire-Resistance Rating: as per Door Schedule

- Fabrication Standard: conform to ANSI 250.8

.4 **INTERIOR DOORS:**

Interior Doors [doors not within an exterior thermal wall and excluding doors comprising the interior doors of a vestibule or airlock] shall be fabricated according to the following:

- Door thickness: 1 ¾"
- Facing panels: 18 gauge steel, flush finish
- Door edges: seamless continuous weld at all facing panels, mechanically inter-locked
- Hinge reinforcement: 10 gauge steel high frequency dual-purpose reinforcement with return bend
- Top Channel: 18 gauge inverted steel channel welded to door skins
- Bottom Channel: 18 gauge inverted steel channel welded to door skins
- Door Closer Reinforcement Box: 18 gauge steel box concealed in door cavity and welded in place
- Hardware Preparation: provide integral preparation for hardware specified [cylinder assembly, mortise assembly or surface-mounted panic/exit device]
- Core: Sound-deadening Honeycomb core [kraft paper] or solid polyurethane foam
- Glazing stops: minimum 1.0 mm base thickness galvanized steel, screw-fixed tamperproof
- Glazing [as/if applicable]: see Section 08800
- Fire-Resistance Rating: as per Door Schedule
- Fabrication Standard: conform to ANSI 250.8

2.4 Fabrication-Frames

- .1 Form profiles accurately to approved shop drawings, free of kinks, twists and warps.
- .2 Cut mitres and joints accurately and weld continuously on inside of frame profile. Where site welding or splicing is required due to size of unit, location of field joints shall be shown on Shop Drawings and strictly adhered to; avoid field welding where possible.

- .3 Fully-weld all miters and corners with continuous welds throughout. Tack welds will seam filler will not be accepted. Grind welds at joints to a smooth and flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .4 Prepare frames for Door Hardware throughout according to ANSI A115 standards. Mortice, reinforce, drill and tap frames to receive templated strikes, butt hinges, continuous piano hinges and/or all related items identified on the Door Hardware Schedule.

Note all special requirements for customized hinges and/or hinge quantities therein. Prepare doors and frames as required relative to Hardware Schedule.

NOTE:

Owner requires that frames NOT be prepped for Security door contacts. Low-voltage and remaining door contact connections will be installed by the Owner's vendor.

Frame manufacturer to supply door frame heads with a concealed continuous interior chase providing a free-and-clear horizontal void for future door-contact wiring via pull-string. This chase may be constructed with steel plate and stiffeners to suit but must provide an uninterrupted horizontal chase along the bottom portion of the door head, ensuring that it is kept clear of surrounding construction materials.

- .5 Weld guard boxes to frame at all strikes, hinges and concealed closers to completely enclose same.
- .6 Install stiffener plates or spreaders between frame trim where required to prevent bending of trim and to maintain alignment when setting and during adjacent construction work.
- .7 Provide 1.5 mm (1/16") clearance at head and jambs, and no more than 9mm (3/8") at floor. Provide clearance for intended finish flooring. Locate top hinges with top 125 mm (5") below door top, bottom hinges with bottom 250 mm (10") from floor, and intermediate hinges equi-distant between top and bottom hinges.
- .8 Provide adjustable "T" anchors or welded in UL type anchors for each jamb at approximately 600 mm (2'-0") centres. Provide floor anchors on frames that terminate at finished floor. Provide jamb extension anchorage on frames that terminate at slab.
- .9 Provide two welded-in channel or angle spreaders per door frame at bottom to ensure frame alignment.
- .10 Reinforce head of frames over 1200 mm (4') in width. Reinforce jambs of frames over 2400 mm (8') in height or where frame heads

are unsupported by adjacent material; install reinforcing continuous from floor to structure above.

- .11 Install 3 bumpers on strike jamb for each single door and 2 bumpers at head for pairs of doors.
- .12 Provide glazing stops in all areas requiring glass or panels, as indicated; stops to be on interior side of exterior frames.
- .13 All frames shall be bonderized and receive one coat of baked on rust inhibitive primer.
- .14 Install all glass with isolation and glazing tapes to suit, included any and all related fabrication techniques or accessories required to achieve specified fire-resistance ratings.

2.5 Fabrication- Doors

- .1 Interior core & stiffening of doors to be as specified previously herein. Laminate core & stiffeners to both inside faces of the steel facing panels.
- .2 Doors shall be flush-faced construction, free of face seams. All joints/seams are to be mechanically-interlocked and finished with full continuous welds.

Localized tack-welds with seam filler will not be accepted.

- .3 Mortice, reinforce, drill and tap doors and reinforcements to receive hardware using templates provided by Finish Hardware supplier. Manufacturer to make allowance for morticed hardware.
- .4 Make provision for glazing as indicated and provide necessary glazing stops. Stops on interior side of exterior doors.
- .5 Doors shall be cleaned and sanded, given a coat of air drying past filler, again sanded to eliminate all unevenness or irregularities and given a baked on coat of rust-inhibitive primer.
- .6 Install all glass in doors with isolation and glazing tapes to suit, included any and all related fabrication techniques or accessories required to achieve specified fire-resistance ratings.

2.6 Fire Rated Doors Door Frames, and Window Frames

- .1 Fabricate fire rated doors and frames in accordance with details and approved Shop Drawings; materials and fabrication shall conform to the requirements of NFPA-80.
- .2 Glazing stops, anchor types and fastening shall conform to NFPA-80. Install all glass with isolation and glazing tapes to suit, included any and all related fabrication techniques or accessories required to achieve specified fire-resistance ratings.

- .3 Attach ULC Labels to doors and frames with permanent fasteners.
- 2.7 **Rust-Resistant Bottom Coating**
 - .1 All exterior door, frame, screen and removal mullions to be finished in [paintable] LeakSeal Clear Flexible Corrosion-Resistant Rubber Coating (or equivalent) spray-painted both inside & out [on interior and exterior faces] continuously over the bottom 12 inches. Apply product finished to a straight line prior to installation. Two finish paint coats to be applied on site as specified elsewhere.

PART 3 - EXECUTION

- 3.1 **Frames**
 - .1 Set frames plumb, square, level and at correct elevation.
 - .2 Secure frames and screens to floor construction with two fasteners at each jamb, and set and brace them securely to maintain true alignment until built-in.
 - .3 Install temporary horizontal wood spreaders at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built in.
 - .4 Make allowance for deflection to ensure structural loads are not transmitted to frames.
 - .5 Install labeled fire rated frames with anchorage as required by NFPA-80.
 - .6 Exterior pressed steel frames are to be grouted in place.
- 3.2 **Doors**
 - .1 Install hollow metal doors complete with hinges as supplied under the work of Section 08710.
 - .2 Install doors only when work has progressed to a stage when no damage will occur to them in place.
- 3.3 **Adjusting and Cleaning**
 - .1 Hang doors to swing easily and freely on their hinges, to remain stationary in any position and to close tightly and evenly on frames without binding.
 - .2 Refinish damaged and defective work before completion of project. Refinishing of exposed surfaces shall show no discernible variation in appearance.

END OF SECTION 08100

PART 1 - GENERAL

1.1 General

- .1 Division One, General requirements, is part of this Section and shall apply as if repeated herein.

**1.2 Description
of Work**

The work shall consist of the following but not limited to:

- .1 The supply and installation of all thermal aluminum curtain wall systems, aluminum-framed thermally-broken windows and doors, sidelites and glazing screens etc. all with related components and accessories (as specified/as applicable) for a complete system including (without strict limitation to): aluminum framing components (including both fixed and operable sash), glazed vision panes, silicone structural glazing components, spandrel units, insulated back-pans behind spandrel panels, window screens, aluminum doors with related hardware as indicated, weather stripping, caulking within and around the curtain wall system, aluminum sills, all required anchorage components, fasteners, attachments, concealed interior (structural) reinforcing, shims, perimeter weather seals and all other items called for and/or as required as part of this scope of work.
- .2 The supply and installation of all interior aluminum-framed glazing screens and interior aluminum doors c/w manufacturer-supplied hinges as specified herein.
- .3 The supply and installation of all aluminum cap flashing (noted as ACF) at both the building interior and exterior as shown on the drawings.
- .4 The investigation of site and building conditions as they affect this scope of work, allowing for same herein, and ensuring that they factor into the pricing and related execution of this work.
- .5 The on-site surveying of all dimensions related to architectural and other building features within and around curtain wall openings they impact the dimensions and of new curtain wall assemblies. All such detailed dimensions are to be reflected in the shop drawings at the time of their submission to the Architect.
- .6 The supply and installation of tarping, boarding and any other temporary means required to ensure the water-resistance of the building envelope for all areas under construction affected by and/or related to the scope of work covered herein.
- .7 Supply and installation of prefinished positively sloped, colour coordinating break-shape aluminum window sills below curtain wall and window items throughout (unless noted otherwise on architectural drawings).

**ALUMINUM CURTAIN WALL,
WINDOWS & DOORS**

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|------------|------------------------------------|----|--|---------------|
| 1.3 | Related Work | .1 | Final Cleaning | Section 01710 |
| | | .2 | Rough Carpentry | Section 06101 |
| | | .3 | Masonry | Section 04220 |
| | | .4 | Masonry Veneer Items | Section 04221 |
| | | .5 | Thermal & Moisture Membranes | Section 07261 |
| | | .6 | Prefinished Metal Siding | Section 07460 |
| | | .7 | Prefinished Metal Roofing/Siding | Section 07613 |
| | | .8 | Prefinished Metal Flashing | Section 07620 |
| | | .5 | Sealants | Section 07900 |
| | | .6 | Glass & Glazing | Section 08800 |
| | | .7 | Mechanical | Division 23 |
| | | | | |
| 1.4 | Sub-Trade Quality Assurance | .1 | <p>Minimum Qualification for Successful Trade: The work of section shall be supplied, fabricated and installed by a company which has a minimum of 5 years of experience in the successful completion of projects of a similar size, design and quality, with a workforce of skilled personnel to complete the work in an efficient, professional and first-quality manner. The size of the Sub-Trades workforce will be critical for the timely execution of project requirements.</p> <p><i>General Contractors are responsible to ensure at the time of Tender that their Sub-Trade executing this component of the work complies with these minimum requirements. Following project award, the Contractor may be required to provide written proof of this qualification, relative to the Sub-Trade being carried, as well as a written outline of the workforce (installation crew) being committed to this project.</i></p> | |
| | | | | |
| 1.5 | Reference Standards | .1 | Aluminum Association (AA): | |
| | | a) | DAF 45 [2003], Designation System For Aluminum Finishes. | |
| | | .2 | American Architectural Manufacturers Association (AAMA): | |
| | | a) | AAMA-501-[2005], Methods of Test for Exterior Walls. | |
| | | b) | AAMA-2603-[2002], Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels. | |
| | | c) | AAMA-2604-[2005], Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels. | |

- d) AAMA-2605-[2005], Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - e) AAMA CW DG-1-[96], Aluminum Curtain Wall Design Guide Manual.
 - f) AAMA CW-10-[2004], Care and Handling of Architectural Aluminum From Shop to Site.
 - g) AAMA CW-11-[1985], Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.
 - h) AAMA-TIR A1-[2004], Sound Control for Fenestration Products.
- .3 ASTM International (ASTM):
- a) ASTM A653 / A653M – [09a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - b) ASTM B209-[07], Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - c) ASTM B221-[08], Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - d) ASTM C612 – [09], Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - e) ASTM E283-[04], Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - f) ASTM E331-[00], Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
 - g) ASTM E413 – [04], Classification for Rating Sound Insulation.
 - h) ASTM E1105 – [00(2008)], Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
 - i) ASTM D2240 – [05], Standard Test Method for Rubber Property—Durometer Hardness.
- .4 Canadian General Standards Board (CGSB):
- a) CAN/CGSB-12.8-[97], Insulating Glass Units.
 - b) CAN/CGSB-12.20-[M89], Structural Design of Glass for Buildings.
 - c) CAN/CGSB-19.13-[M87], Sealing Compound, One-Component, Elastomeric, Chemical Curing.

- .5 CSA International (CSA):
 - a) CAN/CSA-S157-[2005], Strength Design in Aluminum.
 - b) CAN/CSA-S136-[2007], North American Specification for the Design of Cold-Formed Steel Structural Members.
 - c) CAN/CSA W59.2-[M1991(R2003)], Welded Aluminum Construction.
- .6 Environmental Choice Program (ECP):
CCD-45-[1995], Sealants and Caulking Compounds.
- .7 Underwriter's Laboratories of Canada (ULC):
AN/ULC-S710.1 [2005], Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials Standard for Thermal Insulation - Bead - Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials.

1.6 Samples & Submittals

.1 Manufacturer's Certification:

Submit a letter from the manufacturer (on curtain wall manufacturer's letterhead) certifying that the subcontractor who has issued a purchase order, letter of intent or otherwise has entered into contract with the manufacturer to supply and install the related product. The letter must be dated and include the:

- Name and Contact Info of the Manufacturer
- Name of the project
- Name of the approved sub-contractor
- Complete list of product materials, components and accessories to be incorporated into the work including names, types and series numbers of all items being installed
- Manufacturer's Representative serving as contact for this project with telephone, fax and email numbers/addresses.

Submit this certification prior to the preparation of shop drawings.

- .2 Submit to the Architect (upon his request) one representative sample mock-up of typical aluminum window and/or curtain wall assembly, complete with mullion types, vision glass, spandrel panel, insulated back-pan, weep-drainage system, attachments, anchors, caulking system and any other items comprising the full system specified herein.

- .3 Submit to the Architect duplicate samples (12" x 12" size) of all prefinished aluminum colours to be utilized on the project. No related items are to be ordered without written sample approval from the Architect.
- .4 Submit to the Architect duplicate samples (12" x 12" size) of all hermetic vision pane types, all spandrel panel types and all specialty ventilator units to be utilized on the project. No related items are to be ordered without written sample approval from the Architect.

1.7 Shop Drawings

- .1 Submit shop drawings of all windows and curtain-wall items, clearly indicating opening sizes, materials and details for head, jamb and sill, profiles of components and elevations of units, structural or reinforcing members, anchoring details, description of related components and exposed finishes and fasteners, all in accordance with Section 01340.
- .2 Submit with shop drawings **a letter from the identified manufacturer certifying that the details shown on the shop drawings accurately depict the identified manufacturers products.** The letter must be dated and include the:
 - Name of the project
 - Name of the sub-contractor
 - Manufacturers contact with telephone and telefax numbers

Submit this certification with shop drawings.
- .3 Submit one representative sample model and one corner cross section of each type of window, showing sill and jamb section, complete with hardware, weather stripping, glass, screening, etc., and other items to be used at the windows, including finishes.
- .4 Shop drawings for all curtain wall items are to be stamped (sealed) and signed by a **Registered Professional Engineer of Ontario**, ensuring that detailed design of the unit is approved for the intended application.

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|--|--|
| 1.8 Test Reports | <ul style="list-style-type: none">.1 Submit test reports from independent testing agency indicating that windows exceed the performance requirements of CAN/CSA-A440 or equal at the appropriate performance levels to meet climatic requirements, and as specified herein, resistance, thermal performance, ease of operation, load tests on screen, blocked operation..2 Submit a letter or certificate from aluminum profile extruder that the aluminum alloy is 6063 and has been heat treated to T6 temper..3 Submit test reports showing compliance of curtain wall system with specified performance characteristics and physical properties including air-infiltration, water infiltration and structural performance..4 Submit test reports verifying that insulated glazing vision panes used in curtain wall system comply with specified thermal standards. |
| 1.9 Administrative Requirements | <ul style="list-style-type: none">.1 Coordination with Trades: Coordinate work of this Section with work of other trades and for proper timing and sequence to avoid construction delays..2 Project/Site Meetings: Comply with other Sections herein relative to periodic attendance at site meetings as required. Ensure availability of manufacturer's Technical Representative to provide technical input as required..3 Manufacturer's Field Reports: Curtain Wall manufacturer to provide Site Reports in accordance with Section 3.4 Field Quality Control later herein. Copies of Field Reports are to be submitted directly to the Architect within 3 days of representative's visit and site inspection. |
| 1.10 Maintenance | <ul style="list-style-type: none">.1 Provide maintenance data for cleaning and maintenance of aluminum finishes and curtain wall systems for incorporation into maintenance manual specified in Section 01730. |
| 1.11 Delivery, Storage & Handling | <ul style="list-style-type: none">.1 Delivery and Acceptance Requirements:<ul style="list-style-type: none">- deliver material in accordance with Section 01600- deliver aluminum framing and glazing materials and related components in manufacturer's original packaging with identification labels in tact and on products sized to suit project requirements.2 Material Handling and Storage: to AAMA CW-10. |

.3 Storage and Handling Requirements:

Store materials off of ground and protected from exposure to harmful weather conditions, and keep within temperature ranges recommended by manufacturer.

.4 Waste Management Requirements:

- a) Separate and recycle or dispose of packaging material waste by an approved method as outlined related Sections elsewhere herein.
- b) Separate and recycle or dispose of waste construction items by an approved method as outlined in related Sections elsewhere herein.

1.12 Warranty

- .1 Provide written joint warranty between the General Contractor and window manufacturer stating that finished/assembled curtain wall, window, glazing screens and aluminum doors and frames are guaranteed against defects and malfunction under normal usage for a period of 10 years from date of Substantial Performance, including insulated glazing units. Warranty to be provided by Manufacturer(s) in writing, and executed by an authorized company official. This written warranty is in addition to and not intended to limit other rights which the Owner may have under any other Contract conditions or provisions.

PART 2 - PRODUCTS

2.1 Materials

.1 **Acceptable Manufacturers:**

Product shall be as manufactured by Alumicor or OldCastle Building Envelope. Alternate products will not be accepted.

.2 **Design Criteria:**

- a) Products to be designed to AAMA CW-DG-1
- design glazed aluminum curtain wall according to rainscreen principles
 - ensure horizontal members are sealed to vertical members to form individual compartments in accordance with rainscreen principles
 - ventilate and pressure-equalize air space outside exterior surface of insulation to the exterior
- b) Design Aluminum components to CAN/CSA S157.

- c) Design and size curtain wall components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of wall using design pressure of 0.95 kPa (20psi) to AAMA CW11/ASTM E330.
- d) Design curtain wall and window systems for thermal expansion and contraction caused by cycling temperature range of 95 degrees C (surface temperature of system components) over a 12-hour period without causing detrimental effect to interior or exterior system components.

Ensure systems are able to withstand a temperature differential of 85 degrees C (ambient environmental temperature) without any adverse effect on system components and no deterioration of seals.
- e) Design vertical expansion joints with baffled overlaps and compressed resilient air seal laid between mullion ends.
- f) Ensure system is designed to accommodate:
 - movement within curtain wall assembly
 - movement between system and perimeter framing components
 - dynamic loading and release of loads
 - deflection of structural support framing
 - shortening of building concrete structural columns
 - creep of masonry, steel and concrete building components
 - mid-span slab deflections
 - action of door hardware and related items attached to aluminum framing members
- g) Limit mullion deflection to prevent breakage of glass and to ensure maximum recovery of all materials.
- h) Deadload prevention: design curtain wall system with separate, integrated support for insulating glass units.
- i) Size all glass units to CAN/CGSB-12.20
- j) Flatness criteria: 6mm max. in 6 m run for each panel
- k) Air Infiltration: 0.63 cfm maximum of wall area to AAMA 501, ASTM E283 at differential pressure across assembly of 0.044 psi.
- l) Water Infiltration: None to AAMA 501, ASTM E331, ASTM E1105 at differential pressure assembly of 0.104 psi.

- m) Interior surfaces shall have no condensation before exposed edges of sealed units reach dew point temperatures during testing to AAMA 501.
- n) Maintain continuous air-barrier and vapour-retarder throughout building envelope and curtain wall assembly.
- o) Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or system components occur.

.3 **ALUMINUM-FRAMED WINDOWS (W-#):**

All **fixed sash** in aluminum framed windows tagged as W/# to be:

Model 1200-6-AR Series, fixed window units having a (6") deep frame with thermal break to CAN/CSA-A440, performance levels Air Leakage - Fixed, Water Leakage B7, Wind Load C5, Condensation Resistance - Frame I-60, Glass I-59, complete with a B7 sill manufactured by Old Castle Building Envelope **or** Alumicor Model 230.

All awning style **operable sash** [where shown on Architectural Drawings and Window Schedule] in aluminum framed windows is to be:

Old Castle Building Envelope '2000-AR Series Arctic Open-Out Casement Vents, Top-Hung'

or

Alumicor UltraVent 1350 Series Top-Hung (Open Out Casement) units (with +/- 3" perimeter sightlines) throughout.

Casement units to be supplied complete with 1 THPO roto-operator, 2 claw locks and 2 friction arms per vent, all in standard clear aluminum mill finish. All venting units to be equipped with black fiberglass screens.

All windows are to be equipped with **aluminum sills** unless noted otherwise. Sills are to be fabricated in depths to suit the intended application using min. 1.0 mm thick aluminum pre-finished to match adjacent window frames. Ensure positive slope at top of window sill to remove water from base of window frame. Form sills with continuous bent drip at underside projecting a min. ½" beyond the finished face of wall below.

.4 **ALUMINUM CURTAIN WALL (CW-#):**

All curtain wall items tagged as CW/# to be:

A. **Fixed Sash Components:**

Exterior curtain wall frame system shall be Alumicor, Series 2600 thermally broken profiles, utilizing a 4" deep back section, with a total system dimension of 2 1/2" sightlines x 6" deep (51.0mm x 152mm)

or

Old Castle '6500 Arctic Series' curtain wall to match.

Ensure that all aluminum extrusions/framing components are internally reinforced (within extrusions) to accommodate the anchoring and ongoing operation of:

- ***door hinges***
- ***wind chains***
- ***barrier-free operators & activator buttons***
- ***all hardware items specified to be attached to aluminum doors and related framing components***

Exterior Aluminum Caps:

Standard aluminum extrusions for exterior caps throughout (where applicable) to be:

*Alumicor 25050 (3/4" x 2 1/2" standard cap) or
alternate manufacturer equivalent*

SSG Structural Silicone Glazing:

Where shown on Architectural drawings, utilize structural silicone glazing joints between hermetic glass vision panes employing exterior silicone jointing between panes [instead of captured aluminum cap noted above]. Structural silicone colour is to match the glazing colour of the vision panes on either side.

B. **Aluminum Extrusions:**

To ASTM B221, 6063 alloy with T6 Temper. Minimum 1.6mm (.062") thick aluminum extrusions.

C. **Finish Coatings:**

Coating standards (for aluminum finishes) provided later within this specification.

D. **Fasteners** in contact with aluminum shall be stainless steel 300 series, stainless 400 series cadmium plated to meet curtain wall requirements as recommended by manufacturer.

E. **Anchors:** Ensure anchors have 3-way adjustment.

- F. **Insulating Glass:** In accordance with Section 08800.
- G. **Thermal break** shall be polyamide break compressed between main sections and pressure plates. Glazing seals shall be extruded polymer with integral spacer on the interior and a solid compressed EPDM extrusion on the exterior.

H. **Silicone Sealants:**

Structural sealants, weather sealants and related silicone caulking to be as manufactured by G.E., Dow, Tremco or Sica. Product selection to be as required for the intended application within and surrounding curtain wall system components.

.5 **EXTERIOR ALUMINUM DOORS:**

Insulated Exterior Aluminum Man Doors [within curtain wall framing] to be:

Alumicor Thermaporte 7700 series thermally enhanced doors (2 1/4" thick) in style T-600A (fully glazed with 5 3/4" side stiles, 5 5/8" top rail and 8" bottom rail) or Old Castle Building Envelope Wide Stile Door WS 500TC. Doors sizes and components to be as illustrated on Architectural door schedule.

All doors to be equipped with Alumicor-supplied continuous gear hinge #7524101.

.6 **INTERIOR ALUMINUM GLAZING SCREENS (SC-#)
& DOOR FRAMES (F-#):**

Non-insulated interior aluminum glazing screens and door frames to be:

Alumicor 'FlushGlaze TL 1800 Series' storefront glazing system (1 3/4" sight lines x 4 1/2" total system depth) throughout.

Ensure that all aluminum extrusions/framing components are internally reinforced (within extrusions) to accommodate the anchoring and ongoing operation of:

- door hinges
- barrier-free operators & activator buttons
- all hardware items specified to be attached to aluminum doors and related framing components

.7 **INTERIOR ALUMINUM DOORS:**

Interior non-insulated aluminum doors to be:

Alumicor 600A series, 1 3/4" thick (with standard 5 3/4" side stiles, 5 5/8" top rail and 7" bottom rail) or Oldcastle WS500 Wide Stile door. Doors sizes and components to be as illustrated on

Architectural door schedule.

Doors to be equipped with Alumicor-supplied continuous gear hinge #7524101.

.8 Insect Screens:

Flyscreens between the sashes (at operable sash components in aluminum-framed windows) shall meet CGSB 79-GP-1M and CAN#-A440-M90 rating heavy duty, accommodated in extruded aluminum frame having a wall thickness of 1.9mm, finish as specified. Screen cloth shall be:

18 x 14 fiberglass mesh (black)

Fly-screens shall be located between the interior and exterior sliders and shall be removable.

.9 Aluminum Cap Flashing (ACF):

Aluminum cap flashing notes as ACF on Architectural Drawings [at both building interior and exterior] to be break shape aluminum in 0.051" [1.0mm] thickness (gauge), pre-finished as noted elsewhere herein.

.10 Curtain Wall System Fabrication:

- A. Do aluminum welding to CAN/CSA W59.2.
- B. Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
 - a) Ensure vertical and horizontal members are tubular extrusions designed for shear block corner construction.
 - b) Mullion depth sizes as indicated.
 - c) Cap depth sizes: [19 mm (0.75 inches)].
 - d) Structural silicone joints where indicated.
 - e) Ensure caps for mullion assemblies are constructed without gap.
- C. Construct units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - a) Ensure curtain wall is fabricated with separate, integrated support for insulating glass unit.
 - b) Do glazing in accordance with Section 08800.
 - c) Site glazing is permitted.
- D. Fabricate curtain wall with minimum clearances and shim spacing around panel perimeter and ensure installation and dynamic movement of perimeter seal is enabled.

- E. Fabricate infill panels with metal covered edge seals around perimeter of panel assembly, enabling installation and minor movement of perimeter seal.
 - a) Reinforce interior surface of exterior infill panel sheet from deflection caused by wind and suction loads.
 - b) Place insulation within infill panel adhered to exterior face of interior panel sheet over entire area of sheet using impane fasteners with integral discs.
 - c) Reinforce infill panels to receive any mechanical and/or electrical equipment/items related to the scope of work as required.
- F. Accurately fit and secure joints and corners. Ensure joints are flush, hairline, and weatherproof.
- G. Prepare curtain wall to receive anchor devices.
- H. Use only concealed fasteners. Ensure fasteners do not penetrate thermal break. Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used upon receipt of written approval from Consultant.
- I. Prepare components to receive duct openings to unit ventilators and interior mechanical items as required.
- J. Visible manufacturer's labels are not permitted.

.11 FINISHES at ALUMINUM CURTAIN WALL, WINDOWS, DOORS, DOOR FRAMES & RELATED ITEMS:

- a) **Finish at Exterior Aluminum Windows W/1, W/2, W/3, W/4, W-5, W/6 [located in Ground Floor Level]:**
 - all **exterior** faces of fixed and operable sash components at aluminum framed windows noted to be finished in:
*PPG Duranar XL (3-Coat System) in colour
064 Bright Silver UC119338XL*
 - all **interior** faces of fixed and operable sash components at aluminum framed windows noted to be finished in:
clear anodized aluminum
- b) **Finish at Exterior Aluminum Windows W/7, W/8, W/9 [located in Second and Third Floor Levels]:**
 - all **interior and exterior** faces of fixed and operable sash components at aluminum framed windows noted to be finished in:

*PPG Duranar XL (3-Coat System) in colour
069 Silver Shadow UC106707XL*

c) **Finish of Exterior Curtain Wall Windows and Door Frames
CW/1 , CW/2, CW/3, CW/4, CW/5, CW/6, CW/7, CW/8,
CW/9:**

- interior and exterior faces of all aluminum curtain wall sash to be finished in:

*PPG Duranar XL (3-Coat System) in colour
069 Silver Shadow UC106707XL*

d) **Finish at Insulated (Exterior) and Uninsulated (Interior)
Aluminum Doors:**

- all faces of thermal and non-thermal aluminum doors to be finished in:

*PPG Duranar XL (3-Coat System) in colour
069 Silver Shadow UC106707XL*

e) **Finish at Aluminum Cap Flashing [ACF]:**

- interior [indoor] and exterior ACF items to be finished in:

*PPG Duranar XL (3-Coat System) in colour
069 Silver Shadow UC106707XL*

**2.2 Window Performance
Requirements (Air
Infiltration)**

- .12 Isolation coating: alkali resistant bituminous paint in accordance with Section 07900.
- .13 Sealants: in accordance with Section 07900 in colour(s) selected by architect.
- .1 Air Leakage; Operable Windows:
Maximum 0-55 M/3/H metre of sash crack length when tested to ASTM E283-73. Rating A-3, CAN/CSA-A440.
Fixed Windows:
Maximum 0-25 M/3 /H/ M/2 when tested to ASTM E283-73. Rating Fixed, CAN/CSA-A440.
- .2 Water Resistance:
No evidence of water on interior face of frame when tested to ASTM E547 and CAN/CSA-A440 to level B5 at test pressure 500 Pa.
- .3 Wind Load Resistance:
To CAN/CSA-A440, when tested to ASTM E330. Rating - C5 - at test pressure 5000 Pa.

.4 Condensation Resistance:

Window shall be tested to CAN#-A440-M90 for condensation resistance to determine "I" Value to meet winter design temperature and selected relative humidity.

Horizontal Window - Glass - I-61, Frame - I-55

Fixed Window - Glass - I-59, Frame - I-63

2.3 Fabrication

.1 Construct frames to profiles and face sizes shown on drawings.

.2 Design frames in exterior walls to accommodate expansion and contraction within service temperature range of -34 degrees C to 75 degrees C. Make allowances for deflection of structure, ensure that structural loads are not transmitted to aluminum work.

.3 General - Fabricate windows using two separate frames joined by means of a thermal break as follows:

Cope and butt join all joints in main frame and sash neatly in weather tight manner and secure by means of screws anchored into integral screw ports. Secure sash corners with thread cutting type screw to ensure tight corners when re-assembling after glass repairs have been made. Internally seal all sash corners. De-burr and make smooth all sharp milled edges and corners of sash and screen frames. Provide outside main frame sill with device extending beyond plane of operating tracks which will prevent the removal or accidental loss of exterior sash or screens to exterior. Provide sill members with minimum 5 degrees slope. Provide sill weep system which will facilitate drainage of water accumulating in sill area, while preventing passage of air, dirt and insects to interior. Fabricate and anchor both inner and outer frames using specified screw fasteners without violating the thermo-barrier. Exposed fasteners or the use of pop rivets not acceptable.

.4 Fabricate entire window in a manner that will allow easy replacement of any defective, damaged or worn components, hardware or weather stripping.

.5 Fixed Windows:

The fixed unit shall consist of two separate frames, joined by means of a thermal break. All joints of the frame shall be butt-type, joined neatly in a weather tight manner. The units shall be designed for field glazing, using a combination semi-solid/wet seal at the exterior weathering joint and a concealed screw applied stop with a resilient gasket at the interior. The stop shall be extruded aluminum.

.6 Aluminum Horizontal Sliding Window Operation (Style A):

Exterior sash: left operates, right fixed

Interior sash: left operates, right operates

Completely separate all operating sash surfaces from metal to metal contact. Provide sash members with continuous, integral type pull handles. Provide quiet, smooth sash operation using nylon glides concealed in sash bottom rails or stainless steel roller wheels. Provide dual weather stripping in sash bottom rails, below nylon glides, which will clean the sill rib as the sash is operated. Provide all interior and exterior operating vents with spring loaded metal locking device to provide automatic locking in closed position at jambs. All operating sash shall be easily removed from the interior for cleaning.

.7 Thermo Barrier:

Provide complete metal-to-metal separation between the two main frame members. Do not use connecting screws, clips or other devices which would tend to bridge the two frame members or restrict in any manner the expansion and contraction of the individual separate frame members. Factory seal between Thermo-Barrier and frame around the entire perimeter to ensure weather tight assembly.

.8 Glazing:

Provide sash frames which will permit glass replacement without the use of special tools.

.9 Weather stripping:

Double weather strip window units at all sash perimeters. Conceal weather stripping to prevent accumulation of foreign matter due to cleaning, operation or handling which would reduce effectiveness or life of seal.

.10 Install all weather stripping in specially extruded ports and secure to prevent shrinkage, movement or loss when removing sash for cleaning or glass replacement.

.11 Exterior Panning Trim:

Provide one piece sections designed to lock into window frame. Join planting sections at corners, utilizing integral screw ports and screws and back seal. Sheet metal formed shapes not acceptable.

.12 Screens:

Factory install in tubular extruded aluminum frames and secure in place using vinyl spline. Screen is to be located between the interior and exterior sash. Screen guide channels or fins which facilitate the operation of the screen shall be an integral part of the window frame or thermal barrier. Channels or fins which are surface applied to the window frame or thermal barrier by means

of screws or rivets are not acceptable. Screens must meet CAN3-A440-M90 screen rating - heavy duty.

- .13 Apply isolation coating to aluminum to be in contact with dissimilar metals or cementitious materials.
- .14 Manufacturer's nameplates on frames and screens are not permitted.

PART 3 - EXECUTION

3.1 INSTALLERS

- .1 Use only curtain wall manufacturer's authorized installers meeting work experience requirements outlined earlier in this Section.

3.2 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for curtain wall installation in accordance with manufacturer's written instructions.
 - a) Visually inspect substrate in presence of Consultant.
 - b) Inform Consultant of unacceptable conditions immediately upon discovery.
 - c) Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.3 INSTALLATION

- .1 Install curtain wall in accordance with manufacturer's written instructions.
- .2 Do aluminum welding to CAN/CSA W59.2.
- .3 Attach curtain wall assemblies to structure plumb and level, free from warp, and allow for sufficient adjustment to accommodate construction tolerances and other irregularities.
 - a) Maintain dimensional tolerances and align with adjacent work.
 - b) Use alignment attachments and shims to permanently fasten elements to building structure.
 - c) Clean welded surfaces and apply protective primer to field welds and adjacent surfaces.
- .4 Install thermal isolation where components penetrate or disrupt building insulation.
- .5 Install sill flashings (where applicable).

- .6 Co-ordinate installation of fire stop insulation, in accordance with Section [07840 - Firestopping], at each floor slab edge [and intersection with vertical construction where indicated].
- .7 Install smoke sealing in accordance with Section [07800 – Fire and Smoke Protection] where indicated.
- .8 Co-ordinate attachment and seal of perimeter air barrier in accordance with Section [07270 – Air Barriers].
- .9 Co-ordinate attachment and seal of perimeter vapour retarder in accordance with Section [07260 – Vapour Retarders].
- .10 Install [fibrous insulation] [liquid foam insulation] in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .11 Install insulating glass units and infill panels in accordance with Section [08800- Glazing] and to manufacturer's written instructions.
- .12 Install perimeter sealant [to method required to achieve performance criteria, backing materials, and installation criteria in accordance with Section [07920 - Joint Sealing].

3.04 FIELD QUALITY CONTROL

- .1 Field Inspection: Coordinate field inspection in accordance with Section [01 45 00 - Quality Control].
- .2 Site Installation Tolerances:
 - a) Variation from plumb: [12 mm per 30 m (0.5 inches per 100 feet)] maximum.
 - b) Misalignment of two adjacent panels or members: [0.8 mm (0.03 inches)] maximum.
 - c) Sealant space between curtain wall and adjacent construction: [13 mm (0.5 inches)] maximum.
- .3 Manufacturer's Services:
 - a) Coordinate manufacturer's services with Section [01 45 00 - Quality Control].
 - b) Submit to Consultant a written agreement from the manufacturer to perform the manufacturer's services.
 - c) Schedule manufacturer's review of work (including site inspections and written reports) at the following stages:
 - 1 review at commencement of work
 - 1 review at 50% completion of work

- 1 review at full completion of work
- .4 Submit manufacturer's Written Reports to Consultant describing:
 - a) The scope of inspection/reporting services provided.
 - b) Date, time and location of site review.
 - c) Observed installation procedures performed by Sub-Trade noting extent of work complete and conformance to manufacturer's recommendations.
 - d) Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions relative to the intended application.
- .5 Limitations or disclaimers regarding the procedures performed.
- .6 Obtain reports within seven days of review and submit immediately to Consultant.

3.05 CLEANING

- .1 Progress Cleaning: Perform cleanup as work progresses [in accordance with Sections addressing Cleaning and Waste Management]. Leave work area clean end of each day.
- .2 Final cleaning: Perform final cleaning of new curtain wall systems and glazing components (vision pane and spandrel panels, caps, aluminum composite panels etc.) to remove all signs of construction and related debris. Panels to be left cleaned and clear of blemishes, spots, smears etc.
- .3 Waste Management:
 - a) Co-ordinate recycling of waste materials with Sections elsewhere addressing Construction Waste Management and Disposal.
 - b) Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.
 - c) Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.06 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

PART 4 - ON-SITE TESTING

4.1 On-Site Testing

- .1 The Owner reserves the right to appoint an independent testing agency to test installed windows at random for compliance with all requirements contained in the specification. Failure to meet these requirements shall make the contractor liable for full replacement and/or rectification costs for items of concern (cited in Testing Report) as well as cost of further (third party) tests to verify compliance of system including rectification items.

END OF SECTION 08150

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roll-up steel counter shutter in Kitchen 101 and Kitchen 128-2.
 - 2. Operating hardware and supports.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 7100 - Door Hardware.

1.2 REFERENCES

- A. ASTM International (ASTM) B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
 - 2. Product Data: Provide information on grille construction, components, materials, and finishes.
- B. Sustainable Design Submittals:
 - 1. Recycled Content.
 - 2. Regional Materials.
- C. Closeout Submittals:
 - 1. Operation and Maintenance Data.

1.4 WARRANTIES

- A. Provide manufacturer's 2 year warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Contract Documents are based on Series R700 by Richards Wilcox or approved equal.
- B. Substitutions: Under provisions of Division 01

COUNTER SHUTTER

Section 08335
Page 2 DCES
PN 2501

2.2 MATERIALS

- A. 22 guage aluminum.
- B. Galvanized steel endlocks.
- C. Hood: 24 guage aluminum sheet with closed ends.

2.3 PRODUCT

- A. Operation: chain operation.
- B. Size: Refer to drawings for sizes

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install assembly in accordance with manufacturer's instructions.
- B. Anchor to adjacent construction without distortion or stress.
- C. Fit and align assembly including hardware, level and plumb, to provide smooth operation.

3.2 ADJUSTING

- A. Adjust shutter for smooth operation throughout full operating range.

END OF SECTION

PART 1 - GENERAL

- | | | |
|--|----|--|
| 1.1 Description of Work | .1 | All Finish Hardware [related to doors throughout] is to include [without strict limitation to] the following: <ul style="list-style-type: none">a) Hardware for all hinged man doors (butt hinges, adjustable piano hinges, closers, locks and latches, bolts, panic bars, kick plates, pulls etc.)b) Mortised hardware (where specified)c) Door stops in floor or wall types as required.d) Metal thresholds, sweeps, weather-stripping. |
| 1.2 Preparation | .1 | Supply of Finish Hardware is to be as per attached Appendix containing "Finish Hardware Schedule". |
| | .2 | Installation of the above noted Finish Hardware to be done by a certified hardware installer. Installation by General Contractor will not be permitted. |
| 1.3 Related Work | .1 | Finish Carpentry: Section 06200 |
| | .2 | Steel Doors and Frames: Section 08100 |
| | .3 | Architectural Woodwork: Section 06400 |
| 1.4 Requirements of Regulatory Agencies | .1 | All Hardware on fire rated doors and frames to conform to requirements of NFPA-80 and to bear ULC label. |
| 1.5 Qualification | .1 | Personnel who will be responsible for scheduling detailing, ordering, and coordination hardware for this project, shall be experienced hardware consultants. Regular membership in the American Society of Architectural Hardware Consultants is acceptable evidence of such experience. |
| 1.6 Coordination | .1 | The finish hardware contract shall be the responsibility of hardware supplier to request shop drawings from related trades for coordinating. |
| | .2 | Before supplying materials, ensure by check of drawings, shop drawings and details prepared for the Project, that listed hardware is suitable by dimension and function for intended purposes. |

- .3 Work of this Section shall include assistance and supervision of installation when requested, and as otherwise provided by the supplier, to ensure correct installation. After installation of all hardware and before building is accepted, the Contractor shall request the hardware supplier to inspect the installations and certify that the hardware is properly installed in accordance with the manufacturer's recommendations. The guarantee, as published by each manufacturer, will begin when the Owner accepts the building.

1.7 Submittals

- .1 Hardware Supplier to prepare required submittals of product noted in Appendix "A" with cut-sheets of all items as per Section 01340.

1.8 Delivery and Storage

- .1 Receive and check all hardware from supplier. Protect from pilferage at all times.
- .2 Store finishing hardware in locked, clean and dry area.
- .3 Package each item of hardware, including fastenings, separately or in like groups of hardware. Label each package as to item, definition and location.

PART 2 - PRODUCTS**2.1 Material**

- .1 Products shall be as noted in accompanying 'Hardware Schedule'.
- .2 Supply with specified hardware screws, bolts, expansion shields, inserts, and other items and parts required for complete installation and function.

2.2 Manufacturers

- .1 Refer to accompanying "Hardware Schedule" in Appendix.

2.3 Keying

- .1 Refer to accompanying "Hardware Schedule" in Appendix.

PART 3 - EXECUTION

- .1 All items to be installed in full accordance with manufacturers' recommendations for the intended application relative to the door types noted on the Architectural drawings.

END OF SECTION 08710

FINISHING HARDWARE SPECIFICATION

FOR
DAIN CITY PUBLIC SCHOOL
415 EASTBRIDGE AVE
WELLAND, ON

ARCHITECT: WHITELINE ARCHITECTS INC.
83 ONTARIO STREET
ST. CATHARINES, ON L2R 5J5

CONTRACTOR:

SUPPLIER:



GROUP 87
ARCHITECTURAL HARDWARE INC.

UNIT #1 – 3245 HARVESTER RD,
BURLINGTON, ONT. L7N-3T7

PH# 905-639-4676
FAX# 905-639-7561
E-MAIL: glen@group87.ca
WEB: www.group87.ca

CONSULTANT: **GLEN C. WIKKERINK**

DATE: November 17, 2025
REVISION: January 8, 2026
March 4, 2026

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Supply of finishing hardware as listed in the hardware schedule, 3.06
2. Supply of bolts, screws, expansion shields and special fastening devices required to properly install finishing hardware.

B. Related Sections:

1. Installation of finishing hardware.
2. Metal doors and frames.
3. Wood doors.
4. Roll-up doors and fire shutters.
5. Aluminum door hardware.
6. Toilet partition hardware.
7. Miscellaneous specialties.
8. Power connection to automatic door operators. Provision of conduit between operators and activators, power connection to electric hold open devices, section 16000.

1.02 REFERENCES

1. Hardware for Labeled Fire Doors.
2. N.F.P.A. 80. Fire Doors and Windows.
3. N.F.P.A. 101. Life Safety Code.
4. N.F.P.A. 105. Installation of Smoke Control Door Assemblies.
5. Ontario Building Code.

1.03 SUBMITTAL

1. Make submittal in accordance with section 01340.
2. Prepare a detailed finishing hardware schedule itemizing each opening.
List all doors by number including size, hand, swing and any and all relevant details effecting the application of finishing hardware.
3. Submit catalogue cuts of all proposed hardware.
4. Submit samples for approval as required.
5. Submit template information to the General Contractor for preparation of product in related sections' and installation of finishing hardware.
6. Prepare for review a detailed key schedule.
7. Submit wiring diagrams and a description of operation for electrified hardware systems specified.
8. Upon job completion, submit to the owners two 'Owners Operation and Maintenance Manuals' containing the following information:
 1. Maintenance instructions for each item of hardware.
 2. Final Hardware Schedule.
 3. Final Keying Schedule.

1.04 QUALITY ASSURANCE

1. Proposed substitutions must be approved by the Architect prior to submission of tender.
2. The hardware supplier must be regularly involved in supplying and expediting contract hardware for projects of this nature. The supplier must employ a certified **"Architectural Hardware Consultant"** to co-ordinate and oversee scheduling, ordering and the supplying of finishing hardware.

1.05 DELIVERY, STORAGE AND HANDLING

1. Hardware is to be delivered to the site in the Manufacturers original packaging. Each item of hardware to be clearly marked with the door number and item number corresponding to the approved hardware schedule. The General Contractor shall receive, check and be responsible for all items of hardware delivered to the jobsite.
2. Hardware supplier to co-ordinate delivery of hardware to the site or to the appropriate parties as noted in section 1.01.B "Related Sections" for installation.
3. Prior to delivery to the jobsite, a dry, secure room is to be provided for storage of the finishing hardware.

1.06 WARRANTY

1. Provide a minimum one year warranty for finishing hardware.
2. Provide a minimum ten year warranty for door closers.
3. Warranty to commence from date of Substantial Completion.

1.07 MAINTENANCE

1. Provide three wrenches for door closer adjustment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- | | |
|------------------------------|------------------|
| 1. Hinges | Ives |
| 2. Exit Devices | Von Duprin |
| 3. Locksets | Schlage Lock Co. |
| 4. Cylinders | Schlage Lock Co. |
| 5. Door Pulls | Standard Metal |
| 6. Door Closers | LCN Closers |
| 7. Overhead Stops | Glynn-Johnson |
| 8. Push, Kick, Armor Plates | Standard Metal |
| 9. Floor, Wall Stops | Standard Metal |
| 10. Thresholds, Weatherstrip | KN Crowder |
| 11. Auto Door Operators | Horton |

2.02 MATERIALS

1. All hardware shall be supplied complete with the necessary screw, bolts and other fasteners so as to anchor in position all finishing hardware to the Consultants approval. Exposed fasteners to be finished to match hardware. When a door pull is utilized on one side of the door and a push plate on the other, the plate is to be applied so as to conceal the door pull fasteners.

2. Hinges:
 Specified: Five knuckle 5BB1 series by Ives
 Acceptable Substitute:

3. Continuous Hinges
 Specified:
 Acceptable Substitute:

3. Locksets:
 Specified: Grade one lever, ND series Schlage
 Acceptable Substitute:

4. Exit Devices:
 Specified: 98 series by Von Duprin
 Acceptable Substitute:

5. Door Closers:

 Specified: 1461 series by LCN
 Acceptable Substitute:

 Specified: 4040XP LCN
 Acceptable Substitute:

6. Overhead Stops:
 Specified: GJ90 series by Glynn Johnson
 Acceptable Substitute:

GROUP 87 ARCHITECTURAL HARDWARE INC.

2.03 FINISHES

1.	15/652	SATIN NICKEL
	28	ANODIZED ALUMINUM
	26D/ 626	SATIN CHROME
	32D/630	SATIN STAINLESS STEEL
	689	ALUMINUM PAINTED
	AL	ALUMINUM
	PT	PRIMED FOR PAINT

2.04 KEYING

1. All locks to be keyed to new Schlage factory master key system under existing factory Grand Master key system.
2. Supply 20 master keys. Supply change keys as directed by DSBN

PART 3 - EXECUTION

3.01 EXAMINATION

1. Size and condition of opening shall be verified as to door frames being plumb and of correct tolerance to receive doors and hardware. [General Contractor]

3.02 INSTALLATION

1. Review proper mounting heights with the Architect and/or Owner.
2. Standard mounting heights [unless otherwise noted]
 - A. Locks/Latches 40-5/16" to centre line of strike from finished floor.
 - B. Deadlocks 48" to centre line of strike from finished floor.
 - C. Exit Devices 40-5/16" to centre line of strike from finished floor.
 - D. Door Pulls 42" to centre line of pull from finished floor.
 - E. Push Plate 45" to centre line of Push Plate from finished floor.

The above noted mounting heights are a recommended standard and may vary under special applications and conditions.

3.03 FIELD QUALITY CONTROL

1. After installation of hardware, inspect the installation and certify that the hardware is correctly installed and in accordance with the Manufacturers recommendations.

3.04 ADJUSTING AND CLEANING

1. Upon final completion the hardware is to be left clean and free from defect. Hardware found defective is to be repaired or replaced.
2. All door closers are to be inspected for proper installation and adjustment. Provide a written report from the Manufacturers Representative confirming proper door closer installation and submit the report to the Architect.

3.05 PROTECTION

1. Contractor shall provide proper protection of hardware until turned over to the Owner.

3.06 HARDWARE SCHEDULE

1. Provide hardware in accordance with the schedule as follows:

GROUP 87 ARCHITECTURAL HARDWARE INC.

LEGEND

AL	ALUMINUM
CLSR	CLOSER
DR	DOOR
DS	DEAD STOP
HLDR	HOLDER
HM	HOLLOW METAL
HW	HEAVY WEIGHT
LBR	LESS BOTTOM ROD
MNT	MOUNT
MTG	MOUNTING
NRP	NON REMOVABLE PIN
P.A.	PARALLEL ARM
WD	WOOD

FINISHES

15/652	SATIN NICKEL
28	ANODIZED ALUMINUM
26D/ 626	SATIN CHROME
32D/630	SATIN STAINLESS STEEL
689	ALUMINUM PAINTED
AL	ALUMINUM
PT	PRIMED FOR PAINT

MANUFACTURERS

HINGES	IVES
LOCKSETS	SCHLAGE
EXIT DEVICES	VON DUPRIN
DOOR CLOSERS	LCN
OVERHEAD STOPS	GLYNN-JOHNSON
FLATWARE	STANDARD METAL
DOOR PULLS	STANDARD METAL
FLOOR/ WALL STOPS	STANDARD METAL
THRESHOLDS	K.N. CROWDER
WEATHERSTRIP	K.N. CROWDER
AUTO OPERATORS	HORTON

Door Index

Door No	Hdg	Door No	Hdg	Door No	Hdg
001A	01	102-3	24	110-12	41
001B	02	102-5	25	110-13	38
002	03	102-6	26	110-13A	39
003	03	102-7	25	110-14	38
004	03	102A	21	110-15	42
005	03	102B	22	110-16	43
006	03	103	27	110-17	44
007	04	104	28	111	45
008	05	105	29	112	46
009	03	105-1	30	113	29
010	03	105-2	31	114	47
011	03	106	29	115	48
012	06	106-1	30	116	48
013	04	106-2	31	117	48
015	04	107	29	118	48
016	07	107-1	30	120	47
017	08	107-2	31	121	49
018	07	108	29	122	50
019	07	108-1	30	122-1A	51
020	09	108-2	31	122-1B	51
021	10	109	29	122-3	52
022	11	109-1	30	122-4	54
023	12	110	32	123	50
024	13	110-01	33	123-1	53
025	14	110-02	34	123-2	54
100-1	15	110-03	35	124	55
100-5	16	110-04	35	125	56
100-5C	17	110-05	36	126	57
100-5D	17	110-06	37	128-01	58
100-7	18	110-07	36	128-02	59
100-8	18	110-08	38	128-03	60
100-9A	19	110-08A	39	128-04	61
100-9B	19	110-08B	39	128-05	61
100-9C	19	110-09A	40	128-06	62
100-9D	19	110-09B	40	128-07	63
101	20	110-10	41	128-08	63
102-1	23	110-11A	44	128-09	63
102-2	23	110-11B	44	128-10A	64

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Door Index

Door No	Hdg	Door No	Hdg	Door No	Hdg
128-10B	65	304	78		
129	66	307	77		
130	67	308	77		
131-1A	70	309	83		
131-1B	71	309-1	84		
131-3	72	310	76		
131-4	73	311	85		
131-5	73	313	90		
131-6	74	314	91		
131A	68	315	77		
131B	69	316	77		
132	75	317	77		
201	76	318	77		
202	77	319	77		
203	77	320	77		
204	78				
207	79				
208	79				
209	80				
209-1	81				
209-2	82				
209-3	82				
209-4	82				
210	76				
211	85				
212-1	86				
212-2	87				
212A	88				
212B	89				
213	90				
214	91				
217	77				
218	77				
219	77				
220	77				
301	76				
302	77				
303	77				

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Heading 01 (HwSet)

1 PR DOOR(S) 001A EXTERIOR FROM VESTIBULE 100-1
2/3'6 x 8'0-5/8" x 2-1/4" x ALD x ALF x NON-RTD

Hand Degree
LHRA/RHR Act InAct
90 90

Totals	Each Assembly to have:					Act	InAct
(8)	8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE	4 4
(1)	1	EA	ELEC. REM. MULLION	42-8-CNI-AC-TR		PLI	1 1
(1)	1	EA	PANIC HARDWARE	CD35A-EO 4'	626	VON	1
(1)	1	EA	PANIC HARDWARE	CD35A-NL-OP 4'	626	VON	1
(2)	2	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH	1 1
(1)	1	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626	SCH	1
(1)	1	EA	ELECTRIC STRIKE	6300	630	VON	1
(2)	2	EA	DOOR PULL	3015-2 #2 2-1/4" THICK DR.	32D	SMH	1 1
(1)	1	EA	SURFACE CLOSER	4021 RH	689	LCN	1
(1)	1	EA	ADAPTER PLATE	4020-18G	689	LCN	1
(1)	1	EA	AUTO OPERATOR	4100 LE RHR	CL	HOR	1
(2)	2	EA	OVERHEAD STOP	105S	630	GLY	1 1
(2)	2	EA	DOOR SWEEP	W-24S 42"	628	KNC	1 1
(1)	1	EA	THRESHOLD	CT-45 96" X 10 X 1 1/2" FHSD TAP CON	627	KNC	
(1)	1	EA	WEATHERSTRIPPING	BY ALUMINUM DOOR SUPPLIER		UNK	
(1)	1	EA	INTEGRATION BOX	TA2902G3 E-CR-AO		KMT	1
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	2
(1)	1	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	1
(2)	2	EA	DOOR CONTACT	DC-87		G87	1 1
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	1
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	1
(1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK	1
(1)	1	EA	VIDEO/INTERCOM	BY ACCESS CONTROL PROVIDER		UNK	1

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
ACCESS CONTROL PROVIDER TO TERMINATE ACTIVATION IN INTEGRATION BOX.

Heading 02 (HwSet)

1 SGL DOOR(S) 001B EXTERIOR FROM VESTIBULE 100-1
3'6" x 8'0-5/8" x 2-1/4" x ALD x ALF x NON-RTD

Hand Degree
LHR Act InAct
90

Totals	Each Assembly to have:				
(4)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630 IVE

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Heading 02 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	PANIC HARDWARE	CD35A-EO 4'	626	VON
(	1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH
(	1)	1	EA	DOOR PULL	3015-2 #2 2-1/4" THICK DR.	32D	SMH
(	1)	1	EA	SURFACE CLOSER	4021 RH	689	LCN
(	1)	1	EA	ADAPTER PLATE	4020-18G	689	LCN
(	1)	1	EA	OVERHEAD STOP	105S	630	GLY
(	1)	1	EA	DOOR SWEEP	W-24S 42"	628	KNC
(	1)	1	EA	THRESHOLD	CT-45 48" X 10 X 1 1/2" FHSD TAP CON	627	KNC
(	1)	1	EA	WEATHERSTRIPPING	BY ALUMINUM DOOR SUPPLIER		UNK
(	1)	1	EA	DOOR CONTACT	DC-87		G87

Heading 03 (HwSet)

						Hand	Degree Act InAct
1	SGL	DOOR(S)	002	EXTERIOR FROM VESTIBULE	105-3	RHR	90
1	SGL	DOOR(S)	003	EXTERIOR FROM VESTIBULE	106-3	LHR	90
1	SGL	DOOR(S)	004	EXTERIOR FROM VESTIBULE	107-3	RHR	90
1	SGL	DOOR(S)	005	EXTERIOR FROM VESTIBULE	108-3	LHR	90
1	SGL	DOOR(S)	006	EXTERIOR FROM VESTIBULE	109-3	RHR	90
1	SGL	DOOR(S)	009	EXTERIOR FROM VESTIBULE	110-17	LHR	90
1	SGL	DOOR(S)	010	EXTERIOR FROM VESTIBULE	110-11	LHR	90
1	SGL	DOOR(S)	011	EXTERIOR FROM VESTIBULE	110-11	RHR	90
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD							

Totals Each Assembly to have:

(	32)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
(	8)	1	EA	PANIC HARDWARE	CD98EO 4'	626	VON
(	8)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH
(	8)	1	EA	ELECTRIC STRIKE	6300	630	VON
(	8)	1	EA	PULL PLATE	H413 4" X 16"	32D	SMH
(	8)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN
(	8)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH
(	8)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC
(	8)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC
(	8)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC
(8)	1	EA	DOOR CONTACT	DC-87		G87
(8)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK

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Heading 04 (HwSet)

					Hand	Degree Act InAct
1 PR	DOOR(S) 007 EXTERIOR FROM VESTIBULE 100-7				RHRA/LHR	90 90
1 PR	DOOR(S) 013 EXTERIOR FROM STAIR 114				RHRA/LHR	90 90
1 PR	DOOR(S) 015 EXTERIOR FROM STAIR 120				RHRA/LHR	90 90

2/3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Opening Remark: CONFIRM ACTIVE HAND

Totals	Each Assembly to have:							Act	InAct
(24)	8	EA	HINGE	5BB1HW 5 X 4.5 NRP		630	IVE	4	4
(3)	1	EA	ELEC. REM. MULLION	42-7-CNI-AC-TR			PLI	1	1
(6)	2	EA	PANIC HARDWARE	CD98EO 4'		626	VON	1	1
(6)	2	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**		626	SCH	1	1
(3)	1	EA	ELECTRIC STRIKE	6300		630	VON	1	
(6)	2	EA	DOOR PULL	3015-2 #2 1-3/4" THICK DR.		32D	SMH	1	1
(3)	1	EA	SURFACE CLOSER	4040XP.CUSH		689	LCN		1
(3)	1	EA	AUTO OPERATOR	4100 LE RHR		CL	HOR	1	
(3)	1	EA	OVERHEAD STOP	904S		630	GLY	1	
(6)	2	EA	KICKPLATE	K10A 7" X 36" TAPE		32D	SMH	1	1
(6)	2	SET	WEATHERSTRIP	W-20S 1/38" 2/84"		628	KNC	1	1
(6)	2	EA	DOOR SWEEP	W-24S 38"		628	KNC	1	1
(3)	1	EA	THRESHOLD	CT-406 76" X 10 X 1 1/2" FHSD TAP CON		627	KNC		
(3)	1	EA	INTEGRATION BOX	TA2902G3 E-CR-AO			KMT	1	
(6)	2	EA	MOUNTING BOX SQR.	CM-43CBL			CAM	2	
(6)	2	EA	SQR. ACTUATOR	CM-45/4		32D	CAM	2	
(6)	2	EA	DOOR CONTACT	DC-87			G87	1	1
(3)	1	EA	WIRING DIAGRAMS	AS REQUIRED			G87	1	
(3)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL			HOR	1	
(3)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER			UNK	1	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
ACCESS CONTROL PROVIDER TO TERMINATE ACTIVATION IN INTEGRATION BOX.

Heading 05 (HwSet)

					Hand	Degree Act InAct
1 SGL	DOOR(S) 008 EXTERIOR FROM VESTIBULE 110-1				LHR	90

3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:					
(4)	4 EA HINGE	5BB1HW 5 X 4.5 NRP	630	IVE		
(1)	1 EA PANIC HARDWARE	CD98EO 4'	626	VON		

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Heading 05 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH
(	1)	1	EA	ELECTRIC STRIKE	6300	630	VON
(	1)	1	EA	DOOR PULL	3015-2 #2 1-3/4" THICK DR.	32D	SMH
(	1)	1	EA	AUTO OPERATOR	4100 LE LHR	CL	HOR
(	1)	1	EA	OVERHEAD STOP	904S	630	GLY
(	1)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH
(	1)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC
(	1)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC
(	1)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC
(	1)	1	EA	INTEGRATION BOX	TA2902G3 E-CR-AO		KMT
(	2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM
(	2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM
(	1)	1	EA	DOOR CONTACT	DC-87		G87
(	1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87
(	1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR
(	1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK
(	1)	1	EA	VIDEO/INTERCOM	BY ACCESS CONTROL PROVIDER		UNK

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
ACCESS CONTROL PROVIDER TO TERMINATE ACTIVATION IN INTEGRATION BOX.

Heading 06 (HwSet)

1 SGL DOOR(S) 012 EXTERIOR FROM CORRIDOR 110
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LHR
Degree
Act InAct
90

Totals Each Assembly to have:

(	4)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
(	1)	1	EA	PANIC HARDWARE	CD98EO 4'	626	VON
(	1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH
(	1)	1	EA	ELECTRIC STRIKE	6300	630	VON
(	1)	1	EA	PULL PLATE	H413 4" X 16"	32D	SMH
(	1)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN
(1)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH
(1)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC
(1)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC

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Heading 06 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC	
(1)	1	EA	DOOR CONTACT	DC-87		G87	
(1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK	

Heading 07 (HwSet)

						Hand	Degree Act InAct
1 SGL			DOOR(S) 016 EXTERIOR TO ELECTRICAL 126			RH	90
1 SGL			DOOR(S) 018 EXTERIOR TO STORAGE 127			LH	90
1 SGL			DOOR(S) 019 EXTERIOR TO STORAGE 128-10			LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				

Totals Each Assembly to have:

(12)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE	
(3)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTICTED KEYWAY**	626	SCH	
(3)	1	EA	SURFACE CLOSER	4040XP.RWPA	689	LCN	
(3)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH	
(3)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC	
(3)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC	
(3)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC	
(3)	1	EA	DOOR CONTACT	DC-87		G87	

Heading 08 (HwSet)

						Hand	Degree Act InAct
1 PR			DOOR(S) 017 EXTERIOR FROM VESTIBULE 100-8			RHRA/LHR	90 90
			2/3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
			Opening Remark: CONFIRM ACTIVE HAND				

Totals Each Assembly to have:

							Act	InAct
(8)	8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE	4	4
(1)	1		MULLION	BY FRAME PROVIDER		UNK	1	1
(2)	2	EA	PANIC HARDWARE	CD98EO 4'	626	VON	1	1
(2)	2	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH	1	1
(1)	1	EA	ELECTRIC STRIKE	6300	630	VON	1	
(2)	2	EA	DOOR PULL	3015-2 #2 1-3/4" THICK DR.	32D	SMH	1	1
(1)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN		1
(1)	1	EA	AUTO OPERATOR	4100 LE RHR	CL	HOR	1	
(1)	1	EA	OVERHEAD STOP	904S	630	GLY	1	
(2)	2	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH	1	1

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Heading 08 (HwSet) Continued.....

						Hand	Degree Act InAct
(2)	2	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC	1 1
(2)	2	EA	DOOR SWEEP	W-24S 38"	628	KNC	1 1
(1)	1	EA	THRESHOLD	CT-406 76" X 10 X 1 1/2" FHSD TAP CON	627	KNC	
(1)	1	EA	INTEGRATION BOX	TA2902G3 E-CR-AO		KMT	1
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	2
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	2
(2)	2	EA	DOOR CONTACT	DC-87		G87	1 1
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	1
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	1
(1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK	1

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
ACCESS CONTROL PROVIDER TO TERMINATE ACTIVATION IN INTEGRATION BOX.

Heading 09 (HwSet)

1 SGL DOOR(S) 020 EXTERIOR FROM CORRIDOR 128-6
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
RHR
Degree
Act InAct
90

Totals Each Assembly to have:

(4)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE	
(1)	1	EA	PANIC HARDWARE	CD35A-EO 4'	626	VON	
(1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	ELECTRIC STRIKE	6300	630	VON	
(1)	1	EA	PULL PLATE	H413 4" X 16"	32D	SMH	
(1)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN	
(1)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH	
(1)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC	
(1)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC	
(1)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC	
(1)	1	EA	DOOR CONTACT	DC-87		G87	
(1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK	

Heading 10 (HwSet)

1 SGL DOOR(S) 021 EXTERIOR FROM VESTIBULE 128-1

Hand
LHR
Degree
Act InAct
90

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Heading 10 (HwSet) Continued.....

3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:					Hand	Degree Act InAct
(4)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE	
(1)	1	EA	PANIC HARDWARE	CD35A-NL-OP 4'	626	VON	
(1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	ELECTRIC STRIKE	6300	630	VON	
(1)	1	EA	DOOR PULL	3015-2 #2 1-3/4" THICK DR.	32D	SMH	
(1)	1	EA	AUTO OPERATOR	4100 LE LHR	CL	HOR	
(1)	1	EA	OVERHEAD STOP	904S	630	GLY	
(1)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH	
(1)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC	
(1)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC	
(1)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC	
(1)	1	EA	INTEGRATION BOX	TA2902G3 E-CR-AO		KMT	
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	
(1)	1	EA	DOOR CONTACT	DC-87		G87	
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	
(1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
ACCESS CONTROL PROVIDER TO TERMINATE ACTIVATION IN INTEGRATION BOX.

Heading 11 (HwSet)

1 PR DOOR(S) 022 EXTERIOR FROM GYMNASIUM 131

2/3'6" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Opening Remark: PAIR OF DOORS - BOTH ACTIVE

Totals	Each Assembly to have:					Hand	Degree Act InAct
(8)	8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE	4 4
(1)	1	EA	REMOVABLE MULLION	42-7-CNI-TR		PLI	1 1
(2)	2	EA	PANIC HARDWARE	CD98EO 4'	626	VON	1 1
(2)	2	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH	1 1
(2)	2	EA	PULL PLATE	H413 4" X 16"	32D	SMH	1 1

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Heading 11 (HwSet) Continued.....

							Hand	Degree Act InAct
(2)	2	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN	1	1
(2)	2	EA	KICKPLATE	K10A 7" X 40" TAPE	32D	SMH	1	1
(2)	2	SET	WEATHERSTRIP	W-20S 1/42" 2/84"	628	KNC	1	1
(2)	2	EA	DOOR SWEEP	W-24S 42"	628	KNC	1	1
(1)	1	EA	THRESHOLD	CT-406 84" X 10 X 1 1/2" FHSD TAP CON	627	KNC		
(2)	2	EA	DOOR CONTACT	DC-87	G87		1	1

Heading 12 (HwSet)

1 SGL DOOR(S) 023 ROOF FROM SERVICE ROOM 211
3'6" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LHR
Degree
Act InAct
90

Totals Each Assembly to have:

(4)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE		
(1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH		
(1)	1	EA	SECURITY ASTRAGAL	43SP 7'	P	ZER		
(1)	1	EA	SURFACE CLOSER	4040XP.HCUSH	689	LCN		
(1)	1	EA	KICKPLATE	K10A 7" X 40" TAPE	32D	SMH		
(1)	1	SET	WEATHERSTRIP	W-20S 1/42" 2/84"	628	KNC		
(1)	1	EA	DOOR SWEEP	W-24S 42"	628	KNC		
(1)	1	EA	THRESHOLD	CT-406 42" X 10 X 1 1/2" FHSD TAP CON	627	KNC		
(1)	1	EA	DOOR CONTACT	DC-87	G87			

Heading 13 (HwSet)

1 SGL DOOR(S) 024 ROOF FROM STAIR 212-2
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
RHR
Degree
Act InAct
90

Totals Each Assembly to have:

(4)	4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE		
(1)	1	EA	INSTITUTION LOCK	ND82PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH		
(1)	1	EA	SECURITY ASTRAGAL	43SP 7'	P	ZER		
(1)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN		
(1)	1	EA	KICKPLATE	K10A 7" X 36" TAPE	32D	SMH		
(1)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC		
(1)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC		
(1)	1	EA	THRESHOLD	CT-406 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC		

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Heading 13 (HwSet) Continued.....

							Hand	Degree Act InAct
(1)	1	EA	DOOR CONTACT	DC-87		G87	

Heading 14 (HwSet)

							Hand	Degree Act InAct
				1 SGL DOOR(S) 025 EXTERIOR TO OUTDOOR STORAGE SHED			RH	90
				3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
				Opening Remark: CONFIRM DOOR HANDING				
Totals			Each Assembly to have:					
(	4)	4	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(	1)	1	EA	DEADBOLT	B663P 10-087, 50-210, **RESTRICTED KEYWAY**	626	SCH	
(	1)	1	EA	PULL PLATE C/W 2-14 DIA HOLE	H411 3" X 4"	32D	SMH	
(	1)	1	EA	SURFACE CLOSER	4040XP.HCUSH	689	LCN	
(	1)	1	SET	WEATHERSTRIP	W-20S 1/38" 2/84"	628	KNC	
(	1)	1	EA	DOOR SWEEP	W-24S 38"	628	KNC	
(	1)	1	EA	THRESHOLD	CT-10 38" X 10 X 1 1/2" FHSD TAP CON	627	KNC	

Heading 15 (HwSet)

							Hand	Degree Act InAct
				1 PR DOOR(S) 100-1 VESTIBULE 100-1 FROM LOBBY 100-2			LHRA/RHR	90 90
				2/3'6" x 8'0-5/8" x 1-3/4" x ALD x ALF x NON-RTD				
Totals			Each Assembly to have:					Act InAct
(	8)	8	EA	HINGE	5BB1 5 X 4.5	652	IVE	4 4
(	1)	1	EA	ELEC. REM. MULLION	42-8-CNI-AC-TR		PLI	1 1
(	1)	1	EA	PANIC HARDWARE	CD35A-EO 4'	626	VON	1
(	1)	1	EA	PANIC HARDWARE	CD35A-NL-OP 4'	626	VON	1
(	2)	2	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626	SCH	1 1
(	1)	1	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626	SCH	1
(	1)	1	EA	ELECTRIC STRIKE	6300	630	VON	1
(	2)	2	EA	DOOR PULL	3015-2 #2 1-3/4" THICK DR.	32D	SMH	1 1
(	1)	1	EA	SURFACE CLOSER	4021 LH	689	LCN	1
(	1)	1	EA	ADAPTER PLATE	4020-18G	689	LCN	1
(	1)	1	EA	AUTO. OPERATOR	7100 LHR	CL	HOR	1
(2)	2	EA	OVERHEAD STOP	105S	630	GLY	
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	2
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	2

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Heading 15 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED	G87	1
(	1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL	HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
VESTIBULE BUTTON WIRED DIRECTLY TO ACTIVATION. VESTIBULE BUTTON ONLY OPENS
DOOR WHEN EXIT DEVICE IS IN DOGGED POSITION. LOBBY BUTTON WIRED THROUGH
ELECTRIC STRIKE. LOBBY BUTTON ALWAYS ACTIVATES DOOR.

Heading 16 (HwSet)

						Hand	Degree Act InAct
	1	DE	DOOR(S)	100-5 CORRIDOR 100-4 FROM CORRIDOR 100-5		LHR/LHR	90 90
				2/3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN			
				Opening Remark: CONTRA SWING PAIR OF DOORS			
Totals			Each Assembly to have:				Act InAct
(	6)	6	EA	HINGE	5BB1 5 X 4.5	652 IVE	3 3
(	1)	1		MULLION	BY FRAME PROVIDER	UNK	1 1
(	2)	2	EA	FIRE EXIT HARDWARE	98EO-F 4'	626 VON	1 1
(	2)	2	EA	SURFACE CLOSER	4040XP.RWPA	689 LCN	1 1
(	2)	2	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D SMH	1 1
(	2)	2	EA	COMBO FLOOR STOP	S102L	26D SMH	1 1
(	2)	2	EA	MAGNETIC HOLD- OPEN	SEM7850	AL LCN	1 1

Heading 17 (HwSet)

						Hand	Degree Act InAct
	1	SGL	DOOR(S)	100-5C CORRIDOR 100-5 TO STAFF WR 100-5C		LH	90
	1	SGL	DOOR(S)	100-5D CORRIDOR 100-5 TO STAFF WR 100-5D		RH	90
				3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD			
Totals			Each Assembly to have:				
(	6)	3	EA	HINGE	5BB1 5 X 4.5	652 IVE	
(	2)	1	EA	PRIVACY SET	ND40S SPA OS-OCC	626 SCH	
(	2)	1	EA	SURFACE CLOSER	1461.RWPA	689 LCN	
(	2)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D SMH	
(	2)	1	EA	CC WALL STOP	S123	32D SMH	

Heading 18 (HwSet)

						Hand	Degree Act InAct
	1	PR	DOOR(S)	100-7 VESTIBULE 100-7 FROM CORRIDOR 100-6		RHRA/LHR	90 90
	1	PR	DOOR(S)	100-8 VESTIBULE 100-8 FROM CORRIDOR 100-4		RHRA/LHR	90 90

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Heading 18 (HwSet) Continued.....

2/3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:				Hand	Degree Act InAct
(12) 6	EA HINGE	5BB1 5 X 4.5	652	IVE	3	3
(4) 2	EA DUMMY TOUCH BAR	350 4'	626	VON	1	1
(2) 1	EA SURFACE CLOSER	4040XP.CUSH	689	LCN		1
(2) 1	EA AUTO. OPERATOR	7100 RHR	CL	HOR	1	
(2) 1	EA OVERHEAD STOP	904S	630	GLY	1	
(4) 2	EA KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	1	1
(4) 2	EA MOUNTING BOX SQR.	CM-43CBL		CAM	2	
(4) 2	EA SQR. ACTUATOR	CM-45/4	32D	CAM	2	
(2) 1	EA WIRING DIAGRAMS	AS REQUIRED		G87	1	
(2) 1	EA AUTO OPERATOR INSTALLATION	INSTALL		HOR	1	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.

Heading 19 (HwSet)

	Hand	Degree Act InAct
1 SGL DOOR(S) 100-9A WASHROOM 100-9 TO STALL 100-9A	RH	90
1 SGL DOOR(S) 100-9B WASHROOM 100-9 TO STALL 100-9B	RH	90
1 SGL DOOR(S) 100-9C WASHROOM 100-9 TO STALL 100-9C	RH	90
1 SGL DOOR(S) 100-9D WASHROOM 100-9 TO STALL 100-9D	RH	90

2'4" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:			
(12) 3	EA HINGE	5BB1 4.5 X 4	652	IVE
(4) 1	EA PRIVACY SET	ND40S SPA OS-OCC	626	SCH
(4) 1	EA CC WALL STOP	S123	32D	SMH

Heading 20 (HwSet)

	Hand	Degree Act InAct
1 SGL DOOR(S) 101 LOBBY 100-2 TO KITCHEN 101	LH	90

3'2" x 7'8-1/2" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:			
(4) 4	EA HINGE	5BB1 5 X 4.5	652	IVE
(1) 1	EA CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(1) 1	EA SURFACE CLOSER	1461.CUSH	689	LCN
(1) 1	EA KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH

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Heading 20 (HwSet) Continued.....

Hand Degree
Act InAct

Heading 21 (HwSet)

1 SGL DOOR(S) 102A VESTIBULE 100-1 TO MAIN OFFICE 102
3'6" x 8'0-5/8" x 1-3/4" x ALD x ALF x NON-RTD

Hand Degree
LH Act InAct
90

Totals Each Assembly to have:

(4)	4	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTICTED KEYWAY**	626	SCH
(1)	1	EA	ELECTRIC STRIKE	CX-ED1079 LOW PROFILE	32D	CAM
(1)	1	EA	AUTO. OPERATOR	7100 LH	CL	HOR
(1)	1	EA	OVERHEAD STOP	105S	630	GLY
(1)	1	EA	INTEGRATION BOX	TA2902G3 E-CR-AO		KMT
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR
(1)	1	EA	CARD READER	BY ACCESS CONTROL PROVIDER		UNK

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
VESTIBULE SIDE ACTUATOR WIRED DIRECTLY TO ACTIVATION. ELECTRIC STRIKE RELEASED
BY AIPHONE SYSTEM ON DOOR 01A. OFFICE SIDE ACTUATOR WIRED TO ELECTRIC STRIKE.
OFFICE SIDE ACTUATOR ALWAYS OPENS DOOR.

Heading 22 (HwSet)

1 SGL DOOR(S) 102B LOBBY 100-2 TO MAIN OFFICE 102
3'2" x 8'0-5/8" x 1-3/4" x ALD x ALF x NON-RTD

Hand Degree
LH Act InAct
90

Totals Each Assembly to have:

(4)	4	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTICTED KEYWAY**	626	SCH
(1)	1	EA	MORTISE CYLINDER	20-001 1-1/4", 50-210 **RESTRICTED KEYWAY**	626	SCH
(1)	1	EA	ELECTRIC STRIKE	CX-ED1079 LOW PROFILE	32D	CAM
(1)	1	EA	AUTO. OPERATOR	7100 LH	CL	HOR
(1)	1	EA	OVERHEAD STOP	104S	630	GLY
(1)	1	EA	KEYSWITCH	CM-1230-7224 MAINTAINED	32D	CAM
(1)	1	EA	WASHROOM RELAY	CX-33		CAM

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Heading 22 (HwSet) Continued.....

						Hand	Degree Act InAct
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
KEYSWITCH TURNS ON/OFF LOBBY SIDE ACTUATOR AND SECURES ELECTRIC STRIKE.

Heading 23 (HwSet)

						Hand	Degree Act InAct
		1 SGL	DOOR(S) 102-1 MAIN OFFICE 102 TO PRINCIPAL 102-1			RH	90
		1 SGL	DOOR(S) 102-2 MAIN OFFICE 102 TO VICE PRINCIPAL 102-2			LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals	Each Assembly to have:						
(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(2)	1	EA	OFFICE LOCK	ND50PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(2)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 24 (HwSet)

						Hand	Degree Act InAct
		1 SGL	DOOR(S) 102-3 CORRIDOR 100-3 TO CORRIDOR 102-3			RH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	SURFACE CLOSER	1461.CUSH	689	LCN	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 25 (HwSet)

						Hand	Degree Act InAct
		1 SGL	DOOR(S) 102-5 CORRIDOR 102-3 TO HEALTH 102-5			RH	90
		1 SGL	DOOR(S) 102-7 CORRIDOR 102-3 TO MEETING 102-7			LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals	Each Assembly to have:						
(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	

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Heading 25 (HwSet) Continued.....

						Hand	Degree Act InAct
(2)	1	EA	PASSAGE SET	ND10S SPA	626	SCH	
(2)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 26 (HwSet)

1 SGL DOOR(S) 102-6 CORRIDOR 102-3 TO STAFF WR 102-6
3'0" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LH
Degree
Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 4.5 X 4	652	IVE	
(1)	1	EA	PRIVACY SET	ND40S SPA OS-OCC	626	SCH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 27 (HwSet)

1 SGL DOOR(S) 103 CORRIDOR 100-4 TO ELEV. MACHINE RM 103
3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN

Hand
RH
Degree
Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	SURFACE CLOSER	1461.RWPA	689	LCN	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 28 (HwSet)

1 SGL DOOR(S) 104 CORRIDOR 100-4 TO UNIV. WR 104
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LH
Degree
Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	ELECTRIC STRIKE	CX-ED1079D STANDARD	32D	CAM	
(1)	1	EA	AUTO. OPERATOR	7100 LH	CL	HOR	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	
(1)	1	EA	AURA W.R. KIT SURF.	CX-WC13XSM	32D	CAM	

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Heading 28 (HwSet) Continued.....

					Hand	Degree Act InAct
(1)	1	EA	EMERGENCY CALL SYS.	CX-WEC10K2 DBL GANG	CAM	
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED	G87	
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL	HOR	

Heading 29 (HwSet)

					Hand	Degree Act InAct
1 SGL	DOOR(S)	105	CORRIDOR 100-5 TO KINDERGARTEN	105	RH	90
1 SGL	DOOR(S)	106	CORRIDOR 100-5 TO KINDERGARTEN	106	LH	90
1 SGL	DOOR(S)	107	CORRIDOR 100-5 TO KINDERGARTEN	107	RH	90
1 SGL	DOOR(S)	108	CORRIDOR 100-5 TO KINDERGARTEN	108	LH	90
1 SGL	DOOR(S)	109	CORRIDOR 100-5 TO KINDERGARTEN	109	RH	90
1 SGL	DOOR(S)	113	CORRIDOR 100-5 TO LRT	113	RH	90
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD						

Totals Each Assembly to have:

(18)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(6)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH
(6)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH

Heading 30 (HwSet)

					Hand	Degree Act InAct
1 SGL	DOOR(S)	105-1	VESTIBULE 105-3 FROM CUBBIES	105-2	LHR	90
1 SGL	DOOR(S)	106-1	VESTIBULE 106-3 FROM CUBBIES	106-2	RHR	90
1 SGL	DOOR(S)	107-1	VESTIBULE 107-3 FROM CUBBIES	107-2	LHR	90
1 SGL	DOOR(S)	108-1	VESTIBULE 108-3 FROM CUBBIES	108-2	RHR	90
1 SGL	DOOR(S)	109-1	VESTIBULE 109-3 FROM CUBBIES	109-2	LHR	90
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD						

Totals Each Assembly to have:

(15)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(5)	1	EA	DOOR PULL	2509-1	32D	SMH
(5)	1	EA	DUMMY TOUCH BAR	350 4'	626	VON
(5)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN
(5)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH

Heading 31 (HwSet)

					Hand	Degree Act InAct
1 DD	DOOR(S)	105-2	KINDERGARTEN 105 TO KINDERGARTEN	106	LH	180
1 DD	DOOR(S)	106-2	KINDERGARTEN 106 TO KINDERGARTEN	107	LH	180

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Heading 31 (HwSet) Continued.....

1 DD DOOR(S) 107-2 KINDERGARTEN 107 TO KINDERGARTEN 108
 1 DD DOOR(S) 108-2 KINDERGARTEN 108 TO KINDERGARTEN 109
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD
 Opening Remark: DUTCH DOOR

Hand	Degree Act	InAct
LH	180	
LH	180	

Totals	Each Assembly to have:				Act	Upper
(16)	4 EA HINGE	5BB1 5 X 4.5	652	IVE	2	2
(4)	1 EA FLUSH BOLT	F65 UL 12"	26D	SMH		1
(4)	1 EA PASSAGE SET	ND10S SPA	626	SCH	1	
(8)	2 EA MAGNETIC DOOR HOLDER	SMDH	26D	CAN	1	1

Heading 32 (HwSet)

1 SGL DOOR(S) 110 CORRIDOR 100-5 FROM CORRIDOR 110
 3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN

Hand	Degree Act	InAct
RHR	90	

Totals	Each Assembly to have:			
(3)	3 EA HINGE	5BB1 5 X 4.5	652	IVE
(1)	1 EA INSTITUTION LOCK	ND82PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(1)	1 EA SURFACE CLOSER	4040XP.RWPA	689	LCN
(1)	1 EA KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH
(1)	1 EA COMBO FLOOR STOP	S102L	26D	SMH

DOOR LOCKED ON BOTH SIDES. KEY REQUIRE TO OPEN DOOR

Heading 33 (HwSet)

1 SGL DOOR(S) 110-01 VESTIBULE 110-1 FROM CORRIDOR 110
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act	InAct
LHR	90	

Totals	Each Assembly to have:			
(3)	3 EA HINGE	5BB1HW 5 X 4.5	652	IVE
(1)	1 EA DOOR PULL	3015-2 #2 1-3/4" THICK DR.	32D	SMH
(1)	1 EA DUMMY TOUCH BAR	350 4'	626	VON
(1)	1 EA AUTO. OPERATOR	7100 LHR	CL	HOR
(1)	1 EA KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH
(1)	1 EA COMBO FLOOR STOP	S102L	26D	SMH
(2)	2 EA MOUNTING BOX SQR.	CM-43CBL		CAM
(2)	2 EA SQR. ACTUATOR	CM-45/4	32D	CAM
(1)	1 EA WIRING DIAGRAMS	AS REQUIRED	G87	

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Heading 33 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.

Heading 34 (HwSet)

						Hand	Degree Act InAct
	1 SGL	DOOR(S)	110-02 CORRIDOR 110 TO OFFICE 110-2			LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	OFFICE LOCK	ND50PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 35 (HwSet)

						Hand	Degree Act InAct
	1 SGL	DOOR(S)	110-03 CORRIDOR 110 TO STORAGE 110-3			LH	90
	1 SGL	DOOR(S)	110-04 CORRIDOR 110 TO LAUNDRY 110-4			RH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals	Each Assembly to have:						
(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(2)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(2)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 36 (HwSet)

						Hand	Degree Act InAct
	1 SGL	DOOR(S)	110-05 CORRIDOR 110 TO KITCHEN 110-5			RH	90
	1 SGL	DOOR(S)	110-07 CORRIDOR 110 TO STAFF 110-7			RH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals	Each Assembly to have:						
(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(2)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(2)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 37 (HwSet)

						Hand	Degree Act InAct
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Heading 33 (HwSet) Continued.....

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Heading 37 (HwSet) Continued.....

1 SGL DOOR(S) 110-06 CORRIDOR 110 TO WASHROOM 110-6
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand Degree
LH Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTICTED KEYWAY**	626	SCH
(1)	1	EA	ELECTRIC STRIKE	CX-ED1079D STANDARD	32D	CAM
(1)	1	EA	AUTO. OPERATOR	7100 LH	CL	HOR
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH
(1)	1	EA	AURA W.R. KIT SURF.	CX-WC13XSM	32D	CAM
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED	G87	
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.

Heading 38 (HwSet)

1 SGL DOOR(S) 110-08 CORRIDOR 110 TO PRESCHOOL 110-8
1 SGL DOOR(S) 110-13 CORRIDOR 110 TO TODDLER 110-13
1 SGL DOOR(S) 110-14 CORRIDOR 110 TO INFANT 110-14
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand Degree
RH Act InAct
90
LH 90
RH 90

Totals Each Assembly to have:

(9)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(3)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH
(3)	1	EA	OVERHEAD STOP	904S	630	GLY

Heading 39 (HwSet)

1 PR DOOR(S) 110-08A PRESCHOOL 110-8 FROM CLOSET
1 PR DOOR(S) 110-08B PRESCHOOL 110-8 FROM CLOSET
1 PR DOOR(S) 110-13A TODDLER 110-13 FROM CLOSET
2/2'0" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD
Opening Remark: PAIR OF DOORS

Hand Degree
LHR/RHR Act InAct
90 90
LHR/RHR 90 90
LHR/RHR 90 90

Totals Each Assembly to have:

(18)	6	EA	HINGE	5BB1 4.5 X 4	652	IVE	3	3
(6)	2	EA	DUMMY TRIM	ALX170 SPA	626	SCH	1	1
(6)	2	EA	ROLLER LATCH	RL32 (TOP MOUNT)	626	IVE	1	1

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Heading 39 (HwSet) Continued.....

							Hand	Degree Act InAct
(6)	2	EA	OVERHEAD STOP	452S	630	GLY	1	1

Heading 40 (HwSet)

1 SGL DOOR(S) 110-09A PRESCHOOL 110-8 FROM WASHROOM 110-9
 1 SGL DOOR(S) 110-09B TODDLER 110-13 FROM WASHROOM 110-9
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LHR	90
RHR	90

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(2)	1	EA	PASSAGE SET	ND10S SPA	626	SCH
(2)	1	EA	OVERHEAD STOP	904S	630	GLY

Heading 41 (HwSet)

1 SGL DOOR(S) 110-10 PRESCHOOL 110-8 FROM COATS 110-10
 1 SGL DOOR(S) 110-12 PRESCHOOL 110-8 FROM COATS 110-10
 3'2" x 3'6" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LHR	180
RHR	180

Opening Remark: 1/2 HEIGHT DOOR IN 1/2 HEIGHT JAMBS

Totals Each Assembly to have:

(4)	2	EA	HINGE	5BB1 5 X 4.5	652	IVE
(2)	1	EA	PASSAGE SET	ND10S SPA	626	SCH
(2)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 42 (HwSet)

1 SGL DOOR(S) 110-15 INFANT 110-14 FROM SLEEP 110-15
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RHR	110

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	PASSAGE SET	ND10S SPA	626	SCH
(1)	1	EA	OVERHEAD STOP	904S	630	GLY

Heading 43 (HwSet)

1 SGL DOOR(S) 110-16 PRESCHOOL 110-8 FROM COATS 110-10
 3'2" x 3'6" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RHR	90

Opening Remark: 1/2 HEIGHT DOOR IN 1/2 HEIGHT JAMBS

Totals Each Assembly to have:

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Heading 43 (HwSet) Continued.....

						Hand	Degree Act InAct
(2)	2	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	PASSAGE SET	ND10S SPA	626	SCH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 44 (HwSet)

						Hand	Degree Act InAct
1 SGL	DOOR(S)	110-11A VESTIBULE	110-11 FROM COATS	110-10		LHR	90
1 SGL	DOOR(S)	110-11B VESTIBULE	110-11 FROM COATS	110-12		RHR	90
1 SGL	DOOR(S)	110-17 VESTIBULE	110-17 FROM INFANT	110-14		RHR	90
		3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD					

Totals Each Assembly to have:

(9)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(3)	1	EA	DOOR PULL	2509-1	32D	SMH	
(3)	1	EA	DUMMY TOUCH BAR	350 4'	626	VON	
(3)	1	EA	SURFACE CLOSER	4040XP.RWPA	689	LCN	
(3)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(3)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 45 (HwSet)

						Hand	Degree Act InAct
1 SGL	DOOR(S)	111 CORRIDOR	100-6 TO MULTI-PURPOSE	111		RH	90
		3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD					

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 46 (HwSet)

						Hand	Degree Act InAct
1 SGL	DOOR(S)	112 CORRIDOR	100-6 TO JANITOR	112		RH	90
		3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD					

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

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Heading 46 (HwSet) Continued.....

Hand Degree
Act InAct

Heading 47 (HwSet)

1 PR DOOR(S) 114 STAIR A 114 FROM CORRIDOR 100-5
1 PR DOOR(S) 120 STAIR B 120 FROM CORRIDOR 100-4
2/3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN
Opening Remark: PAIR OF DOORS BOTH ACTIVE

Hand Degree
Act InAct
LHR/RHR 150 150
LHR/RHR 150 150

Totals Each Assembly to have:

							Act	InAct
(12)	6	EA	HINGE	5BB1HW 5 X 4.5	652	IVE	3	3
(2)	1	EA	FIRE RATED REMOVABLE MULLION	42-7-CNI-TR-FR		PLI	1	1
(4)	2	EA	FIRE EXIT HARDWARE	98L-BE-F 4'	626	VON	1	1
(4)	2	EA	SURFACE CLOSER	4040XP.RWPA	689	LCN	1	1
(4)	2	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	1	1
(4)	2	EA	MAGNETIC HOLD- OPEN	SEM7850	AL	LCN	1	1

Heading 48 (HwSet)

1 SGL DOOR(S) 115 CORRIDOR 100-5 TO CLASSROOM 115
1 SGL DOOR(S) 116 CORRIDOR 100-5 TO CLASSROOM 116
1 SGL DOOR(S) 117 CORRIDOR 100-5 TO CLASSROOM 117
1 SGL DOOR(S) 118 CORRIDOR 100-5 TO CLASSROOM 118
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand Degree
Act InAct
RH 90
LH 90
RH 90
LH 90

Totals Each Assembly to have:

(12)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(4)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(4)	1	EA	OVERHEAD STOP	904S	630	GLY	

Heading 49 (HwSet)

1 SGL DOOR(S) 121 CORRIDOR 100-4 TO STORAGE 121
3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN

Hand Degree
Act InAct
LH 90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	SURFACE CLOSER	1461.RWPA	689	LCN	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	

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Heading 49 (HwSet) Continued.....

							Hand	Degree Act InAct
(1)	1	EA	CC WALL STOP	S123		32D	SMH	

Heading 50 (HwSet)

							Hand	Degree Act InAct
			1 SGL DOOR(S) 122 CORRIDOR 100-4 TO SPECIAL NEEDS 122				RH	90
			1 SGL DOOR(S) 123 CORRIDOR 100-4 TO SPECIAL NEEDS 123				LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD					

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5		652	IVE	
(2)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**		626	SCH	
(2)	1	EA	OVERHEAD STOP	904S		630	GLY	

Heading 51 (HwSet)

							Hand	Degree Act InAct
			1 SGL DOOR(S) 122-1A SPECIAL NEEDS 122 TO LEARNING 122-1				RH	90
			1 SGL DOOR(S) 122-1B SPECIAL NEEDS 123 TO LEARNING 122-1				LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD					

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5		652	IVE	
(2)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**		626	SCH	
(2)	1	EA	COMBO FLOOR STOP	S102L		26D	SMH	

Heading 52 (HwSet)

							Hand	Degree Act InAct
			1 SGL DOOR(S) 122-3 SPECIAL NEEDS 122 TO WASHROOM 122-3				RH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD					

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5		652	IVE	
(1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTRICTED KEYWAY**		626	SCH	
(1)	1	EA	MORTISE CYLINDER	20-001 1-1/4", 50-210 **RESTRICTED KEYWAY**		626	SCH	
(1)	1	EA	ELECTRIC STRIKE	CX-ED1079D STANDARD		32D	CAM	
(1)	1	EA	AUTO. OPERATOR	7100 RH		CL	HOR	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE		32D	SMH	
(1)	1	EA	COMBO FLOOR STOP	S102L		26D	SMH	

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Heading 52 (HwSet) Continued.....

							Hand	Degree Act InAct
(1)	1	EA	KEYSWITCH	CM-1230-7224	MAINTAINED	32D	CAM
(	1)	1	EA	AURA W.R. KIT SURF.	CX-WC13XSM		32D	CAM
(	1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	
(	1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
KEYSWITCH TURNS ON/OFF AUTOMATIC OPERATOR

Heading 53 (HwSet)

							Hand	Degree Act InAct
				1 SGL DOOR(S) 123-1 SPECIAL NEEDS 123 TO WASHROOM 123-1			LH	90
				3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals			Each Assembly to have:					
(	3)	3	EA	HINGE	5BB1 5 X 4.5		652	IVE
(	1)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTICTED KEYWAY**		626	SCH
(	1)	1	EA	MORTISE CYLINDER	20-001 1-1/4", 50-210 **RESTRICTED KEYWAY**		626	SCH
(	1)	1	EA	ELECTRIC STRIKE	CX-ED1079D STANDARD		32D	CAM
(	1)	1	EA	AUTO. OPERATOR	7100 LH		CL	HOR
(	1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE		32D	SMH
(	1)	1	EA	COMBO FLOOR STOP	S102L		26D	SMH
(	1)	1	EA	KEYSWITCH	CM-1230-7224 MAINTAINED		32D	CAM
(	1)	1	EA	AURA W.R. KIT SURF.	CX-WC13XSM		32D	CAM
(	1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	
(	1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
KEYSWITCH TURNS ON/OFF AUTOMATIC OPERATOR

Heading 54 (HwSet)

							Hand	Degree Act InAct
				1 SGL DOOR(S) 122-4 SPECIAL NEEDS 122 TO SENSORY 122-4			RH	90
				1 SGL DOOR(S) 123-2 SPECIAL NEEDS 123 TO SENSORY 123.2			LH	90
				3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				
Totals			Each Assembly to have:					
(6)	3	EA	HINGE	5BB1 5 X 4.5		652	IVE
(2)	1	EA	PASSAGE SET	ND10S SPA		626	SCH

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Heading 54 (HwSet) Continued.....

							Hand	Degree Act InAct
(2)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 55 (HwSet)

1 SGL DOOR(S) 124 CORRIDOR 100-4 TO CUSTODIAN OFFICE
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LH
Degree
Act InAct
90

Totals Each Assembly to have:

(	3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(	1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(	1)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 56 (HwSet)

1 SGL DOOR(S) 125 VESTIBULE 100-8 TO SPRINKLER 125
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
RH
Degree
Act InAct
90

Totals Each Assembly to have:

(	3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(	1)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(	1)	1	EA	SURFACE CLOSER	1461.CUSH	689	LCN
(	1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH

Heading 57 (HwSet)

1 SGL DOOR(S) 126 SPRINKLER 125 TO ELECTRICAL 126
3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN

Hand
LH
Degree
Act InAct
90

Totals Each Assembly to have:

(	3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(	1)	1	EA	PASSAGE SET	ND10S SPA	626	SCH
(	1)	1	EA	SURFACE CLOSER	1461.RWPA	689	LCN
(	1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH
(	1)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 58 (HwSet)

1 SGL DOOR(S) 128-01 VESTIBULE 128-1 FROM COMMUNITY 128

Hand
LHR
Degree
Act InAct
90

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Heading 58 (HwSet) Continued.....

3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	DOOR PULL	3015-2 #2 1-3/4" THICK DR.	32D	SMH	
(1)	1	EA	DUMMY TOUCH BAR	350 4'	626	VON	
(1)	1	EA	AUTO. OPERATOR	7100 LHR	CL	HOR	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.

Heading 59 (HwSet)

1 SGL DOOR(S) 128-02 COMMUNITY 128 TO KITCHEN 128-2
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand Degree
LH Act InAct
90

Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 60 (HwSet)

1 SGL DOOR(S) 128-03 COMMUNITY 128 TO STORAGE 128-3
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD
Opening Remark: LH

Hand Degree
LH Act InAct
90

Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 61 (HwSet)

Hand Degree
Act InAct

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Heading 61 (HwSet) Continued.....

1 SGL DOOR(S) 128-04 CORRIDOR 128-6 TO OFFICE 128-4
 1 SGL DOOR(S) 128-05 CORRIDOR 128-6 TO OFFICE 128-5
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LH	90
RH	90

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(2)	1	EA	OFFICE LOCK	ND50PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(2)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH

Heading 62 (HwSet)

1 SGL DOOR(S) 128-06 GYMNASIUM 131 TO COMMUNITY 128
 3'2" x 7'0" x 1-3/4" x HMD x HMF x 20MIN

Hand	Degree Act InAct
LH	90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	INSTITUTION LOCK	ND82PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(1)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH

DOOR LOCKED ON BOTH SIDES. KEY REQUIRE TO OPEN DOOR

Heading 63 (HwSet)

1 SGL DOOR(S) 128-07 CORRIDOR 128-6 TO WASHROOM 128-7
 1 SGL DOOR(S) 128-08 CORRIDOR 128-6 TO WASHROOM 128-8
 1 SGL DOOR(S) 128-09 CORRIDOR 128-6 TO WASHROOM 128-9
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LH	90
RH	90
LH	90

Totals Each Assembly to have:

(9)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(3)	1	EA	PRIVACY SET	ND40S SPA OS-OCC	626	SCH
(3)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH

Heading 64 (HwSet)

1 SGL DOOR(S) 128-10A GYMNASIUM 131 TO STORAGE 128-10
 3'2" x 7'0" x 1-3/4" x HMD x HMF x 20MIN

Hand	Degree Act InAct
RH	90

Totals Each Assembly to have:

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Heading 64 (HwSet) Continued.....

						Hand	Degree Act InAct
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	SURFACE CLOSER	4040XP.RWPA	689	LCN	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 65 (HwSet)

1 SGL DOOR(S) 128-10B STORAGE 128-10 FROM CORRIDOR 128-6
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LHR
Degree
Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	INSTITUTION LOCK	ND82PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	SURFACE CLOSER	4040XP.HCUSH	689	LCN	
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	

DOOR LOCKED ON BOTH SIDES. KEY REQUIRE TO OPEN DOOR

Heading 66 (HwSet)

1 SGL DOOR(S) 129 CORRIDOR 100-4 TO RECYCLE 129
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
RH
Degree
Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 67 (HwSet)

1 SGL DOOR(S) 130 CORRIDOR 100-4 TO JANITOR 130
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LH
Degree
Act InAct
90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	

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Heading 67 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 68 (HwSet)

1 PR DOOR(S) 131A LOBBY 100-2 FROM GYMNASIUM 131
2/3'2" x 7'8-1/2" x 1-3/4" x HMD x HMF x 20MIN

Hand Degree
LHRA/RHR Act InAct
90 90

Totals	Each Assembly to have:					Act	InAct
(8)	8	EA	HINGE	5BB1HW 5 X 4.5	652	IVE	4 4
(1)	1	EA	FIRE RATED REMOVABLE MULLION	42-8-CNI-TR-FR		PLI	1 1
(2)	2	EA	FIRE EXIT HARDWARE	98L-F 4'	626	VON	1 1
(2)	2	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626	SCH	1 1
(1)	1	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN	1
(1)	1	EA	AUTO. OPERATOR	7100 LHR	CL	HOR	1
(2)	2	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	1 1
(1)	1	EA	KEYSWITCH	CM-1230-7224 MAINTAINED	32D	CAM	1
(2)	2	EA	MOUNTING BOX SQR.	CM-43CBL		CAM	2
(2)	2	EA	SQR. ACTUATOR	CM-45/4	32D	CAM	2
(1)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	1
(1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	1

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
KEYSWITCH TURNS ON/OFF AUTOMATIC OPERATOR

Heading 69 (HwSet)

1 PR DOOR(S) 131B CORRIDOR 100-4 FROM GYMNASIUM 131
2/3'2" x 7'0" x 1-3/4" x HMD x HMF x 20MIN
Opening Remark: PAIR OF DOORS, BOTH LEAVES ACTIVE

Hand Degree
LHR/RHR Act InAct
90 90

Totals	Each Assembly to have:					Act	InAct
(6)	6	EA	HINGE	5BB1HW 5 X 4.5	652	IVE	3 3
(1)	1		MULLION	BY FRAME PROVIDER		UNK	1 1
(2)	2	EA	FIRE EXIT HARDWARE	98L-F 4'	626	VON	1 1
(2)	2	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626	SCH	1 1
(2)	2	EA	SURFACE CLOSER	4040XP.CUSH	689	LCN	1 1
(2)	2	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	1 1

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Heading 70 (HwSet)

1 SGL DOOR(S) 131-1A CORRIDOR 100-3 TO STAIR 131-1
3'2" x 7'0" x 1-3/4" x HMD x HMF x 20MIN

Hand Degree
LH 90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH
(1)	1	EA	SURFACE CLOSER	1461.RWPA	689	LCN
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH
(1)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 71 (HwSet)

1 SGL DOOR(S) 131-1B GYMNASIUM 131 TO STAIR 131-1
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand Degree
RH 90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	PASSAGE SET	ND10S SPA	626	SCH
(1)	1	EA	SURFACE CLOSER	1461.CUSH	689	LCN
(1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH

Heading 72 (HwSet)

1 PR DOOR(S) 131-3 GYMNASIUM 131 TO GYM STORAGE 131-3
2/3'2" x 7'0" x 1-3/4" x HMD x HMF x 20MIN

Hand Degree
RHA/LHI 90 90

Totals Each Assembly to have:

							Act	InAct
(6)	6	EA	HINGE	5BB1 5 X 4.5	652	IVE	3	3
(1)	1	SET	CONST LATCHING BOLT	FB51P	630	IVE		1
(1)	1	EA	DUST PROOF STRIKE	DP2	626	IVE		1
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 14-042, 50-210, **RESTRICTED KEYWAY**	626	SCH	1	
(1)	1	EA	COORDINATOR	COR52 X FL32	628	IVE		
(2)	2	EA	MOUNTING BRACKET	MB2	689	IVE	1	1
(2)	2	EA	SRUFACE CLOSER	1461.CUSH ST 3410	689	LCN	1	1
(2)	2	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	1	1

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Heading 73 (HwSet)

1 SGL DOOR(S) 131-4 GYMNASIUM 131 TO CHANGE ROOM 131-4
1 SGL DOOR(S) 131-5 GYMNASIUM 131 TO CHANGE ROOM 131-5
3'2" x 7'0" x 1-3/4" x HMD x HMF x 20MIN

Hand	Degree Act InAct
RH	90
LH	90

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(2)	1	EA	PASSAGE SET	ND10S SPA	626	SCH
(2)	1	EA	SURFACE CLOSER	1461.RWPA	689	LCN
(2)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH
(2)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 74 (HwSet)

5 PR DOOR(S) 131-6 GYMNASIUM 131 FROM UNDER STAGE STORAGE
2'2'0" x 2'5-1/2" x 1-3/4" x HMD x HMF x NON-RTD
Opening Remark: 5 PAIRS OF DOORS

Hand	Degree Act InAct
LHR/RHR	90 90

Totals Each Assembly to have:

(20)	4	EA	HINGE	5BB1 4.5 X 4	652	IVE	Act	InAct
(10)	2	EA	ROLLER LATCH	RL38	630	IVE	1	1
(10)	2	EA	FLUSH PULL	H406	32D	SMH	1	1

Heading 75 (HwSet)

1 SGL DOOR(S) 132 CORRIDOR 100-3 TO MULTI-PURPOSE 132
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RH	90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH
(1)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 76 (HwSet)

1 PR DOOR(S) 201 STAIR A 201 FROM CORRIDOR 200
1 PR DOOR(S) 210 STAIR B 210 FROM CORRIDOR 200
1 PR DOOR(S) 301 STAIR A 301 FROM CORRIDOR 300
1 PR DOOR(S) 310 STAIR B 310 FROM CORRIDOR 300
2'3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN
Opening Remark: PAIR OF DOORS, BOTH LEAVES ACTIVE

Hand	Degree Act InAct
LHR/RHR	150 150
LHR/RHR	150 150
LHR/RHR	90 180
LHR/RHR	180 90

Totals Each Assembly to have:

Act	InAct
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Heading 76 (HwSet) Continued.....

							Hand	Degree Act InAct
(24)	6	EA	HINGE	5BB1HW 5 X 4.5	652	IVE	3	3
(4)	1	EA	FIRE RATED REMOVABLE MULLION	42-7-CNI-TR-FR		PLI	1	1
(8)	2	EA	FIRE EXIT HARDWARE	98L-F 4'	626	VON	1	1
(8)	2	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626	SCH	1	1
(8)	2	EA	SURFACE CLOSER	4040XP.RWPA	689	LCN	1	1
(8)	2	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	1	1
(8)	2	EA	MAGNETIC HOLD- OPEN	SEM7850	AL	LCN	1	1

Heading 77 (HwSet)

							Hand	Degree Act InAct
1 SGL	DOOR(S)	202	CORRIDOR 200 TO CLASSROOM 202				RH	90
1 SGL	DOOR(S)	203	CORRIDOR 200 TO CLASSROOM 203				LH	90
1 SGL	DOOR(S)	217	CORRIDOR 200 TO CLASSROOM 217				RH	90
1 SGL	DOOR(S)	218	CORRIDOR 200 TO CLASSROOM 218				LH	90
1 SGL	DOOR(S)	219	CORRIDOR 200 TO CLASSROOM 219				RH	90
1 SGL	DOOR(S)	220	CORRIDOR 200 TO CLASSROOM 220				LH	90
1 SGL	DOOR(S)	302	CORRIDOR 300 TO CLASSROOM 302				RH	90
1 SGL	DOOR(S)	303	CORRIDOR 300 TO CLASSROOM 303				LH	90
1 SGL	DOOR(S)	307	CORRIDOR 300 TO CLASSROOM 307				RH	90
1 SGL	DOOR(S)	308	CORRIDOR 300 TO CLASSROOM 308				LH	90
1 SGL	DOOR(S)	315	CORRIDOR 300 TO CLASSROOM 315				LH	90
1 SGL	DOOR(S)	316	CORRIDOR 300 TO CLASSROOM 316				LH	90
1 SGL	DOOR(S)	317	CORRIDOR 300 TO CLASSROOM 317				RH	90
1 SGL	DOOR(S)	318	CORRIDOR 300 TO CLASSROOM 318				LH	90
1 SGL	DOOR(S)	319	CORRIDOR 300 TO CLASSROOM 319				RH	90
1 SGL	DOOR(S)	320	CORRIDOR 300 TO CLASSROOM 320				LH	90
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD								

Totals Each Assembly to have:

(48)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE		
(16)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH		
(16)	1	EA	OVERHEAD STOP	904S	630	GLY		

Heading 78 (HwSet)

							Hand	Degree Act InAct
1 SGL	DOOR(S)	204	CORRIDOR 200 TO B.F WASHROOM 204				LH	90
1 SGL	DOOR(S)	304	CORRIDOR 300 TO B.F WASHROOM 304				LH	90
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD								

Totals Each Assembly to have:

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Heading 78 (HwSet) Continued.....

						Hand	Degree Act InAct
(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(2)	1	EA	STOREROOM LOCK	ND96PD SPA 50-210, **RESTICTED KEYWAY**	626	SCH	
(2)	1	EA	ELECTRIC STRIKE	CX-ED1079D STANDARD	32D	CAM	
(2)	1	EA	AUTO. OPERATOR	7100 LH	CL	HOR	
(2)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH	
(2)	1	EA	CC WALL STOP	S123	32D	SMH	
(2)	1	EA	AURA W.R. KIT SURF.	CX-WC13XSM	32D	CAM	
(2)	1	EA	EMERGENCY CALL SYS.	CX-WEC10K2 DBL GANG		CAM	
(2)	1	EA	WIRING DIAGRAMS	AS REQUIRED		G87	
(2)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL		HOR	

Heading 79 (HwSet)

1 SGL DOOR(S) 207 CORRIDOR 200 TO LRT 207
 1 SGL DOOR(S) 208 CORRIDOR 200 TO LRT 208
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RH	90
RH	90

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(2)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(2)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 80 (HwSet)

1 SGL DOOR(S) 209 CORRIDOR 200 TO STAFF 209
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RH	90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 81 (HwSet)

1 SGL DOOR(S) 209-1 STAFF 209 TO STAFF WORK RM 209-1

Hand	Degree Act InAct
RH	90

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3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	PASSAGE SET	ND10S SPA	626	SCH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 82 (HwSet)

1 SGL DOOR(S) 209-2 STAFF 209 TO WASHROOM 209-2
 1 SGL DOOR(S) 209-3 STAFF 209 TO WASHROOM 209-3
 1 SGL DOOR(S) 209-4 STAFF 209 TO WASHROOM 209-4
 2'6" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RH	90
LH	90
LH	90

Totals	Each Assembly to have:						
(9)	3	EA	HINGE	5BB1 4.5 X 4	652	IVE	
(3)	1	EA	PRIVACY SET	ND40S SPA OS-OCC	626	SCH	
(3)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Heading 83 (HwSet)

1 SGL DOOR(S) 309 CORRIDOR 300 TO STAFF WORK RM 309
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RH	90

Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	CLASSROOM SEC LOCK	ND78PD SPA IS-CRS 50-210, **RESTRICTED KEYWAY**	626	SCH	
(1)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 84 (HwSet)

1 SGL DOOR(S) 309-1 STAFF WORK RM 309 TO WASHROOM 309-1
 3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LH	90

Totals	Each Assembly to have:						
(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(1)	1	EA	PRIVACY SET	ND40S SPA OS-OCC	626	SCH	
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

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Heading 85 (HwSet)

1 SGL DOOR(S) 211 CORRIDOR 200 TO SERVICE RM 211
1 SGL DOOR(S) 311 CORRIDOR 300 TO SERVICE RM 311
3'2" x 7'0" x 1-3/4" x HMD x HMF x 45MIN

Hand	Degree Act InAct
RH	90
RH	90

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(2)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(2)	1	EA	SURFACE CLOSER	1461.CUSH	689	LCN
(2)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D	SMH

Heading 86 (HwSet)

1 SGL DOOR(S) 212-1 LEARNING COMMONS 212 TO WORK RM 212-1
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LH	90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(1)	1	EA	CC WALL STOP	S123	32D	SMH

Heading 87 (HwSet)

1 SGL DOOR(S) 212-2 LEARNING COMMONS 212 TO STAIR 212-2
3'0" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
LH	90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 4.5 X 4	652	IVE
(1)	1	EA	STOREROOM LOCK	ND80PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH
(1)	1	EA	SURFACE CLOSER	1461.RWPA	689	LCN
(1)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH

Heading 88 (HwSet)

1 SGL DOOR(S) 212A CORRIDOR 200 FROM LEARNING COMMONS 212
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand	Degree Act InAct
RHR	90

Totals Each Assembly to have:

(3)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE
(1)	1	EA	PANIC HARDWARE	CD98L-NL 4'	626	VON

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Heading 88 (HwSet) Continued.....

						Hand	Degree Act InAct
(1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626 SCH	
(	1)	1	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626 SCH	
(	1)	1	EA	SURFACE CLOSER	4040XP.RWPA	689 LCN	
(	1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D SMH	
(	1)	1	EA	CC WALL STOP	S123	32D SMH	

Heading 89 (HwSet)

1 SGL DOOR(S) 212B CORRIDOR 200 FROM LEARNING COMMONS 212
3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
LHR
Degree
Act InAct
90

Totals Each Assembly to have:

(	3)	3	EA	HINGE	5BB1 5 X 4.5	652 IVE	
(	1)	1	EA	PANIC HARDWARE	CD98L-NL 4'	626 VON	
(	1)	1	EA	MORTISE CYLINDER	20-001 1-1/4" XQ11-949, 50-210 **RESTRICTED KEYWAY**	626 SCH	
(	1)	1	EA	RIM CYLINDER	20-021 50-210, **RESTRICTED KEYWAY**	626 SCH	
(	1)	1	EA	ELECTRIC STRIKE	6300	630 VON	
(	1)	1	EA	AUTO. OPERATOR	7100 LHR	CL HOR	
(	1)	1	EA	KICKPLATE	K10A 7" X 36.5" TAPE	32D SMH	
(	1)	1	EA	CC WALL STOP	S123	32D SMH	
(	2)	2	EA	MOUNTING BOX SQR.	CM-43CBL	CAM	
(	2)	2	EA	SQR. ACTUATOR	CM-45/4	32D CAM	
(	1)	1	EA	WIRING DIAGRAMS	AS REQUIRED	G87	
(	1)	1	EA	AUTO OPERATOR INSTALLATION	INSTALL	HOR	

120V, LOW VOLTAGE WIRE, CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.
EXIT DEVICE MUST BE DOGGED FOR THE EXTERIOR ACTUATOR TO OPEN DOOR. INTERIOR
ACTUATOR ALWAYS OPENS DOOR.

Heading 90 (HwSet)

1 SGL DOOR(S) 213 CORRIDOR 200 TO JANITOR 213

1 SGL DOOR(S) 313 CORRIDOR 300 TO JANITOR 313

3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD

Hand
RH
Degree
Act InAct
90
RH
90

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652 IVE	
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Heading 90 (HwSet) Continued.....

						Hand	Degree Act InAct
(2)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(2)	1	EA	CC WALL STOP	S123	32D	SMH	

Heading 91 (HwSet)

						Hand	Degree Act InAct
			1 SGL DOOR(S) 214 CORRIDOR 200 TO STORAGE 214			RH	90
			1 SGL DOOR(S) 314 CORRIDOR 300 TO STORAGE 314			LH	90
			3'2" x 7'0" x 1-3/4" x HMD x HMF x NON-RTD				

Totals Each Assembly to have:

(6)	3	EA	HINGE	5BB1 5 X 4.5	652	IVE	
(2)	1	EA	CLASSROOM LOCK	ND70PD SPA 50-210, **RESTRICTED KEYWAY**	626	SCH	
(2)	1	EA	COMBO FLOOR STOP	S102L	26D	SMH	

Miscellaneous

Qty	UM	Description	Catalog Number		Hand	Fin	Mfgr
10	EA	MASTER KEY	49-268 **RESTRICTED KEYWAY**				SCH
1	EA	KEY CABINET	C-20			689	LUN

End of Schedule

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PART 1 - GENERAL

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|--------------------------------|--|---------------|----------------|---------------|----|------------|---------------|----|-----------------|---------------|----|--------------------|---------------|----|-----------------------------|---------------|----|---------------------------|---------------|----|----------|---------------|----|-------------------------------------|---------------|----|-------------------------------|---------------|-----|---------------|---------------|
| 1.1 General | .1 Division One (01000 series specifications) General requirements, is part of this Section and shall apply as if repeated here. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.2 Description of Work | <p>The work shall consist of the following but not limited to:</p> <p>.1 Hermetically sealed double pane (insulating) glazing units in locations shown on the drawings. Hermetically sealed double pane glass units may include vision panes and/or spandrel panes as indicated on the drawings.</p> <p>.2 Single pane glass (in varying types specified herein) at interior doors, frames, glazing screens etc. (in varying frame types as shown on the drawings). Ensure provision of fire-rated and/or safety glass in areas specified herein, on Architectural drawings and/or on Door, Frame and Glazing Screen Schedules.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.3 Related Work | <table border="0"> <tr><td>.1</td><td>Final Cleaning</td><td>Section 01710</td></tr> <tr><td>.2</td><td>Demolition</td><td>Section 02100</td></tr> <tr><td>.3</td><td>Rough Carpentry</td><td>Section 06101</td></tr> <tr><td>.4</td><td>Finished Carpentry</td><td>Section 06200</td></tr> <tr><td>.5</td><td>Fire Stopping & Smoke Seals</td><td>Section 07270</td></tr> <tr><td>.6</td><td>Aluminum Composite Panels</td><td>Section 07420</td></tr> <tr><td>.7</td><td>Sealants</td><td>Section 07900</td></tr> <tr><td>.8</td><td>Steel Door Frames & Glazing Screens</td><td>Section 08100</td></tr> <tr><td>.9</td><td>Aluminum Curtain Wall & Doors</td><td>Section 08150</td></tr> <tr><td>.10</td><td>Metal Louvres</td><td>Section 10700</td></tr> </table> | .1 | Final Cleaning | Section 01710 | .2 | Demolition | Section 02100 | .3 | Rough Carpentry | Section 06101 | .4 | Finished Carpentry | Section 06200 | .5 | Fire Stopping & Smoke Seals | Section 07270 | .6 | Aluminum Composite Panels | Section 07420 | .7 | Sealants | Section 07900 | .8 | Steel Door Frames & Glazing Screens | Section 08100 | .9 | Aluminum Curtain Wall & Doors | Section 08150 | .10 | Metal Louvres | Section 10700 |
| .1 | Final Cleaning | Section 01710 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .2 | Demolition | Section 02100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .3 | Rough Carpentry | Section 06101 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .4 | Finished Carpentry | Section 06200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .5 | Fire Stopping & Smoke Seals | Section 07270 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .6 | Aluminum Composite Panels | Section 07420 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .7 | Sealants | Section 07900 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .8 | Steel Door Frames & Glazing Screens | Section 08100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .9 | Aluminum Curtain Wall & Doors | Section 08150 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .10 | Metal Louvres | Section 10700 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.4 Dimensions | .1 The Contractor shall carefully check all frames and openings to be glazed in the field to determine all opening sizes; do not cut the glass until dimensions have been site-verified. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 Glass Breakage | .1 The Contractor shall be responsible for all glass broken or unsuitable because of faulty setting or manufacturer's errors or product failure Glass broken by others shall be replaced by the glazing sub-contractor. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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|-------------------------------------|----|--|
| 1.6 Environmental Conditions | .1 | Glaze with compounds, sealants or tapes only when glazing surfaces are at temperatures over 45°F (7.5°C), and when positive that no moisture is accumulating on them from frost, rain, mist, or condensation. |
| 1.7 Glass Design | .1 | This contractor shall be responsible for proper glass thickness, design and type as required by all prevailing Codes and mandated legislations. Report any such discrepancies in glass design, type and thickness immediately to the Architect during tendering. |
| | .2 | Glass types, sizes and locations to be as shown on Architectural drawings and all related door, frame, window and glazing Schedules as applicable. |

PART 2 - PRODUCTS

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|----------------------------|----|--|
| 2.1 Glass Materials | .1 | Polished float glass to CAN2-12.3M and amendments; glazing "A" quality, thickness and tint as indicated. Units to be tempered, laminated where specified or where required by the O.B.C. |
| | .2 | Sealant compound: multicomponent, chemical curing to CAN2-19.24 M80 type 2, class A, black colour. |
| | .3 | Glazing tape for non-rated applications: pre-formed butyl tape, Tremco 440 black colour, 5mm thick x 10mm wide. |
| | .4 | Glazing tape for fire-rated glass: must be PVC, 3mm thick x 12 mm wide |
| | .5 | Setting blocks: neoprene, Shore "A" durometer hardness 80, 75mm long x 2.4mm thick x 5mm high. |
| | .6 | Spacer shims: neoprene, Shore "A" durometer hardness 70, 75mm long x 2.4mm thick x 5mm high. |
| | .7 | Primer-sealers and cleaners: to glass manufacture's standard. |
| | .8 | Low-E solar rejection film shall be as specified, applied to surfaces noted. |

2.2 Fabrication

.1 **GLASS at INTERIOR DOORS and GLAZING SCREENS:****Standard Applications:**

Single pane glass at interior doors, sidelights and glazing screens (denoted on drawings as 'gl.' and/or 'glass') is to be clear 6mm min. thick glass throughout as noted:

- clear tempered impact-resistant glass in all panes below 7'-2" a.f.f
- clear float glass in all panes above 7'-2" a.f.f.

Fire-Rated Applications:

Fire-rated [single pane] glass in doors, sidelights, transoms, glazing screens and related applications (denoted on the Schedule and/or drawings as 'F.R.GL.' and/or 'fire-rated glass') is to be selected by the glazing trade (from the material options below or approved alternate materials) in the appropriate thickness and material type required to accommodate the glass sizes and fire-protection ratings shown on Drawings and/or as indicated on the Schedules. [NOTE: Re-design of the frames and/or reduction of glass unit sizes specified to attain required ratings will not be permitted. -rated and labelled throughout].

All fire-rated glass is to be impact safety-rated throughout without the use of surface-applied films. Impact resistance is to be achieved either by use of tempering or laminating.

Product options include:

- Vetrotech 'Keralite Select Laminated Safety Glass',
fire-rated impact-safety ceramic glass, 8 mm thick as
manufactured by Saint-Gobain; ensure glass is labeled to
minimum fire-rating as indicated on drawings
or
- Pyran 'Platinum L' fire-rated impact-safety ceramic glass,
8 mm thick as manufactured by Schott AG; ensure glass is
labeled to minimum fire-rating as indicated on drawings
or
- Vetrotech 'Contraflam' fire-rated impact-resistant glass
(annealed glass laminated to intumescent inter-layers) as
manufactured by Saint-Gobain;
ensure glass is labeled to minimum fire-rating as indicated
on drawings

Fire-rated glass material selection is to be determined by the Glazing Trade from the noted options [or from approved alternates] and is to be suited to the required fire-protection rating level (and to and the glazing sizes) shown on the Drawings and related Schedules. Select glass type to ensure that the finished door

assembly (with related door, sidelights, and transoms) and/or the assembled glazing screen (as applicable) can be certified (labeled) to the specified fire-protection rating according to recognized Canadian Testing authorities/agencies having jurisdiction.

Note that acceptable glass options include materials that provide both fire-protection and impact safety without the use of surface-applied films. Non-impact resistant fire-rated glass products will not be accepted.

Ensure that all installed panes of impact-protection fire-rated glass are duly labeled (with a permanent etching) to provide Manufacturer's Name, Product Name, UL or ULC mark, indication of fire-resistance rating/duration in minutes and/or any alternate information required by Code.

.2 VISION PANE (VP) INSULATED GLAZING @ EXTERIOR WINDOWS, CURTAIN WALL & DOORS:

Vision panes of insulating/hermetic glazing is to be used in:

- all fixed sash
- all casement window operable sash

components of exterior windows, doors and glazing screens

Insulated Glazing/Hermetic glass units are to be supplied by Oldcastle Building Envelope, Trulite, Saand or approved alternate.

Insulated Glazing units are to be 25.4 mm thick Double-Glazed **Hermetically Sealed Units consisting of:**

- *Exterior Sheet:*
6 mm Vitro Glass/PPG 'Solargray' tinted glass, with PPG Solarban 60 film on surface 2

or

6 mm Guardian 'Gray Float' tinted glass, tempered, with Sunguard 'SN 68' film on surface 2
- *Vacuum Space:*
1/2" argon-gas space (90% argon, 10% air) with 'Technoform I-Spacer' in colour black
- *Interior Sheet:*
6 mm clear glass, tempered

.3 OBSCURED GLASS (OG) INSULATED GLAZING @ EXTERIOR WINDOWS [IN WASHROOMS ONLY]:

Obscured glass (for use in washroom windows) is to be 25.4 mm thick Double-Glazed Hermetically Sealed, Insulated Unit consisting of:

- *Exterior Sheet:*
6 mm Vitro Glass/PPG 'Solargray' tinted glass, with PPG Solarban 60 film on surface 2

or

6 mm Guardian 'Gray Float' tinted glass, tempered, with
Sunguard 'SN 68' film on surface 2

- *Vacuum Space:*
1/2" argon-gas space (90% argon, 10% air) with 'Technoform
I-Spacer' in colour black
- *Interior Sheet:*
6mm clear 'raindrop' obscured glass, tempered

PART 3 - EXECUTION

- | | |
|---|---|
| 3.1 Examination | <p>.1 All wood and steel shall be properly primed by others before glazing, and primer must be hard and dry. All openings must be free from moisture, frost, rust, dirt, plaster, cement, oil or grease.</p> <p>.2 The Glazing sub-contractor shall examine all openings to be glazed and shall report any conditions which may affect the work of this trade before commencing. Commencement of work will be construed as an acceptance of existing conditions.</p> |
| 3.2 Installation of Interior Glazing | <p>.1 Remove protective coatings and clean contact surfaces with Interior solvent and wipe dry. Apply primer-sealer to contact surfaces.</p> <p>.2 Glazing compound shall be neatly run in straight line paralleled with glazing rebate. Corners shall be carefully made.</p> <p>.3 All glass shall be back and face bedded in glazing compound with 3mm (1/8") clearance on all sides. Glass shall be set on setting blocks as required, with equal bearing on the entire width of plane. Convex side of glass shall be on exterior.</p> <p>.4 Insert spacer shims to centre glass in space. Place shims at 100mm o.c. Keep 6mm below sight line.</p> <p>.5 Install removable stops, without displacing tape or sealant.</p> <p>.6 Apply cap bead of sealant, at exterior void, in a uniform and Level line, flush with sight line, tooled or wiped with solvent to smooth appearance.</p> |
| 3.3 Thermal Glazing Installation | <p>.1 Accurately measure glass openings and calculate glass size based on manufacturer's installation tables allowing for proper edge engagement, rabbet width, rabbet depth, tolerances for expansion and contraction etc.</p> <p>.2 Before glazing, verify openings to see that they are square, plumb, and in true planes. If found otherwise, do not proceed with glazing until proper corrections are made.</p> |

- .3 Set hermetically sealed insulated glass units on setting blocks placed at $\frac{1}{4}$ points from each corner of glass.
- .4 Dry glaze by means of EPDM gaskets on interior and preformed glazing tape with built-in shim on exterior.

3.4 Cleaning

- .1 Immediately remove all excess sealant and compound and droppings from finished surfaces.
- .2 Clean all glass prior to handover to Owner, ensuring it is clear of surface soiling and debris of any sort.

END OF SECTION 08800

PART 1 - GENERAL

1.1	Description of Work	The general scope of work shall include, but not be limited to the following:		
		.1 All gypsum wall board, cement board, steel studwork, steel furring and framing etc. throughout the building interior and exterior.		
		.2 Supply and installation of all sound and fire-resistant batt insulation materials at interior building assemblies.		
1.2	Related Work	.1	Steel Doors and Frames	Section 08100
		.2	Mechanical	Section 15000
		.3	Cement Plaster	Section 09201
		.4	Finish Carpentry	Section 06200
		.5	Acoustical Ceilings	Section 09130
		.6	Painting & Decorating	Section 09900
		.7	Structural Steel Stud	Section 09110
1.3	Product Handling	.1	Store product in protected dry areas. Store gypsum board laying flat in piles with edges protected.	
		.2	Ensure that metal members are not bent, dented, or otherwise deformed.	
		.3	Deliver products supplied under the work of this Section only to those who are responsible for installation, to the place they direct, and to meet installation schedules.	
1.4	Environmental Conditions	.1	Install work only in areas closed and protected against weather, and maintained between 10 degrees C and 21 degrees C. In cold weather ensure that heat is introduced in sufficient time, before work commences, to bring surrounding materials up to these temperatures; and maintained until materials installed by this Section have cured.	
1.4	Environmental Conditions	.2	Provide adequate ventilation to carry off excess moisture during curing of joint compound and textured finishes.	

PART 2 - PRODUCTS**2.1 Materials**

- .1 All materials to be supplied by Canadian Gypsum Company, Domtar or approved alternates.
- .2 Steel stud framing: to ASTM C645 formed from minimum 0.5mm (25 ga.) thickness hot-dipped galvanized steel sheet, meeting ASTM A525 and A568, for screw attachment of gypsum board. Knockout service holes at 450mm minimum o.c. Stud size to be as noted on the drawings.

Steel gauge of studs to be as noted above only as a minimum, and shall be increased in gauge as required to suit job requirements. Select stud gauge to related wall heights utilizing one single stud for height of wall. Select stud gauge for bulkheads respective to length of bulkhead and any anchoring loads to be accommodated by the studs from glazing screens, doors and similar items.
- .3 Furring Channel: ASTM C645, 1.5mm (16 ga.) 32 x 22 mm (1 1/4" x 7/8") galvanized metal.
- .4 Corner bead: galvanized metal 32 mm (1 1/4") flange.
- .5 Edge trim: "J" or "L" profile galvanized metal, minimum 22 mm (7/8") flange.
- .6 Runner channels: meeting ASTM A525 and A568; 1.2 mm (18 ga.), 38 mm x 19 mm (1 1/2" x 3/4") galvanized metal.
- .7 Hanger wire: galvanized 4 mm (8 ga.).
- .8 Tie Wire: galvanized 1.2 mm (18 ga.)

Fasteners Type S Bugle head or as otherwise required, in lengths to suit application.
- .9 **General-Use Gypsum Wall Board (GWB):**

Gypsum board on Interior Walls above 8'-0" (2440 mm) above finished floor:

Product to be 15.9 mm (5/8") thick standard paper-faced gypsum board Type 'X' fire rated; 1200 mm (4') width sheets in lengths to suit tapered edges and square cut meeting CSA A82-27-M.

Gypsum Board on Interior Ceilings and Bulkheads: use 5/8" thick gwb generally throughout with Type 'X' fire-rating (unless noted otherwise on drawings); where drawings specifically note 1/2" thick board on horizontal ceiling surfaces, ensure use of sag-resistant 'ceiling board' throughout.

.10 Abuse-Resistant Gypsum Wall Board (GWB):**GWB on Interior Walls below 8'-0" (2440 mm) above finished floor:**

Product to be 5/8" thick Georgia-Pacific 'Dens Armor Plus Abuse Resistant Interior Panels' with moisture-resistant core faced in coated fibre-glass matts. Product inherently meets type X fire-rating requirements. Board widths to be 4'-0" x longest practical lengths to suit.

.11 Joint tape: perforated paper; 50 mm (2") width.

.12 Joint filler compound: to ASTM C474.67, ready-to-use; all purposed, for base coats, special topping grade for final coat.

.13 Vapour Barrier 0.25 mm (6 mil) polyethylene sheet.

.14 VOC content of all adhesives and sealants used shall be as per limits specified in Section 01359.

.15 Sound and/or Fire-Resistance Batt Insulation:

Fire-resistance insulation is to be supplied thicknesses no less than that required to achieve noted fire-resistance ratings according to related CAN/ULC assembly types.

All sound insulation is to be supplied in thicknesses fully filling the depth of related wall assembly.

Sound and Fire-Resistance Batt Insulation is to be Rockwool AFB throughout, supplied and installed in full accordance with the manufacturer's recommendations for the intended application.

PART 3 - EXECUTION**3.1 Examination**

.1 The installing sub-contractor shall examine all ceilings and wall surfaces to which his work is attached; report to the Contractor, in writing, any defects of work prepared by other trades and unsatisfactory site conditions.

.2 Before work of this Section commences ensure that services have been installed, tested, and approved by relevant jurisdictional authorities, that conduit, pipes, cables, and outlet are plugged, capped, or covered; and that fastenings and supports installed by others are in place. Do not permit work of others to touch the back of wallboard.

3.2 Installation

- .1 Framing and furring shown on Drawings is indicative but do not regard it as exact or complete. Construct work to provide adequate strength to withstand stresses imposed by use and application conditions without distortion. Maintain dimensions indicated on Drawings, and execute work in accordance with regulations governing fire rated assemblies and separations.
Ensure that all gwb panels/panel types are installed and finished in full accordance with panel manufacturer's recommendations, notwithstanding notations to the contrary herein. Use all manufacturer recommended fasteners, joint tapes, joint compounds, application products and installation techniques suited to the intended application.
- .2 Erect supporting and finish materials to dimensions indicated on Drawings; plumb, level, straight, and square to adjoining elements. Install work within 3 mm (1/8") of dimensioned location unless otherwise approved, flat to a tolerance of 1:1000 (1/8" in 10.0") overall and 1.5 mm (1/16") maximum in any 300 mm (1.0").
- .3 Do not support the work of this Section from, nor make attachment to: ducts, pipes, conduit, or the support framing of the work of other sections.
- .4 Do not apply gypsum board in close proximity to hot pipes or heating ducts.
- .5 Install materials with the minimum of joints. Tightly butt joints, without force, and neatly align them.
- .6 Provide clearances required at mechanical and electrical services, such as grilles, diffusers, access panel, and lighting fixtures only after verification of requirements in each case.
- .7 Provide freedom for deflection under beams and structural slabs.
- .8 Do not use or install metal framing, trim, or accessories which have bent or otherwise deformed.

**3.3 Installation:
Steel studs and
Wall Furring**

- .1 Install steel stud and wall furring as specified and/or as otherwise required for fire rated separations or protection.
- .2 Align partition tracks plumb and level at ceiling or bulkheads as shown on the drawings, secure at 600 mm oc (2'-0") maximum.
- .3 Place studs in tracks vertically at 400 mm (16") oc and not more than 50 mm (2") from abutting walls, and at each side of openings. Cross brace steel studs or add horizontal stiffeners as required to provide rigid installation to manufacturer's instructions.

- .4 Attach studs to bottom and ceiling track using screws. No crimping allowed.
 - .5 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
 - .6 Coordinated erection of studs with installation of doors and special supports or anchorage for work specified in other Sections.
 - .7 Erect studs for fascia in similar manner.
 - .8 Install wall furring for gypsum board wall finished at 400 mm (16") oc; install furring for other material as indicated nest channels 200 mm (8") at splices.
 - .9 Furr duct shafts, beams, columns, pipes and exposed serviced where indicated. Provide access doors at clean outs and fire dampers.
- 3.4 Installation:
Gypsum Bd.
Ceiling Framing**
- .1 Erect hangers, runner and furring channels for suspended gypsum board ceiling as specified or as otherwise required to provide fire rated ceilings separation or protection.
 - .2 Anchor hangers to structure.
 - .3 Space hangers for runner channels to suite structure, to support ceiling load, at a maximum distance of 1,200 mm o.c., and at no greater distance than 150 mm (6") from ends of runner channel. Bend rod hangers securely in place with saddle ties.
 - .4 Install runner channels at 1200 mm (4'-0") o.c., generally, and at no greater distance than 150 mm (6") from terminations of supported cross furring members or adjacent walls. Provide 25 mm (1") clearance between runners and abutting walls and partitions.
 - .5 Splice runner channels by lapping at least 300 mm (12") with interlocking flanges, and wired at each end with two loops. Splice only where unavoidable. Do not bunch or line up spliced.
 - .6 Install cross furring at 600 mm (24") oc, no closer than 25 mm (1") and at no greater distance than 150 mm (6"), from walls, openings, breaks in continuity of ceiling, and changes of direction. Space furring in all cases to suite incorporated services, and so as to avoid contact with perimeter walls, span furring channels no greater than 1200 mm (4'-0"); use metal studs for greater spans as approved by Architect.

- .7 Secure cross furring to supports with double loops of tie wire or approved equivalent attachment. Splice by nesting and tying together within 200 mm (8") overlap.
 - .8 Frame perimeter of openings for access panels, light fixtures, diffusers, grilles, etc. with furring channels to maintain integrity of framing.
 - .9 Furr for gypsum board faced vertical bulkheads within or at termination of ceilings.
 - .10 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
 - .11 Erect entire hanger and suspension system to adequately support the ceiling assembly, including services incorporated, with a maximum deflection of 1/360 in the span of each component member, and free from horizontal movement. Install work level to tolerance of 1:1200 (1/8" in 12'-6").
- 3.5 Installation:
Gypsum Board Panels**
- .1 Install gypsum board wall and ceiling finishes in gypsum panel type and thicknesses indicated and/or as otherwise required to provide required fire-rated separations, ratings or protection.
 - .2 Apply wallboard with long dimension perpendicular to supports. Back all joints with framing member.
 - .3 Install wallboard in maximum lengths and widths to minimize joints, and never in lengths of under 1800 mm (6'-0").
Stagger end joints where they are unavoidable. Locate joints in soffits where least prominently discerned.
 - .4 Form neat joints at mill ends and at field cut edges of wallboard panels. Cut paper on face with a knife. Smooth by sanding and rubbing edges together.
 - .5 Fasten wallboard to metal support members by sheet metal screws no closer than 9 mm (3/8") to, and no farther than 12.5 mm (1/2") from, centre of joints, and at 300 mm (12") maximum oc at edges and on intermediate supports. Where two layers of wallboard are used, screw outer layer through inner to metal framing.
 - .6 Finish all exposed edges of wall board panels, or where gypsum board butts against a surface having no trim concealing its juncture, with appropriate metal trim, Erect plumb or level with minimum joints. Where trim abuts block or brick walls, the joint shall be carefully caulked to overcome irregularities in the masonry wall.

- .7 At external corners install corner beads secure through wallboard, to framing at 150 mm (6") oc on alternate flanges.
 - .8 Ensure that all gwb reveals are installed level and true throughout and are compounded in place, flush with surrounding gwb faces. Ensure that joints between adjacent reveals are seamed imperceptibly.
- 3.6 Taping and Filling**
- .1 Fill joints between boards, at edge trim and corner beads, **and** all screw holes and depressions on wallboard surfaces exposed to view to provide smooth seamless surfaces and square neat corners. Use jointing compounds and reinforcing tapes in conformance with manufacturer's specifications. Ensure that wall board is tight against framing members, fasteners are properly depressed, and adhesives have sufficiently cured.
 - .2 Fill at joints by three-coat method:
 - (a) Embed reinforcing tape in a cover of joint filler.
 - (b) Apply level coat of joint filler when cover coat has dried.
 - (c) Apply skim coat of topping cement when level coat has dried.
 - .3 At beveled joints: apply cover coat 178 mm (7") wide, level coat 254 mm (10") wide, and skim coat 300 mm (12") wide.
 - .4 At end joints, and butt joints formed at cut edges of wallboard: apply cover coat 356 mm (14") wide level coat 508 mm (20") wide, and skim coat 600 mm (24") wide. Camber treatment over end joints to 0080 mm (1/32") thick.
 - .5 At Internal Corners: first fill gaps between boards with joint filler. Embed creased reinforcing tape in a thin coat of joint filler applied 52 mm (2") wide at each side of corner. Apply cover coat as specified for beveled joints. Apply skim coat (as specified for beveled joints) to just one side of joint, and when dry apply skim coat to other side.
 - .6 At External Corners: fill to nose of corner bead with joint filler and topping cement as specified for beveled joints.
 - .7 At edge trim: as specified for beveled joints.
 - .8 At screws and heads: fill holes and depressions with a two coat application of joint filler so as to be invisible after painting is complete.
 - .9 At control joints: as specified for beveled joints both sides. Do not fill control joint.

- .10 Feather edges of compounds into surfaces of wallboards After skim coat has dried for at least 24 hours sand lightly to leave smooth for decoration. Do not sand paper face of wallboard.
 - .11 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.
 - .12 Cement Board Finishing: wherever cement board is used as a ceiling finish, supply and install fiberglass mesh and cementitious plaster skim coat(s) as required to provide a smooth consistent surface, suitable for painting and resistant to moisture and vapour from showers, cooking equipment and/or any other fixtures, equipment items etc.
- 3.7 Patching and Cleaning**
- .1 Remove droppings and excess joint compound from work before it sets.
 - .2 Vacuum clean working areas at the end of each day to reduce traffic of gypsum dust through other areas.
 - .3 Make good to cut-outs for services and other work. Fill in defective joints, holes and other depression with joint compound; ensure that surfaces are smooth, evenly textured and within specified tolerances to receive finish treatments.
 - .4 Clean off beads, casings and other metal trim, and leave all surfaces ready for specified finishes.
- 3.8 Protection**
- .1 Provide adequate protection of materials and work of this section from damage by weather and other causes. Protect other work from damage resulting from work of this section.
 - .2 Any damage caused to work of this section shall be repaired by this section at this sections expense to the satisfaction of the Architect.

END OF SECTION 09111

PART 1 - GENERAL

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|--|--|--|---------------|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | | |
| 1.2 Description of Work | Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to the supply and installation of: | | |
| | .1 | Lay-in acoustical ceiling panels and metal suspension grid systems for SAT ceiling assemblies as indicated on the Drawings and schedules. | |
| | .2 | Specialty ceiling features (factory-fabricated) including 'clouds, vaults etc.' specified herein and as shown on the Architectural drawings. | |
| | .3 | Supply and installation of airline cable suspension system for millwork bulkhead above Library discharge desk. | |
| 1.3 Related Work | .1 | Structural Masonry/Brick Masonry | Section 04220 |
| | .2 | Metal Stud and Gypsum Board | Section 09111 |
| | .3 | Hanging Sleeping Curtains | Section 10991 |
| | .4 | Mechanical Fixtures | Section 15000 |
| | .5 | Electrical Fixtures | Section 16000 |
| 1.4 Requirements of Regulatory Agencies | .1 | Install ceilings that serve as fire protective membranes exactly as specified in Underwriter's Laboratories text design specifications. Verify, before installation of ceiling, that work specified in other Sections, as a part of the entire assembly, is installed to meet validating specification for a ceiling-floor or a ceiling roof assembly. | |
| | .2 | Materials supplied shall carry marks identifying them as U.L.C. approved for the particular use and assembly. | |
| 1.5 Submittals | .1 | Samples: Submit samples of each specified acoustical board, suspension components, and exposed grid material. Items to be approved by the Architect prior to product ordering. | |
| | .2 | Affidavits: Submit to Architect two (2) copies of affidavits in accordance with Section 01300 to verify that ceiling meets fire | |

protective requirements.

- .3 Extra Stock: Provide two sealed cartons of each specified acoustical ceilings for Owner's use. Deliver to Owner as directed.

1.6 Product Handling

- .1 Deliver all products in fully sealed packages.
- .2 Store all materials in a protected dry area.
- .3 Ensure that pre-finished metal members are not bent, dented, or otherwise deformed or blemished.
- .4 Deliver products supplied under the work of this Section to those who are responsible for installation, to the place they direct, and to meet installation schedule.

1.7 Environmental Conditions

- .1 Install work only in areas closed and protected against weather, and maintained at no less than 10 degrees C. (50 degrees F.)
- .2 Do not install work in any area unless satisfied that work in place has dried out, and that no further installation of damp materials is contemplated.

PART 2 - PRODUCTS

2.1 Materials

- .1 Materials shall be supplied with all means of fastening and suspension components as recommended by the manufacturer for the particular type of installation, and to include all system components for a completed assembly, conforming to the requirements of the U.L.C.-tested assembly where a fire-rated ceilings are required.

- .2 **SUSPENDED ACOUSTIC TILE CEILINGS (SAT-#):**

Acoustical tile ceiling panels and suspension systems as illustrated on Reflected Ceiling Plans and Architectural drawings to be as noted below.

SAT #1 (Standard SAT):

24" x 48" x 5/8" Rockfon "Origin 70" Square Lay-In tiles #51101 (LRV = 0.76, NRC = 0.70) in Rockfon 15/16" SQ Square Tee System, all in white factory finish.

SAT #2 (High Acoustic SAT):

24" x 48" x 1" Rockfon "Education Premium" square tegular tiles #43301 (LRV = 0.84, NRC = 0.90) in Rockfon 15/16" SL Tegular Tee System, all in white factory finish.

.3 SUSPENDED ACOUSTIC CLOUDS (SAC-#):

Suspended Acoustic Cloud sizes, quantities and locations as shown on Architectural Drawings throughout. Cloud types are to be as noted below.

All cloud and cloud-related products are to be as manufactured by Armstrong. In all circumstances, clouds are intended to be supplied complete with all related carrying channels, trims, splicers, connectors, suspension components and related accessories required for a finished installation.

All suspended clouds are to be supplied by the manufacturer as a 'kit' customized to overall sizes shown on Architectural drawings. Kits are to be supplied complete with all related system components, factory cut to required finish sizes.

Suspended Acoustic Clouds to be as follows:

SAC-1:

Location: Entrance Vestibule 100-1

Size: 8 ft. x 12 ft. (total tile area less perimeter)

Product: Formations Rectangular Cloud

Tile: 24" x 24" x 5/8" Metalworks Square Tegular tile #6456-M2-FXOK in colour 'Effects Oak FXOK' with 'M2 Microperforation' pattern; product to be supplied with #8200100 optional fibreglass infill throughout, with NRC = 0.90

Grid: Suprafine XL 9/16" suspension system in colour 'Platinum PL'

Perimeter: Axiom Knife Edge for Formations in colour 'Platinum PL'; approx. width = 6 3/16"

Note: supply 'StrongBack' mounting system with *airline cable suspension components* set 2'-0" back from outside perimeter of clouds throughout

SAC-2:

Location: Foyer 100-2

Size: 16 ft. x 22 ft. (total tile area less perimeter)

Product: Formations Rectangular Cloud

Tile: 24" x 24" x 5/8" Metalworks Square Tegular tile #6456-M2-FXOK in colour 'Effects Oak FXOK' with 'M2 Microperforation' pattern; product to be supplied with #8200100 optional fibreglass infill throughout, with NRC = 0.90

Grid: Suprafine XL 9/16" suspension system in colour 'Platinum PL'

Perimeter: Axiom Knife Edge for Formations in colour 'Platinum PL'; approx. width = 6 3/16"

Note: supply 'StrongBack' mounting system with *airline cable suspension components* set 2'-0" back from outside perimeter of clouds throughout

- .3 Accessories: Miscellaneous clips, splicers, connectors, screws, and other standard accessories shall be steel, zinc coated or cadmium plated, strength and design compatible with suspension methods and system specified.
- .4 Hangers: Galvanized annealed steel wire: 2.5mm diameter (#12 ga.) to support a maximum weight of 68 kg/hanger (150 lbs.)
- .5 Inserts and Hanger Connections: Steel; galvanized after forming; suitable for structure and ceiling conditions, and loading; and approved by Architect before work commences.

PART 3 - EXECUTION

3.1 Cooperation

- .1 The contractor shall cooperate with all other trades concerned to ensure a satisfactory installation. This contractor shall furnish the electrical trade all necessary information so that their lights and fixtures will conform to the centres and joining of the tiles and panels.

3.2 Scaffolding

- .1 The contractor shall provide all necessary scaffolding required for the proper execution of the wall and ceiling finishes. Scaffolding shall be erected to interfere as little as possible with the work of the other trades and shall be removed immediately on completion of the work of this section.

3.3 Examination

- .1 Ensure that environmental conditions and work preceding this Section are satisfactory and will permit compliance with the quality and dimension required of this work.
- .2 Verify that work performed under other Sections as a part of an Underwriter Specification for a fire rated protective assembly has been done in accordance with that Specification.

3.4 Installation

- .1 Install grid system ceilings as specified by the manufacturer of the system. Ensure that methods of installation used are acceptable to the manufacturer of each system component and in

conformance with requirements of U.L.C. rated assemblies where required.

- .2 Coordinate work of this Section with that of other Sections. Ensure that adequate preparation is made for attachment of hangers and fasteners. Do not use through the-roof hangers. Provide for carrying and integration of flush-mounted and recessed services components only after consultation and verification of methods and locations with those performing the work of Sections 15000 and 16000.
- .3 Space hangers for supporting grid generally at 1200mm (48") nominal centres each way, to suit structure and ceiling system. Secure wire hangers to framing by bending sharply upward and wrapping securely with three turns. Install hangers free of kinks, provide extra hangers for each corner of lighting fixtures, and reinforce other ceiling equipment with hangers. Secure hangers to structure by a permanent method as approved by Architect.
- .4 Install the entire hanger and suspension grid to adequately support the ceiling assembly, including services incorporated, with a maximum deflection of $1/360$ of the span of each component member, and free from horizontal movement. Provide intermediate support channels as and when required between structural building components securely wired thereto. Install hangers at no more than 5 degrees off vertical.
- .5 Frame and trim all openings as required for recessed lighting fixtures, diffusers, grilles and openings.
- .6 Lay out work in accordance with Drawings to provide even spacing in each area, with grid lines symmetrical about room axes, columns and service dimensions on opposite sides of areas. Work shall include suitable moldings as required where ceilings abut walls or other vertical surfaces
- .7 Maintain true surface planes, and component and joint lines throughout each area.
- .8 Butt joints between components tightly together.
- .9 Do not install tile/panel units with exposed edges either broken or marred.
- .10 Brace system to maintain alignment of grid.
- .11 Adapt installation to provide for access to ceiling where required for services.
- .12 Mark access panels in an unobtrusive manner.

- .13 Work shall include expansion joints in ceiling where required or indicated.
- 3.5 Tolerances**
 - .1 Install ceilings within a variation of +/- 5 mm (3/16") of dimensioned height above floor unless approved otherwise by Architect, and level within a maximum tolerance of 1 mm in 1000 mm (1/8" in 10'-0").
- 3.6 Cleaning**
 - .1 Clean soiled or discoloured surfaces of exposed work on completion of work.
 - .2 Replace components which are visibly damaged, marred, or uncleanable.
 - .3 Final cleaning is specified in Section 01700.
- 3.7 Repair**
 - .1 Repair any fire protection removed or damaged by work in this Section in accordance with Section 07812.

END OF SECTION 09130

PART 1 - GENERAL

- A. The scope of work covered herein includes acoustic wood slat wall panels **[AWP]** as shown on Architectural Drawings.
- B. The General Conditions and the requirements of Division 1 of the specifications shall apply to all work hereunder.
- C. All work shall be performed in accordance with the manufacturer's instructions, and in a manner satisfactory to the Architect.

1.01 SCOPE

- A. The specified product manufacturers shall furnish all acoustic panel products and assemblies necessary to complete installation by the contractor, in accordance with plans and specifications, including manufacturer-supplied hanging clips/cleats at the back of the panels and related accessories.

1.02 QUALITY ASSURANCE

- A. Installer Qualifications: The installer shall be a firm with a minimum of two (2) years of successful experience in installation of products with similar requirements to this project. The installer shall be acceptable to the architect, manufacturer, and owner's representative.
- B. Fire Performance Characteristics: When specified as "Fire Resistant", the Acoustical Wall Panel types noted herein shall conform to Class 1, or A flame spread rating, when tested according to ASTM E-84. Clear intumescent treatment to the specified panels shall be applied to meet fire-resistance ratings required and/or specified.

1.04 PROJECT CONDITIONS

- A. Installation shall be done only when the temperature and humidity closely approximate the interior conditions that will exist when the building is occupied. The heating and cooling systems shall be operating before, during, and after installation, with the humidity of the interior spaces maintained between 25% and 55%, temperature between 60 to 90 degrees F.
- B. It is important that area have proper ventilation, especially in high moisture areas. There shall be no excessive build up of heat in the space.
- C. Prior to the start of installation, all exterior windows and doors are to be in place, glazed, and weather-stripped. The roof is to be watertight, and all wet trades' work is to be completed, and thoroughly dry.

- D. Mechanical, electrical, and other utility service installations behind the wall plane shall have been completed. No materials should rest or wrap around, the wall suspension components.

1.05 COORDINATION OF WORK

- A. The layout and installation of all Acoustical Panels shall be coordinated with other work penetrating the finished panels including all trades and divisions related to the wall assembly, wall finishing, integration of mechanical and electrical items etc., and all related construction considerations in the subject areas.

1.06 SUBMITTALS

- A. Product Data: Panel manufacturer shall provide product specifications and installation instructions for all items being supplied as a part of this division.
- B. Shop Drawings: Panel manufacturer shall supply shop drawings showing Acoustic Wall Panel sizes and locations, and other details deemed pertinent to proper installation. Shop drawings are to be submitted to the Architect for review and approval prior to production.
- C. Samples: A 12" (305mm) wide x 12" (305mm) long sample, with specified finish applied, shall be submitted to the Architect for approval prior to production for each wall panel type and stain/finish selection.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Acoustical Wall Panel assemblies shall be delivered to the project site in original, unopened packages.
- B. Acoustical Wall Panels shall be stored in a fully enclosed space. For a minimum of seventy-two (72) hours immediately prior to installation, the Acoustic Wall Panels shall be stored in the room in which they will be installed to adequately acclimate to environmental conditions. The temperature and humidity of the room shall closely approximate those conditions that will exist when the building is occupied. All Acoustic Wall Panels shall be stored off the floor and in locations not exposed to water infiltration of any sort.
- C. Care in handling must be exercised to avoid damage to any panel surfaces.

1.08 WARRANTIES

- A. Manufacturer' Warranty: All materials supplied by the Wall Panel manufacturer shall be guaranteed against manufacturing defects for one (1) year. Because of differing site conditions, wood stains and colorings can vary with age, and are excluded from this warranty.
- B. Contractor's Warranty: All work shall be guaranteed for one (1) year from final acceptance of completed work.

PART 2 - PRODUCT**2.01 ACOUSTIC PANELS****A. Acoustic Wall Panels [AWP] :**

AWP to be:

- **Ranura R6-54** slatted acoustic wall panels as supplied and manufactured by Accent Digital; specifications to be:
 - panel size: $\frac{3}{4}$ " thick x 23 $\frac{5}{8}$ " wide x 96" or 120" long [chose length as required to optimize yield for the intended application]; slats run along the long panel dimension throughout; panels to be cut to suit field requirements and are to be installed in the orientations shown on the architectural drawings
 - finish: slat faces to be white oak with clear topcoat; reveals between slat faces to be standard MDF colour [unpainted]
 - flame spread ratings: AWP in Vestibule 100-1 and Foyer 100-2 to have Class A flame spread rating of <25 (ASTM E84)

All AWP panels on walls are to be installed vertically throughout, in the areas and runs as shown on the drawings. Panels are intended to be borderless and are to be installed without perimeter edging trims [unless noted otherwise].

All AWP panels are to be supplied complete with manufacturer-supplied and/or manufacturer recommended/related accessories required to provide a complete and finished installation as noted herein.

2.02 PANEL INSTALLATION MATERIALS:

- A. AWP products shall be installed with manufacturer-recommended 'glue and finish nail' installation method, including use of manufacturer-supplied mechanical narrow-head anchoring screws in reveals between slats. Mechanical anchoring is required for temporary support until construction adhesive [at backside of panel] is set and cured. Panels are to be adhered with construction adhesive [LePage PL-Premium or alternate fast-set product] with coverage rates recommended by the manufacturer. All anchoring screws are to be touched up with black paint [following installation] to blend with reveals throughout.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Wall Layout: Prior to manufacture, field dimensions shall be taken as required to verify sizes of the panels relative to site conditions and design intent as shown on the Architectural drawings. The contractor shall measure applicable areas prior to installation to confirm application and location of Panel supports, in accordance with installation instructions.

- B. Coordination: The contractor shall coordinate with other trades the location of devices which will penetrate the Wall Panels or interfere with the installation. Recessed or surface devices located within the wall panels are to be located and cut in the field.

3.02 INSTALLATION

- A. General: The contractor shall install materials in accordance with product manufacturer's printed instructions and the intent shown on the architect's drawings. The installation shall comply with applicable regulations and industry standards.
- B. All items are to be installed flush with walls and related substates. Panels are to be installed level and plumb throughout. Ensure that alignments and joints between panels are consistent and true, free from dimensional deviations and irregular gapping.
- C. All panels shall be securely anchored to wall assemblies by means of construction adhesive and mechanical fasteners as recommended by product manufacturer for the intended application.

3.03 ADJUSTMENT, CLEANING, AND REPAIR

- A. The contractor shall make final adjustments as directed by the Architect for work not in conformance to requirements.
- B. Upon completion of installation, all Acoustic Wall Panels shall be cleaned free of dirt, dust, grease, oils, and fingerprints.
- C. Ensure that all field-cut items are touched-up with manufacturer supplied products to ensure continuity of factory-applied finishes.
- C. All work which cannot be successfully cleaned or repaired (free of visible irregularities) shall be removed and replaced.

3.04 INSPECTION

- A. Upon completion of installation, the Architect shall inspect all finished surfaces to ensure that work has been performed in a manner satisfactory to the owner. Any deficiencies in the installed Wall Panels shall be corrected by the contractor at no additional cost to the Building Owner, his representatives or to the panel manufacturer.

END of SECTION

PART 1 - GENERAL

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|-----|---------------------|---|---|
| 1.1 | General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | |
| 1.2 | Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to the supply and install of the following:</p> <p>.1 Porcelain and ceramic tile finishes on floors and/or walls and at all other locations noted on drawings.</p> <p>.2 Porcelain tile base as specified herein.</p> | |
| 1.3 | Related Work | <p>.1 Cast-in-Place Concrete</p> <p>.2 Resilient Flooring</p> <p>.3 Masonry</p> <p>.4 Steel Stud and Gypsum Board</p> <p>.5 Architectural Millwork</p> <p>.6 Carpeting</p> | <p>Section 03300</p> <p>Section 09660</p> <p>Section 04220</p> <p>Section 09111</p> <p>Section 06400</p> <p>Section 09680</p> |
| 1.4 | Samples | <p>.1 Submit at least 2 units of each tile, selected at random from stock, and typical base and corner accessories in accordance with Section 01340. All tile samples s are to be submitted to the Architect for approval prior to ordering.</p> <p>.2 Submit manufacturer's maintenance instructions in accordance with Section 01340.</p> <p>.3 Provide min. 10% of the quantity of each specified material, at least one each of base corner accessories; deliver extra stock in a sealed labeled package to owner at their direction.</p> | |

PART 2 - PRODUCTS

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|-----|-----------|----|--|
| 2.1 | Materials | .1 | <p><u>PORCELAIN TILE # [PT-#]:</u></p> <p>Porcelain wall tile is to be as noted below, in the locations, orientations and layout patterns as shown on the drawings:</p> <p>PT-1: 12" x 24" x 9.0mm PORTOBELLO LAB SERIES PORCELAIN TILE IN COLOUR 'ASH NATURAL #900059E' AS SUPPLIED BY CENTURA; PRODUCT TO BE INSTALLED WITH LONG DIMENSION RUNNING VERTICALLY</p> <p>PT-2: 12" x 24" x 9.0mm PORTOBELLO LAB SERIES PORCELAIN TILE IN COLOUR 'WHITE NATURAL #900058E' AS SUPPLIED BY CENTURA; PRODUCT TO BE INSTALLED WITH LONG DIMENSION</p> |
|-----|-----------|----|--|

RUNNING VERTICALLY

- .2 **PORCELAIN TILE # [PT-#]:**
Porcelain floor tile is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.
- PT-3 PORCELAIN TILE 3:
24" x 48" x 8mm THICK MIRAGE 'RE-STONE' (AS SUPPLIED BY CENTURA) IN COLOUR 'DUNE LINE SPAZZOLATO'
- PT-4 PORCELAIN TILE 4:
24" x 48" x 8mm THICK MIRAGE 'RE-STONE' (AS SUPPLIED BY CENTURA) IN COLOUR 'ICELANDIC LINE SAPAZZALATO'
- PT-5 PORCELAIN TILE 5:
24" x 48" x 8mm THICK MIRAGE 'RE-STONE' (AS SUPPLIED BY CENTURA) IN COLOUR 'SAFARI LINE SPAZZOLATO'
- .3 **Ceramic Tile [CT-1]:**
Ceramic Tile 1 is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.
- CT-1:
2" x 8" EQUIPPE COSTA NOVA SERIES FLUTED CERAMIC TILE AS SUPPLIED BY CENTURA IN COLOUR ONDA TANSA GREEN MATT #CON28524; PRODUCT TO BE INSTALLED IN STACKED GRID PATTERN WITH LONG DIMENSION RUNNING VERTICALLY
- .4 **Ceramic Tile [CT-2x]:**
Ceramic Tile 2 is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.
- CT-2x:
2" x 8" EQUIPPE COSTA NOVA SERIES FLAT CERAMIC TILE AS SUPPLIED BY CENTURA IN COLOURS NOTED:
- CT-2a: BEIGE PALE MATT #CON 28467
CT-2b: TERRA MATT #CON28465
- PRODUCT TO BE INSTALLED IN STACKED GRID PATTERN WITH LONG DIMENSION RUNNING VERTICALLY
- .5 **Ceramic Tile [CT-3x]:**
Ceramic Tile 3 is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.

CT-3x:

3" x 12" CIFRE OVAL SERIES PATTERNED CERAMIC TILE [IN GLOSS FINISH] AS SUPPLIED BY CENTURA IN COLOURS NOTED:

CT-3a: WHITE BRILLO #OVWH312

CT-3b: COBALT BRILLO #OVCO312

PRODUCT TO BE INSTALLED IN STACKED GRID PATTERN WITH LONG DIMENSION RUNNING VERTICALLY

.6 Porcelain Moscaic Tile [PMT]:

Porcelain is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.

PMT: 7/8" X 5 5/8" X 9.5mm THICK PORCELAIN FINGERS [SUPPLIED IN 12" X 12" MESH-MOUNTED SHEETS] TO BE 'CONCAVE BORDER' MOSAIC AS SUPPLIED BY CENTURA IN COLOUR 'WEATHERED GREY' AND PRODUCT #BH02126

.7 TILE MORTARS/ADHESIVES:

Mortar formulations are to be in full accordance with each tile manufacturer's recommendations for the intended application and applicable substrate type. Tile trade is responsible to verify conformity of specifications herein to tile manufacturers' recommendations throughout.

Mortar formulations specified herein. Alternates from Mapei, Laticrete, Ardex or Flextile may also be considered.

Mortar at Porcelain and Ceramic Tile:

Mapei 'Kerabond/Keralastic' flexible 2-part mortar system [Kerabond premium dryset mortar with Keralastic acrylic latex additive]

.8 TILE GROUT:

All grout products and formulations are to be in full accordance with each tile manufacturer's recommendations acknowledging tile type, substrate material, required joint widths and the intended location/application. Tile trade is responsible to verify conformity of specifications herein to tile manufacturers' recommendations throughout.

Grout colours and formulations specified herein are based upon Mapei products. Alternates from Laticrete, Ardex or Flextile may also be considered.

Grout at all porcelain tile to be Mapei "Flexcolour CQ" pre-mixed stain-resistant grout in colours noted:

Grout Colours:

Grout Colour at CT-1:	mix to match CT-1
Grout Colour at CT-2a:	Mapei #14, Biscuit
Grout Colour at CT-2b:	mix to match CT-2b
Grout Colour at CT-3a:	Mapei #38, Alabaster
Grout Colour at CT-3b:	Mapei #38, Alabaster
Grout Colour at PT-1:	Mapei #19, Pearl Gray
Grout Colour at PT-2:	Mapei #02, Pewter
Grout Colour at PT-3:	Mapei #02, Pewter
Grout Colour at PT-4:	Mapei #02, Pewter
Grout Colour at PT-5:	Mapei #02, Pewter
Grout Colour at PMT:	Mapei #77, Frost

.9 WALL TILE EDGING/FINISHING STRIPS:

At all outside wall corners of ceramic and/or porcelain wall tile installations, and/or where tiled wall faces terminate [against dissimilar wall finishes] supply and install Schluter edging strip in depth to suit the intended application. Edging profile types, materials and colours as noted:

Edging Strip at CT-1 to be:

Schluter JOLLY-PVC-HG [PVC profile in colour Light Grey]

Edging Strip at CT-2a and CT-2b to be:

Schluter JOLLY-AE [clear anodized aluminium profile]

Edging Strip at CT-3a and CT-3b to be:

Schluter JOLLY-PVC-BW [PVC profile in colour Bright White]

Edging Strip at PT-1, PT-2 and PMT to be:

Schluter JOLLY-AE [clear anodized aluminium profile]

Edging Strip at top of PTB to be:

Schluter JOLLY-AE [clear anodized aluminium profile]

.10 TRANSITION STRIPS at Porcelain Tile Floors:

Transitions strips to be as manufactured by Schluter Systems throughout. Flooring trade responsible to select and verify required profile depth against actual thicknesses of the tile products. All strips to be installed in longest practical lengths throughout.

Transition Strip at Installations of Porcelain Tile Flooring:

At all locations of porcelain floor tile meeting adjacent dissimilar floor finishes [of different thicknesses], supply and install Schluter RENO-TK-AE satin anodized aluminum transition strip [in adjoining depths to suit the intended application] in longest practical lengths throughout.

At all locations of porcelain floor tile meeting adjacent dissimilar floor finishes [of matching thicknesses], supply and install Schluter SCHIENE-AE satin anodized aluminum edge protection strip [in adjoining depths to suit the intended application] in longest practical lengths throughout.

.11 **PORCELAIN TILE BASE [PTB]:**

All porcelain tile base is to match adjacent porcelain tile floors throughout. Cut base to 4" high x 48" long from floor tile specified in subject area [PT-3, PT-4 or PT-5] as shown on drawings and schedules. Grout colour at PTB to match adjacent porcelain tile floors.

2.2 Layout

- .1 Tile layouts, installation patterns, pattern orientations, and locations as per Architectural drawings throughout.

PART 3 - EXECUTION

3.1 Installation

- .1 All floor and wall tiles to be installed in full accordance with tile manufacturer's recommendations for intended application.
- .2 Examine surfaces to which tile is to be applied to ensure that they are clear, sound and at appropriate levels and locations; report any discrepancies to Contractor before proceeding.
- .3 Remove sub floor/substrates ridges and bumps. Fill low spots, cracks, joints, holes and other defects with appropriate subfloor filler. Grind down to even surface where necessary.
- .4 Coordinate with the installation of adjacent differing flooring finishes to establish and provide appropriate joints and junctures between the two finishes. Make all joints straight and flush.
- .5 Apply any patching or leveling base coats in accordance with best trade practice.
- .6 Install tile edging and transition strips in full accordance with manufacturer's recommendations for the intended application; provide 45° mitre-cuts at 90° outside corners of tiled wall surfaces where required.
- .7 **Mortar/Adhesive Installation and Tile Setting:**

All tile-setting mortars are to be installed in full accordance with adhesive manufacturer's recommendations for the intended application including trowel types and notch sizes, percentage of coverage on substrate and back of tile, and all related installation considerations [environmental conditions, substrate preparation application techniques, etc.] Immediately upon setting, ensure that all tiles are co-planar between one another to comprise a flat and consistent plane in the finished installation.

When setting tiles, use levels, leveling strings and leveling lasers as required to ensure uniform, straight, and consistent tile lines. Lines between rows of tiles are to be parallel and/or perpendicular throughout (as applicable).

When setting tiles, use spacers to ensure continuity and consistency in tile joint widths throughout. Variation in joint widths shall not exceed $\frac{1}{4}$ of the joint dimension specified herein.

Immediately upon setting tiles, remove all excess (uncured) mortar from tile joints which might adversely affect the subsequent installation of grout.

in parallel joint widths/dimensions throughout. All joint lines to be level and plumb both horizontally and vertically throughout.

.8 Grout/Joint Widths at Ceramic Tile:

Grout widths at ceramic wall tile to be approx. 1/8 - 3/16" wide throughout, but may be varied marginally to suit final installation dimensions.

Grout/Joint Widths at Porcelain Tile:

Grout widths at porcelain wall tile to be approx. 1/8 - 3/16" wide throughout, but may be varied marginally to suit final installation dimensions.

Use tile setting spacers throughout as required to ensure tile alignments and consistent joint widths throughout, with no variations exceeding $\frac{1}{4}$ of the specified grout widths (typical).

.9 Grout installation:

- a) Do not disturb or grout tiles until the adhesive or dryset mortar is sufficiently cured.
- b) All joints must be clean and free from standing water, dust and foreign substances and tile-setting spacers.
- c) Surface temperatures must be raised and maintained at a recommended level of between 15°C (60°F) and 32° (90°F).
- d) Tile surfaces must be clean and dry. Clean as required.
- e) Remove excess mortar/adhesive from joints so that min. 2/3 of the depth of the tile is available for grouting.
- f) Prepare and mix grout as per manufacturer's recommendations, to ensure uniformity and consistency in colour and quality.
- g) Pour the mix over the grouting surfaces.
- h) Use manufacturer's recommended float.
- i) Force grout into joints flush with the tile surface applying enough grout and pressure to fill joints free of voids and air pockets.
- j) Fill joints with a tooled profile.
- k) Remove excess grout from tile face, using a float at a 45 - 90° angle as a squeegee diagonally across tile face.
- l) Clean tiles after applying each unit of grout, to ensure no grout remains on tile face.

.10 Protect tiled surfaces from use or contact until tile mortar and grouting has adequately cured.

3.2 Cleaning

- .1 Immediately remove any and all excess grout haze from tiled surfaces. Wipe tile faces with a sponge and clean potable water (rinsed progressively) until no grout haze is left. Do not flood floor with excess water which may adversely affect grout setting and remove excess water with a clean dry sponge.
- .2 If any grout haze remains after tile grout is sufficiently set, remove haze with applicable grout haze sealer, as manufactured by Mapei or Miracle Sealants. Formulation of haze remover to be selected relative to the flooring products in question and degree of haze residue. All haze removers are to be utilized in full accordance with the manufacturer's recommendations for the intended application.
- .3 Clean all installed tile surfaces prior to hand-over to the building owner, ensuring removal of all construction-related dirt, grime and residue. Protect cleaned tile surfaces as required.

END OF SECTION 09315

PART 1 - GENERAL

- | | | | |
|-----|---------------------|---|---|
| 1.1 | General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | |
| 1.2 | Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to the supply and install of the following:</p> <p>.1 Porcelain and ceramic tile finishes on floors and/or walls and at all other locations noted on drawings.</p> <p>.2 Porcelain tile base as specified herein.</p> | |
| 1.3 | Related Work | <p>.1 Cast-in-Place Concrete</p> <p>.2 Resilient Flooring</p> <p>.3 Masonry</p> <p>.4 Steel Stud and Gypsum Board</p> <p>.5 Architectural Millwork</p> <p>.6 Carpeting</p> | <p>Section 03300</p> <p>Section 09660</p> <p>Section 04220</p> <p>Section 09111</p> <p>Section 06400</p> <p>Section 09680</p> |
| 1.4 | Samples | <p>.1 Submit at least 2 units of each tile, selected at random from stock, and typical base and corner accessories in accordance with Section 01340. All tile samples s are to be submitted to the Architect for approval prior to ordering.</p> <p>.2 Submit manufacturer's maintenance instructions in accordance with Section 01340.</p> <p>.3 Provide min. 10% of the quantity of each specified material, at least one each of base corner accessories; deliver extra stock in a sealed labeled package to owner at their direction.</p> | |

PART 2 - PRODUCTS

- | | |
|----------------------------------|--|
| <p>2.1 Materials</p> | <p>.1 <u>PORCELAIN TILE # [PT-#]:</u>
 Porcelain wall tile is to be as noted below, in the locations, orientations and layout patterns as shown on the drawings:</p> <p>PT-1: 12" x 24" x 9.0mm PORTOBELLO LAB SERIES PORCELAIN TILE IN COLOUR 'ASH NATURAL #900059E' AS SUPPLIED BY CENTURA; PRODUCT TO BE INSTALLED WITH LONG DIMENSION RUNNING VERTICALLY</p> <p>PT-2: 12" x 24" x 9.0mm PORTOBELLO LAB SERIES PORCELAIN TILE IN COLOUR 'WHITE NATURAL #900058E' AS SUPPLIED BY CENTURA; PRODUCT TO BE INSTALLED WITH LONG DIMENSION</p> |
|----------------------------------|--|

RUNNING VERTICALLY

- .2 **PORCELAIN TILE # [PT-#]:**
Porcelain floor tile is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.
- PT-3 PORCELAIN TILE 3:
24" x 48" x 8mm THICK MIRAGE 'RE-STONE' (AS SUPPLIED BY CENTURA) IN COLOUR 'DUNE LINE'
- PT-4 PORCELAIN TILE 4:
24" x 48" x 8mm THICK MIRAGE 'RE-STONE' (AS SUPPLIED BY CENTURA) IN COLOUR 'ICELANDIC HAMMERED'
- PT-5 PORCELAIN TILE 5:
24" x 48" x 8mm THICK MIRAGE 'RE-STONE' (AS SUPPLIED BY CENTURA) IN COLOUR 'SAFARI ARROW'
- .3 **Ceramic Tile [CT-1]:**
Ceramic Tile 1 is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.
- CT-1:
2" x 8" EQUIPPE COSTA NOVA SERIES FLUTED CERAMIC TILE AS SUPPLIED BY CENTURA IN COLOUR ONDA TANSA GREEN MATT #CON28524; PRODUCT TO BE INSTALLED IN STACKED GRID PATTERN WITH LONG DIMENSION RUNNING VERTICALLY
- .4 **Ceramic Tile [CT-2x]:**
Ceramic Tile 2 is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.
- CT-2x:
2" x 8" EQUIPPE COSTA NOVA SERIES FLAT CERAMIC TILE AS SUPPLIED BY CENTURA IN COLOURS NOTED:
- CT-2a: BEIGE PALE MATT #CON 28467
CT-2b: TERRA MATT #CON28465
- PRODUCT TO BE INSTALLED IN STACKED GRID PATTERN WITH LONG DIMENSION RUNNING VERTICALLY
- .5 **Ceramic Tile [CT-3x]:**
Ceramic Tile 3 is to be as noted below, in the locations, orientations and layouts as shown on the architectural drawings.

CT-3x:

3" x 12" CIFRE OVAL SERIES PATTERNED CERAMIC TILE
[IN GLOSS FINISH] AS SUPPLIED BY CENTURA IN
COLOURS NOTED:

CT-3a: WHITE BRILLO #OVWH312

CT-3b: COBALT BRILLO #OVCO312

PRODUCT TO BE INSTALLED IN STACKED GRID
PATTERN WITH LONG DIMENSION RUNNING
VERTICALLY

.6 Porcelain Moscaic Tile [PMT]:

Porcelain is to be as noted below, in the locations,
orientations and layouts as shown on the architectural
drawings.

PMT: 7/8" X 5 5/8" X 9.5mm THICK PORCELAIN
FINGERS [SUPPLIED IN 12" X 12" MESH-MOUNTED
SHEETS] TO BE 'CONCAVE BORDER' MOSAIC AS
SUPPLIED BY CENTURA IN COLOUR 'WEATHERED
GREY' AND PRODUCT #BHTH02126

.7 TILE MORTARS/ADHESIVES:

Mortar formulations are to be in full accordance with each tile
manufacturer's recommendations for the intended application
and applicable substrate type. Tile trade is responsible to
verify conformity of specifications herein to tile
manufacturers' recommendations throughout.

Mortar formulations specified herein. Alternates from Mapei,
Laticrete, Ardex or Flextile may also be considered.

Mortar at Porcelain and Ceramic Tile:

Mapei 'Kerabond/Keralastic' flexible 2-part mortar system
[Kerabond premium dryset mortar with Keralastic acrylic
latex additive]

.8 TILE GROUT:

All grout products and formulations are to be in full
accordance with each tile manufacturer's recommendations
acknowledging tile type, substrate material, required joint
widths and the intended location/application. Tile trade is
responsible to verify conformity of specifications herein to tile
manufacturers' recommendations throughout.

Grout colours and formulations specified herein are based
upon Mapei products. Alternates from Laticrete, Ardex or
Flextile may also be considered.

Grout at all porcelain tile to be Mapei "Flexcolour CQ" pre-
mixed stain-resistant grout in colours noted:

Grout Colours:

Grout Colour at CT-1: mix to match CT-1

Grout Colour at CT-2a:	Mapei #14, Biscuit
Grout Colour at CT-2b:	mix to match CT-2b
Grout Colour at CT-3a:	Mapei #38, Alabaster
Grout Colour at CT-3b:	Mapei #38, Alabaster
Grout Colour at PT-1:	Mapei #19, Pearl Gray
Grout Colour at PT-2:	Mapei #02, Pewter
Grout Colour at PT-3:	Mapei #02, Pewter
Grout Colour at PT-4:	Mapei #02, Pewter
Grout Colour at PT-5:	Mapei #02, Pewter
Grout Colour at PMT:	Mapei #77, Frost

.9 WALL TILE EDGING/FINISHING STRIPS:

At all outside wall corners of ceramic and/or porcelain wall tile installations, and/or where tiled wall faces terminate [against dissimilar wall finishes] supply and install Schluter edging strip in depth to suit the intended application. Edging profile types, materials and colours as noted:

Edging Strip at CT-1 to be:

Schluter JOLLY-PVC-HG [PVC profile in colour Light Grey]

Edging Strip at CT-2a and CT-2b to be:

Schluter JOLLY-AE [clear anodized aluminium profile]

Edging Strip at CT-3a and CT-3b to be:

Schluter JOLLY-PVC-BW [PVC profile in colour Bright White]

Edging Strip at PT-1, PT-2 and PMT to be:

Schluter JOLLY-AE [clear anodized aluminium profile]

Edging Strip at top of all PTB to be:

Schluter JOLLY-AE [clear anodized aluminium profile]

.10 TRANSITION STRIPS at Porcelain Tile Floors:

Transitions strips to be as manufactured by Schluter Systems throughout. Flooring trade responsible to select and verify required profile depth against actual thicknesses of the tile products. All strips to be installed in longest practical lengths throughout.

Transition Strip at Installations of Porcelain Tile Flooring:

At all locations of porcelain floor tile meeting adjacent dissimilar floor finishes [of different thicknesses], supply and install Schluter RENO-TK-AE satin anodized aluminum transition strip [in adjoining depths to suit the intended application] in longest practical lengths throughout.

At all locations of porcelain floor tile meeting adjacent dissimilar floor finishes [of matching thicknesses], supply and install Schluter SCHIENE-AE satin anodized aluminum edge protection strip [in adjoining depths to suit the intended application] in longest practical lengths throughout.

.11 **PORCELAIN TILE BASE [PTB]:**

All porcelain tile base is to match adjacent porcelain tile floors throughout. Cut base to 4" high x 48" long from floor tile specified in subject area [PT-3, PT-4 or PT-5] as shown on drawings and schedules. Grout colour at PTB to match adjacent porcelain tile floors.

2.2 Layout

- .1 Tile layouts, installation patterns, pattern orientations, and locations as per Architectural drawings throughout.

PART 3 - EXECUTION

3.1 Installation

- .1 All floor and wall tiles to be installed in full accordance with tile manufacturer's recommendations for intended application.
- .2 Examine surfaces to which tile is to be applied to ensure that they are clear, sound and at appropriate levels and locations; report any discrepancies to Contractor before proceeding.
- .3 Remove sub floor/substrates ridges and bumps. Fill low spots, cracks, joints, holes and other defects with appropriate subfloor filler. Grind down to even surface where necessary.
- .4 Coordinate with the installation of adjacent differing flooring finishes to establish and provide appropriate joints and junctures between the two finishes. Make all joints straight and flush.
- .5 Apply any patching or leveling base coats in accordance with best trade practice.
- .6 Install tile edging and transition strips in full accordance with manufacturer's recommendations for the intended application; provide 45° mitre-cuts at 90° outside corners of tiled wall surfaces where required.

.7 **Mortar/Adhesive Installation and Tile Setting:**

All tile-setting mortars are to be installed in full accordance with adhesive manufacturer's recommendations for the intended application including trowel types and notch sizes, percentage of coverage on substrate and back of tile, and all related installation considerations [environmental conditions, substrate preparation application techniques, etc.] Immediately upon setting, ensure that all tiles are co-planar between one another to comprise a flat and consistent plane in the finished installation.

When setting tiles, use levels, leveling strings and leveling lasers as required to ensure uniform, straight, and consistent tile lines. Lines between rows of tiles are to be parallel and/or perpendicular throughout (as applicable).

When setting tiles, use spacers to ensure continuity and

consistency in tile joint widths throughout. Variation in joint widths shall not exceed $\frac{1}{4}$ of the joint dimension specified herein.

Immediately upon setting tiles, remove all excess (uncured) mortar from tile joints which might adversely affect the subsequent installation of grout.

in parallel joint widths/dimensions throughout. All joint lines to be level and plumb both horizontally and vertically throughout.

.8 Grout/Joint Widths at Ceramic Tile:

Grout widths at ceramic wall tile to be approx. 1/8 - 3/16" wide throughout, but may be varied marginally to suit final installation dimensions.

Grout/Joint Widths at Porcelain Tile:

Grout widths at porcelain wall tile to be approx. 1/8 - 3/16" wide throughout, but may be varied marginally to suit final installation dimensions.

Use tile setting spacers throughout as required to ensure tile alignments and consistent joint widths throughout, with no variations exceeding $\frac{1}{4}$ of the specified grout widths (typical).

.9 Grout installation:

- a) Do not disturb or grout tiles until the adhesive or dryset mortar is sufficiently cured.
- b) All joints must be clean and free from standing water, dust and foreign substances and tile-setting spacers.
- c) Surface temperatures must be raised and maintained at a recommended level of between 15°C (60°F) and 32° (90°F).
- d) Tile surfaces must be clean and dry. Clean as required.
- e) Remove excess mortar/adhesive from joints so that min. 2/3 of the depth of the tile is available for grouting.
- f) Prepare and mix grout as per manufacturer's recommendations, to ensure uniformity and consistency in colour and quality.
- g) Pour the mix over the grouting surfaces.
- h) Use manufacturer's recommended float.
- i) Force grout into joints flush with the tile surface applying enough grout and pressure to fill joints free of voids and air pockets.
- j) Fill joints with a tooled profile.
- k) Remove excess grout from tile face, using a float at a 45 - 90° angle as a squeegee diagonally across tile face.
- l) Clean tiles after applying each unit of grout, to ensure no grout remains on tile face.

.10 Protect tiled surfaces from use or contact until tile mortar and grouting has adequately cured.

3.2 Cleaning

.1 Immediately remove any and all excess grout haze from tiled

surfaces. Wipe tile faces with a sponge and clean potable water (rinsed progressively) until no grout haze is left. Do not flood floor with excess water which may adversely affect grout setting and remove excess water with a clean dry sponge.

- .2 If any grout haze remains after tile grout is sufficiently set, remove haze with appropriate grout haze remover as manufactured by Mapei, Laticrete or Miracle Sealants. Formulation of haze remover to be selected relative to the flooring products in question and degree of haze residue. All haze removers are to be utilized in full accordance with the manufacturer's recommendations for the intended application.
- .3 Clean all installed tile surfaces prior to hand-over to the building owner, ensuring removal of all construction-related dirt, grime and residue. Protect cleaned tile surfaces as required.

END OF SECTION 09315

PART 1 - GENERAL

- | | | |
|----------------------------------|--|--|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | |
| 1.2 Description of Work | Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to the supply and installation of the following: | |
| | .1 | Resilient flooring materials (in types and formats as specified herein and as shown on the drawings) |
| | .2 | Rubber wall base (at all walls and/or the base of all millwork items as indicated on the Drawings) |
| | .3 | Resilient flooring transition strips (between resilient floors and dissimilar flooring finishes) |
| | .4 | Preparation of all existing floors and applicable substrates as required to ensure first-rate installation, adhesion and performance of new resilient flooring products specified herein. This work may include (without strict limitation to) removal of existing flooring and wall base; scraping and removal of existing sub-floor irregularities down to a smooth substrate; dustless diamond grinding of existing concrete floors as required; isolated patching and repair of existing substrates to provide smooth and consistent finish for newly installed resilient flooring materials and related items specified herein. |
| 1.3 Related Work | .1 | Demolition Section 02100 |
| | .2 | Cast-in-Place Concrete Section 03300 |
| | .3 | Steel Stud & Gypsum Board Section 09111 |
| | .4 | Porcelain and Ceramic Tile Flooring Section 09315 |
| | .5 | Carpet Section 09680 |
| | .6 | Millwork Section 06400 |
| | .7 | Floor Access Covers Mechanical Division |
| 1.4 Maintenance Data | .1 | Provide data for maintenance of resilient tile flooring in accordance with Section 01730. |
| 1.5 Maintenance Materials | .1 | Deliver 2 square meters of each colour, pattern and type of flooring material required for this project, for maintenance use, excluding sheet goods. Package and clearly identify each type. Deliver to Owner as directed. |
| | .2 | Maintenance materials to be same production run as installed materials. |
| 1.6 Environmental | .1 | Maintain minimum 20° air temperature at flooring installation area for 3 days before, during and for 48 hours after installation. |

- .2 Acclimate all resilient flooring and wall
- 1.7 Samples .1 Submit a 300mm x 300mm (12" x 12") sample of each colour and material indicated, including insets/accents as applicable. All samples are to be approved by the Architect prior to product ordering.

PART 2 - PRODUCTS

- 2.1 Materials .1 **LUXURY VINYL TILE FLOORING (LVT-#):**
- All LVT to be as noted below in the quantities, locations and installation patterns as noted on the drawings.
- LVT-1 LUXURY VINYL TILE 1:
12" x 36" x 3mm THICK TARKETT CONTOUR SERIES 'PALLADIAN' IN COLOUR TERRACE #4663 QU
- LVT-2 LUXURY VINYL TILE 2:
12" x 36" x 3mm THICK TARKETT CONTOUR SERIES 'PALLADIAN' IN COLOUR PALAZZO #4662 QU
- LVT-3 LUXURY VINYL TILE 3:
12" x 36" x 3mm THICK TARKETT CONTOUR SERIES 'PALLADIAN' IN COLOUR MYSTIC BEIGE #4659 QU
- All LVT is to be laid in 'vertical ashlar' pattern as recommended by the manufacturer for the intended application.
- .2 **RUBBER STAIR TREADS (RST-#):**
- RST-1 RUBBER STAIR TREAD 1 (AT GENERAL STAIRS):
TARKETT ANGLEFIT ONE-PIECE 'HAMMERED TREAD /RISER VISUALLY IMPAIRED' #VIHNTR' IN COLOUR-SPLASH SPECKLED COLOURWAY IN COLOUR 'VE7 MT RAINIER" C/W 'BLACK #40' VISUALLY IMPAIRED RUBBER INSET STRIP
- RST-2 RUBBER STAIR TREAD 2 (AT STAGE AREA STAIRS):
TARKETT ANGLEFIT ONE-PIECE 'HAMMERED TREAD /RISER VISUALLY IMPAIRED' #VIHNTR' IN COLOUR-SPLASH SPECKLED COLOURWAY IN COLOUR 'VF5 GORGE AREA" C/W 'SILVER GREY #55 VISUALLY IMPAIRED RUBBER INSET STRIP

All step treads to be supplied in one-piece width to suit the intended application.

Uppermost step at all landings [at upmost step in each stair flight] to utilize RST with vertical riser removed. Removed

riser material to be installed on first riser at bottom of stair in related flight.

.3 Rubber Tile (RT-#):

- RT-1 RUBBER TILE 1 (AT LANDINGS ADJACENT TO RST-1):
RUBBER TILE: 24" X 24" X 1/8" THICK TARKETT 'COLOUR SPLASH' RUBBER TILE IN COLOUR 'VE7 MT RAINIER' IN HAMMERED FINISH
- TACTILE WARNING SURFACE (IMMEDIATELY ABOVE UPPERMOST STEP IN EACH STAIR FLIGHT): 300 mm DEEP TARKETT STUDDED CIRCLE 'TACTILE WARNING SURFACE VINYL TILE' LOCATED 300 mm FROM ADJACENT STAIR NOSING AND EXTENDING FULL WIDTH OF STAIR; PRODUCT COLOUR TO BE #40 BLACK
- RT-2 RUBBER TILE 2 (AT RAMPS AND LANDINGS ADJACENT TO RST-2):
RUBBER TILE: 24" X 24" X 1/8" THICK TARKETT 'COLOUR SPLASH' RUBBER TILE IN COLOUR 'VF5 GORGE AREA' IN HAMMERED FINISH
- TACTILE WARNING SURFACE (IMMEDIATELY ABOVE UPPERMOST STEP IN EACH STAIR FLIGHT): 300 mm DEEP TARKETT STUDDED CIRCLE 'TACTILE WARNING SURFACE VINYL TILE' LOCATED 300 mm FROM ADJACENT STAIR NOSING AND EXTENDING FULL WIDTH OF STAIR; PRODUCT COLOUR TO BE #55 SILVER GREY

.4 RUBBER BASE (RB-#):

RB-1 & RB-2:

Rubber Base 1 and Rubber Base 2 to be 4.25" high Tarkett 'Traditional Rubber Base with toe' in colours and locations noted as specified on Room Finish Schedule. Product to be supplied in roll goods throughout and installed in longest practical lengths with seams only at inside corners.

Colours to be as noted below:

RB-1 [general use throughout unless noted otherwise]:
#VK7 Mt. Rainier

RB-2 [in Stage-related areas as indicated]:
#20 Charcoal

Base to be installed with Johnsonite #960 Adhesive on porous substrates and Johnsonite #945 Contact Base Adhesive on non-porous surfaces.

Flooring trade to note requirement for rubber base on millwork items where shown on Architectural drawings.

.5 LVT Flooring Adhesives:

LVT Adhesives: to be as recommended by product manufacturer for the specific flooring material and intended application on applicable substrate (above, at, or below grade). **All adhesives to be capable of resisting 95% RH floor applications.**

For all applications on slabs-on-grade and/or on newly poured concrete subfloors, adhesive to be:

Tarkett 959RH High-Moisture Substrate Adhesive
[or approved alternate]

.6 Resilient Rubber Flooring Adhesives:

RST and RLT Adhesives: to be as recommended by product manufacturer for the specific flooring material and intended application on applicable substrate (above, at, or below grade).

For all applications on slabs-on-grade and/or on newly poured concrete subfloors, adhesive to be:

Mannington MoistureLoc Sheet
[capable of 95% RH floor applications]

.7 Transition Strips:

Transition strips shall include all 'reducers', 'adaptors' 'slimline transitions' and/or 'wheeled traffic transitions' as manufactured by Johnsonite (unless noted otherwise).

Transition strips are to be supplied and installed at all flooring transitions throughout where dissimilar flooring materials meet [unless noted otherwise]. Flooring trade to determine the required profile of the transition strips for the intended application, supplying and installing suitable transitions strips to:

- mediate/transition between new flooring of different thicknesses
- mediate/transition between a new flooring finish and an adjacent existing flooring finish which is not co-planar (i.e. with a different finish level)
- protectively cap seams between differing flooring materials/types of the same or differing thicknesses

Transition Strip Colours:

Architect to select colours from Johnsonite's full colour range including metallics.

.8 Sub-Floor Preparation Materials:

Flooring trade is responsible to prepare existing concrete floors as required for newly specified materials, ensuring that final installation of resilient flooring is free of calendaring and

any evidence of substrate irregularities. This may include the installation of subfloor treatment products including (without strict limitation to): subfloor primers, patching and skimcoat products, slope & deep fill products; dry-pack mortars, self-leveling (poured-on) underlayments etc. [as and where required throughout]. All sub-floor preparation materials are to be selected suited to the intended application, substrate conditions, and manufacturer installation requirements for newly specified products outlined herein. All preparation materials utilized are to provide a lasting bond to the subfloor and are to support long-term use of the specified finished flooring products. The flooring trade is to responsible to coordinate subfloor preparation and installation requirements with flooring manufacturers, allowing for and providing all related materials and techniques herein.

All sub-floor preparation products are to be:

- fully bonded to substrate
- finished flush, level and smooth with surrounding subfloors
- fully compatible with both substrate material and the new newly specified floor finishes

Acceptable manufacturers for sub-floor preparation products include Mapei and Ardex.

PART 3 - EXECUTION

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|-----|-----------------------|----|---|
| 3.1 | Sub-floor Conditions | .1 | <p>Ensure concrete sub-floors are clean and dry, exhibiting negative alkalinity and no signs of efflorescence, carbonization or dusting.</p> <p>Perform sub-floor moisture test using test methods recommended by flooring manufacturer to determine moisture content in substrates. Ensure that they conform to manufacturer's standards prior to installation, and that correct manufacturer-recommended adhesives are used related to the moisture content of both sub-floors and relative humidity (ambient air) at the time of installation.</p> |
| 3.2 | Sub-floor Preparation | .1 | <p>Remove sub-floor ridges and bumps. Remove residue from any previous materials and/or finishes. Grind down to even surface where necessary. As required, provide dustless diamond grinding (via commercial dustless diamond grinder) to ensure flatness and smoothness of substrate free of irregularities.</p> |
| | | .2 | <p>Clean floors and substrates to remove all dust and irregularities which might adversely affect the work. Ensure use of suitable cleansing agents for areas of oil or other contaminants on the sub-floor surface. Rinse all cleansing agents from the floor to with clean water to ensure that no residue remains.</p> |
| | | .3 | <p>Fill all low spots, dishing, cracks, joints, holes and other inset irregularities in the sub-floor, choosing a patching, skimming,</p> |

levelling or filler agent as required related to each subfloor irregularity. Utilize primers where necessary to ensure proper bond. Trowel and float filler agents as required to leave a smooth, hard surface once cured. Sand or grind cured fillers where required. Ensure that all filling materials provide a smooth, consistent and flat finish which is permanently bonded to the subfloor.

3.3 Environmental Acclimation

- .1 All resilient flooring products (including both sheet and tile products) are required to acclimate to ambient indoor temperatures within related installation spaces (at temperatures between 65°F and 75°F for a min. 72 hours prior to installation). Ensure that all resilient flooring materials are installed in full accordance with the manufacturer's environmental conditions throughout.

3.4 Resilient Tile Installation

- .1 Apply adhesive uniformly using recommended trowel type in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place. All tile must be installed prior to adhesives 'setting-up' and curing in order to promote optimal and lasting bond.
- .2 All tile installation patterns, colours and locations are to be as per Architectural drawings and Colour and Finish Schedule.
- .3 ***Verify installation orientation of all resilient flooring products with Architect prior to installation***, particularly for resilient flooring products which are 'directional' (i.e. have a distinct visual 'grain' running in a single direction).
Unless noted otherwise, square-format resilient floor tile is to be installed in each room with all tiles (and visual 'grain' thereon) running in a single direction throughout. Quarter-turned (tessellated) tile installations will ***not*** be accepted. Installation orientation is to be as indicated on architectural drawings and/or as directed by the Architect.
- .4 Unless noted otherwise, install tile flooring in half offset brickwork pattern with all lines aligned and parallel to building lines wherever possible. All joints between tiles to be tight and free of gaps, ensuring same is true at patterned installations throughout.
- .5 Double-cut any patterned installations involving angles or curves using plywood scribing templates to suit.
- .6 Cut and fit neatly around fixed or excessively heavy objects.
- .7 Install flooring in removable floor access covers where applicable) maintaining floor pattern.
- .8 Terminate flooring at centerline of door (where possible) in

openings where adjacent floor finish or colour is dissimilar.

- .9 Roll all installed products with commercial flooring roller as recommended by flooring product manufacturer to remove air bubbles below flooring and to ensure that all product lays flat and true, free of any lifting edges and irregularities throughout.
 - .10 Following cleaning, provide initial waxing and sealing of VCT floors (in full accordance with VCT manufacturer's recommendations) prior to hand-over to client.
- 3.5 Base Installation**
- .1 Set base in adhesive tightly against wall and floor surfaces. Use lengths as long as practical and not less than 500mm (20") long.
 - .2 Install straight and level to variation of 1:100.
 - .3 All base products are to be installed in full accordance with manufacturer's recommendations, including scribing details at all interior and exterior corners. Fit base goods neatly to all doorframes. All short returns of base goods (and at any locations where base product may not sit firmly against wall surface), base to be secured in place with construction adhesive or contact cement adhesive, sufficient to ensure full adhesion.
- 3.6 Protection of Finished Work**
- .1 Prohibit traffic on floor for 48 hours after installation.
 - .2 Where floors are to be subject to traffic before final inspection, provide suitable protection following installation of initial wax and seal by flooring trade.

END OF SECTION 09660

PART 1 - GENERAL

- | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|--|---------------------|------------|---------------|----|------------------------|---------------|----|---------------------------|---------------|----|-------------------------------------|---------------|----|--------|---------------|----|----------|---------------|----|---------------------|---------------------|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | | | | | | | | | | | | | | | | | | | | | |
| 1.2 Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to the supply and installation of the following:</p> <ul style="list-style-type: none"> .1 Resilient flooring materials (in types and formats as specified herein and as shown on the drawings) .2 Rubber wall base (at all walls and/or the base of all millwork items as indicated on the Drawings) .3 Resilient flooring transition strips (between resilient floors and dissimilar flooring finishes) .4 Preparation of all existing floors and applicable substrates as required to ensure first-rate installation, adhesion and performance of new resilient flooring products specified herein. This work may include (without strict limitation to) removal of existing flooring and wall base; scraping and removal of existing sub-floor irregularities down to a smooth substrate; dustless diamond grinding of existing concrete floors as required; isolated patching and repair of existing substrates to provide smooth and consistent finish for newly installed resilient flooring materials and related items specified herein. | | | | | | | | | | | | | | | | | | | | | |
| 1.3 Related Work | <table border="0" style="width: 100%;"> <tr> <td style="width: 5%;">.1</td> <td style="width: 75%;">Demolition</td> <td style="width: 20%;">Section 02100</td> </tr> <tr> <td>.2</td> <td>Cast-in-Place Concrete</td> <td>Section 03300</td> </tr> <tr> <td>.3</td> <td>Steel Stud & Gypsum Board</td> <td>Section 09111</td> </tr> <tr> <td>.4</td> <td>Porcelain and Ceramic Tile Flooring</td> <td>Section 09315</td> </tr> <tr> <td>.5</td> <td>Carpet</td> <td>Section 09680</td> </tr> <tr> <td>.6</td> <td>Millwork</td> <td>Section 06400</td> </tr> <tr> <td>.7</td> <td>Floor Access Covers</td> <td>Mechanical Division</td> </tr> </table> | .1 | Demolition | Section 02100 | .2 | Cast-in-Place Concrete | Section 03300 | .3 | Steel Stud & Gypsum Board | Section 09111 | .4 | Porcelain and Ceramic Tile Flooring | Section 09315 | .5 | Carpet | Section 09680 | .6 | Millwork | Section 06400 | .7 | Floor Access Covers | Mechanical Division |
| .1 | Demolition | Section 02100 | | | | | | | | | | | | | | | | | | | | |
| .2 | Cast-in-Place Concrete | Section 03300 | | | | | | | | | | | | | | | | | | | | |
| .3 | Steel Stud & Gypsum Board | Section 09111 | | | | | | | | | | | | | | | | | | | | |
| .4 | Porcelain and Ceramic Tile Flooring | Section 09315 | | | | | | | | | | | | | | | | | | | | |
| .5 | Carpet | Section 09680 | | | | | | | | | | | | | | | | | | | | |
| .6 | Millwork | Section 06400 | | | | | | | | | | | | | | | | | | | | |
| .7 | Floor Access Covers | Mechanical Division | | | | | | | | | | | | | | | | | | | | |
| 1.4 Maintenance Data | .1 Provide data for maintenance of resilient tile flooring in accordance with Section 01730. | | | | | | | | | | | | | | | | | | | | | |
| 1.5 Maintenance Materials | <ul style="list-style-type: none"> .1 Deliver 2 square meters of each colour, pattern and type of flooring material required for this project, for maintenance use, excluding sheet goods. Package and clearly identify each type. Deliver to Owner as directed. .2 Maintenance materials to be same production run as installed materials. | | | | | | | | | | | | | | | | | | | | | |
| 1.6 Environmental | .1 Maintain minimum 20° air temperature at flooring installation area for 3 days before, during and for 48 hours after installation. | | | | | | | | | | | | | | | | | | | | | |

- .2 Acclimate all resilient flooring and wall
- 1.7 Samples
- .1 Submit a 300mm x 300mm (12" x 12") sample of each colour and material indicated, including insets/accents as applicable. All samples are to be approved by the Architect prior to product ordering.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 **LUXURY VINYL TILE FLOORING (LVT-#):**
- All LVT to be as noted below in the quantities, locations and installation patterns as noted on the drawings.
- LVT-1 **LUXURY VINYL TILE 1:**
12" x 36" x 3mm THICK TARKETT CONTOUR SERIES 'PALLADIAN' IN COLOUR TERRACE #4663 QU
- LVT-2 **LUXURY VINYL TILE 2:**
12" x 36" x 3mm THICK TARKETT CONTOUR SERIES 'PALLADIAN' IN COLOUR PALAZZO #4662 QU
- LVT-3 **LUXURY VINYL TILE 3:**
12" x 36" x 3mm THICK TARKETT CONTOUR SERIES 'PALLADIAN' IN COLOUR MYSTIC BEIGE #4659 QU
- All LVT is to be laid in 'vertical ashlar' pattern as recommended by the manufacturer for the intended application.
- .2 **RUBBER STAIR TREADS (RST-#):**
- RST-1 **RUBBER STAIR TREAD 1 (AT STAGE AREA STAIRS):**
TARKETT ANGLEFIT ONE-PIECE 'HAMMERED TREAD /RISER VISUALLY IMPAIRED' #VIHNTR' IN COLOUR-SPLASH SPECKLED COLOURWAY IN COLOUR 'VF5 GORGE AREA" C/W 'SILVER GREY #55 VISUALLY IMPAIRED RUBBER INSET STRIP
- All step treads to be supplied in one-piece width to suit the intended application.
- Uppermost step at all landings [at upmost step in each stair flight] to utilize RST with vertical riser removed. Removed riser material to be installed on first riser at bottom of stair in related flight.
- .3 **Rubber Tile (RT-#):**
- RT-1 **RUBBER TILE 1 (AT RAMPS AND LANDINGS ADJACENT TO RST-1):**

RUBBER TILE: 24" X 24" X 1/8 THICK TARKETT 'COLOUR SPLASH' RUBBER TILE IN COLOUR 'VF5 GORGE AREA' IN HAMMERED FINISH

TACTILE WARNING SURFACE (IMMEDIATELY ABOVE UPPERMOST STEP IN EACH STAIR FLIGHT): 300 mm DEEP TARKETT STUDDED CIRCLE 'TACTILE WARNING SURFACE VINYL TILE' LOCATED 300 mm FROM ADJACENT STAIR NOSING AND EXTENDING FULL WIDTH OF STAIR; PRODUCT COLOUR TO BE #55 SILVER GREY

RT-2 RUBBER TILE 2 (INSET VISUAL ACUITY STRIPS AT RT-1):
RUBBER TILE: 24" X 24" X 1/8 THICK TARKETT 'COLOUR SPLASH' RUBBER TILE IN COLOUR 'VE7 MOUNT RAINIER' IN HAMMERED FINISH

.4 RUBBER BASE (RB-#):

RB-1 & RB-2:

Rubber Base 1 and Rubber Base 2 to be 4" high Tarkett 'Traditional Rubber Base with toe' in colours and locations noted as specified on Room Finish Schedule. Product to be supplied in roll goods throughout and installed in longest practical lengths with seams only at inside corners.

Colours to be as noted below:

RB-1 [general use throughout unless noted otherwise]:
#VK7 Mt. Rainier

RB-2 [in Stage-related areas as indicated]:
#20 Charcoal

Base to be installed with Johnsonite #960 Adhesive on porous substrates and Johnsonite #945 Contact Base Adhesive on non-porous surfaces.

Flooring trade to note requirement for rubber base on millwork items where shown on Architectural drawings.

.5 LVT Flooring Adhesives:

LVT Adhesives: to be as recommended by product manufacturer for the specific flooring material and intended application on applicable substrate (above, at, or below grade). **All adhesives to be capable of resisting 95% RH floor applications.**

For all applications on slabs-on-grade and/or on newly poured concrete subfloors, adhesive to be:

Tarkett 959RH High-Moisture Substrate Adhesive
[or approved alternate]

.6 Resilient Rubber Flooring Adhesives:

RST and RLT Adhesives: to be as recommended by product manufacturer for the specific flooring material and intended application on applicable substrate (above, at, or below grade).

For all applications on slabs-on-grade and/or on newly poured concrete subfloors, adhesive to be:

Mannington MoistureLoc Sheet
[capable of 95% RH floor applications]

.7 Transition Strips:

Transition strips shall include all 'reducers', 'adaptors' 'slimline transitions' and/or 'wheeled traffic transitions' as manufactured by Johnsonite (unless noted otherwise).

Transition strips are to be supplied and installed at all flooring transitions throughout where dissimilar flooring materials meet [unless noted otherwise]. Flooring trade to determine the required profile of the transition strips for the intended application, supplying and installing suitable transitions strips to:

- mediate/transition between new flooring of different thicknesses
- mediate/transition between a new flooring finish and an adjacent existing flooring finish which is not co-planar (i.e. with a different finish level)
- protectively cap seams between differing flooring materials/types of the same or differing thicknesses

Transition Strip Colours:

Architect to select colours from Johnsonite's full colour range including metallics.

.8 Sub-Floor Preparation Materials:

Flooring trade is responsible to prepare existing concrete floors as required for newly specified materials, ensuring that final installation of resilient flooring is free of calendaring and any evidence of substrate irregularities. This may include the installation of subfloor treatment products including (without strict limitation to): subfloor primers, patching and skimcoat products, slope & deep fill products; dry-pack mortars, self-leveling (poured-on) underlayments etc. [as and where required throughout]. All sub-floor preparation materials are to be selected suited to the intended application, substrate conditions, and manufacturer installation requirements for newly specified products outlined herein. All preparation materials utilized are to provide a lasting bond to the subfloor and are to support long-term use of the specified finished flooring products. The flooring trade is to responsible to coordinate subfloor preparation and installation requirements with flooring manufacturers, allowing for and providing all

related materials and techniques herein.

All sub-floor preparation products are to be:

- fully bonded to substrate
- finished flush, level and smooth with surrounding subfloors
- fully compatible with both substrate material and the new newly specified floor finishes

Acceptable manufacturers for sub-floor preparation products include Mapei and Ardex.

PART 3 - EXECUTION

- | | | | |
|-----|---------------------------|----|---|
| 3.1 | Sub-floor Conditions | .1 | <p>Ensure concrete sub-floors are clean and dry, exhibiting negative alkalinity and no signs of efflorescence, carbonization or dusting.</p> <p>Perform sub-floor moisture test using test methods recommended by flooring manufacturer to determine moisture content in substrates. Ensure that they conform to manufacturer's standards prior to installation, and that correct manufacturer-recommended adhesives are used related to the moisture content of both sub-floors and relative humidity (ambient air) at the time of installation.</p> |
| 3.2 | Sub-floor Preparation | .1 | <p>Remove sub-floor ridges and bumps. Remove residue from any previous materials and/or finishes. Grind down to even surface where necessary. As required, provide dustless diamond grinding (via commercial dustless diamond grinder) to ensure flatness and smoothness of substrate free of irregularities.</p> |
| | | .2 | <p>Clean floors and substrates to remove all dust and irregularities which might adversely affect the work. Ensure use of suitable cleansing agents for areas of oil or other contaminants on the sub-floor surface. Rinse all cleansing agents from the floor to with clean water to ensure that no residue remains.</p> |
| | | .3 | <p>Fill all low spots, dishing, cracks, joints, holes and other inset irregularities in the sub-floor, choosing a patching, skimming, levelling or filler agent as required related to each subfloor irregularity. Utilize primers where necessary to ensure proper bond. Trowel and float filler agents as required to leave a smooth, hard surface once cured. Sand or grind cured fillers where required. Ensure that all filling materials provide a smooth, consistent and flat finish which is permanently bonded to the subfloor.</p> |
| 3.3 | Environmental Acclimation | .1 | <p>All resilient flooring products (including both sheet and tile products) are required to acclimate to ambient indoor temperatures within related installation spaces (at temperatures between 65°F and 75°F for a min. 72 hours prior to installation). Ensure that all resilient flooring materials are installed in full accordance with the manufacturer's</p> |

environmental conditions throughout.

3.4 Resilient Tile Installation

- .1 Apply adhesive uniformly using recommended trowel type in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place. All tile must be installed prior to adhesives 'setting-up' and curing in order to promote optimal and lasting bond.
- .2 All tile installation patterns, colours and locations are to be as per Architectural drawings and Colour and Finish Schedule.
- .3 ***Verify installation orientation of all resilient flooring products with Architect prior to installation***, particularly for resilient flooring products which are 'directional' (i.e. have a distinct visual 'grain' running in a single direction).
Unless noted otherwise, square-format resilient floor tile is to be installed in each room with all tiles (and visual 'grain' thereon) running in a single direction throughout. Quarter-turned (tessellated) tile installations will ***not*** be accepted. Installation orientation is to be as indicated on architectural drawings and/or as directed by the Architect.
- .4 Unless noted otherwise, install tile flooring in half offset brickwork pattern with all lines aligned and parallel to building lines wherever possible. All joints between tiles to be tight and free of gaps, ensuring same is true at patterned installations throughout.
- .5 Double-cut any patterned installations involving angles or curves using plywood scribing templates to suit.
- .6 Cut and fit neatly around fixed or excessively heavy objects.
- .7 Install flooring in removable floor access covers where applicable) maintaining floor pattern.
- .8 Terminate flooring at centerline of door (where possible) in openings where adjacent floor finish or colour is dissimilar.
- .9 Roll all installed products with commercial flooring roller as recommended by flooring product manufacturer to remove air bubbles below flooring and to ensure that all product lays flat and true, free of any lifting edges and irregularities throughout.
- .10 Following cleaning, provide initial waxing and sealing of VCT floors (in full accordance with VCT manufacturer's recommendations) prior to hand-over to client.

3.5 Base Installation

- .1 Set base in adhesive tightly against wall and floor surfaces.

Use lengths as long as practical and not less than 500mm (20") long.

- .2 Install straight and level to variation of 1:100.
- .3 All base products are to be installed in full accordance with manufacturer's recommendations, including scribing details at all interior and exterior corners. Fit base goods neatly to all doorframes. All short returns of base goods (and at any locations where base product may not sit firmly against wall surface), base to be secured in place with construction adhesive or contact cement adhesive, sufficient to ensure full adhesion.

**3.6 Protection
of Finished
Work**

- .1 Prohibit traffic on floor for 48 hours after installation.
- .2 Where floors are to be subject to traffic before final inspection, provide suitable protection following installation of initial wax and seal by flooring trade.

END OF SECTION 09660

PART 1 - GENERAL

1.1 General

Division One, General Requirements, is part of this section and shall apply as if repeated here.

1.2 Description of Work

Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:

- .1 This document specifies a wood strip gymnasium floor system consisting, in general, of maple flooring, plywood subflooring, 55 Durometer EPDM rubber, frusto-conical shape pads, vapour barrier, sanding, sealers, finishes, game lines, and rubber or vinyl wall base.
- .2 The new slab recess for new wood flooring is assumed at 2.75".
- .3 Floor system shall be:
 - i) Bio Cushion by Robbins Sports Surfaces
 - ii) Neoshok by Connor
 - iii) Action Thrust 1 available from Advantage Sport
 - iv) Safe 2 by Horner
 - v) Tarkett Clutch Court Performance Core
 - vi) or approved equal (via addenda only)

All incorporating $\frac{3}{4}$ " x $1\frac{7}{8}$ " x $\frac{7}{8}$ ", 60-70 Durometer conical pads.

- .4 The flooring contractor shall provide all tools and services to furnish, deliver, and install a complete wood floor system from the surface vapor proofing of the slab, where required, through the sanding and finishing, plus the installation of perimeter base moldings and thresholds.
- .5 The flooring contractor shall install all game floor sockets as supplied by Athletic Equipment, Section 11480.

1.2 Quality Assurance

- .1 The wood flooring shall be supplied by Canadian MFMA approved mills only. No tariff costs will be entertained.
- .2 The flooring installers that will be onsite performing the installation shall be led by an individual that is an accredited installer recognized by the MFMA and have at least 5 years of

school board gymnasium installation experience. References may be requested prior to award.

- .3 Flooring shall be delivered to the premises a minimum of seven days before installation commences, or as required for acclimation.
 - .4 All flooring bundles should be broken and loosely piled to acclimate the flooring to environmental conditions in the building.
- 1.4 Working Conditions**
- .1 Heating shall be maintained at a temperature range of 55° to 75° and a relative humidity range of 35% to 50% (no more than a 15% difference between high and low humidity levels).
- 1.5 Warranty**
- .1 The flooring contractor shall warrant the floor for a period of one year and shall furnish a warranty from the flooring manufacturer.
 - .2 Refer to individual flooring manufacturer's warranty for specific provisions and exclusions.

PART 2 - PRODUCTS

- 2.1 Materials**
- .1 Flooring shall be MFMA Canadian Northern Hard Maple: 25/32" thick x 2-1/4" wide; Second, and Better Grade; T&G and EM; grade marked and stamped as produced by an MFMA member manufacturer. Random length strips.
 - .2 Vapour barrier shall be 6 mil. polyethylene.
 - .4 Subfloor shall be 2 layers of 15/32" 4' x 8' APA Rated Sheathing, Exposure 1.
 - .3 Cushion pads shall be 3/4" thick conical shaped 60-70 EPDM rubber as supplied by flooring manufacturer.
 - .6 Flooring fasteners shall be 2" barbed cleats or 15 gauge coated staples, unless otherwise specified by flooring manufacturer.
 - .7 Wall base shall be 3" x 4" heavy duty molded, vented, rubber or vinyl cove base with premolded outside corners as supplied by flooring manufacturer.
 - .8 Extruded aluminum thresholds as required.

- .9 Finish materials shall be selected from the most recent listing of MFMA tested and certified products and shall be applied according to manufacturer's instructions.
- .10 Expansion joint filler to be medium density compressed cork strip that is mildew resistant and has a resin binder.

PART3 - EXECUTION

3.1 Inspection

- .1 Inspect concrete slab for proper tolerance and dryness, and report any discrepancies in writing to the Owner for correction.
- .2 The concrete slab shall be cleaned of all debris by flooring contractor.

3.2 Installation

- .1 Cover entire concrete slab with 6 mil. Polyethylene, lapping joints minimum of 4" and taped. Edge at junctions with vertical faces, poly to be turned to be flush with finished floor.
- .2 Install first layer of subfloor plywood opposite the direction of the maple flooring. ¼" spacing all edges and breaking joints 4'. Provide 2" expansion voids at perimeter and all vertical obstructions. The underside of the first layer shall have 32 conical pads per sheet attached 12" o.c. and 6" from 4 edges of subfloor material on all sides.
- .3 The second layer of subfloor material shall be laid diagonally (45°) over the first layer ¼" spacing all edges and breaking joints 4". Attach second layer of subfloor material with nails or staples 12" o.c.
- .4 Install maple flooring in the same direction by power nailing or stapling approximately 12" o.c.
 - i) Space joints between flooring strips to allow for immediate expansion, in accordance with local humidity conditions are to be left as required and filled with expansion joint material.
 - ii) Provide 2" expansion voids at the perimeter and at all vertical obstructions.

- 3.3 Floor Sanding**
- .1 Machine sand with coarse, medium and fine paper to a smooth, even and uniform surface.
 - .2 Remove sanding dust from entire surface by tack or vacuum.
- 3.4 Finishing**
- .1 Inspect entire area of floor to ensure that surface is acceptable for finishing, completely free from drum stop marks, gouges, streaks, shiners, sanding dust and perfectly clean.
 - .2 Apply seal and finish using 4 coats of oil modified polyurethane and as per manufacturer's instructions.
 - .3 Buff and clean floor between each coat.
 - .4 Paint game lines as shown on drawings. Game line paint shall be Bona CourtLines Sport Floor Paint. Paint between seals and first finish coat.
 - .5 Seal floor and game lines with 4 coats of oil modified polyurethane and as per manufacturer's instructions.
- 3.5 Base Installation**
- .1 Install vent cove base by anchoring to walls with base cement, screws or anchors. Miter all joints at 45° angles. Nail securely into blocking or last board.
 - .2 Miter inside corners, and use premolded outside corners. Double nail corners carefully.
 - .3 Install metal thresholds as required, anchoring firmly in concrete floor beyond limits of wood flooring.
- 3.6 Floor Sockets**
- .1 Set floor sockets plumb, true and accurately centred in locations indicated on the drawings in accordance with manufacturer's recommended installation instructions. Set to provide flush finish with wood floor finish.
- 3.7 Maintenance**
- .1 Upon completion of floor installation, the owner's attendants or individuals in charge are responsible for the upkeep of the building and are to see that the care and maintenance instructions of the MFMA and the flooring manufacturer are followed.

GYM WOOD FLOORING

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End of Section 09850

PART 1 - GENERAL**1.1 General**

Division One, General Requirements, is part of this section and shall apply as if repeated here.

1.2 Description of Work

Provide all labour, materials, and equipment required or called for in this specification, or which is necessary to complete the work without any extra cost. This work may require, without strict limitation to the following (at the building interior and/or exterior):

- .1 Priming and painting of interior masonry, gypsum board, cement plaster, plaster and other surfaces as indicated on Drawings and Schedules.
- .2 Finish priming and painting of steel doors and frames, and other non-prefinished metal components including priming and finish painting of all miscellaneous steel items contained within the Architectural and related Engineering drawings.
- .3 Staining and topcoating or other finishing of all wood and wood veneer items (including trimwork, wood perimeter of plastic laminate doors, hardwood veneered cabinetry etc.) as applicable.
- .4 Painting and/or priming (as required) of all new non-prefinished miscellaneous metal items (convector cabinets, fire-hose cabinets, access hatches) etc.
- .5 Re-painting and/or priming (as required) of existing metal items (convector cabinets, fire-hose cabinets, access hatches) etc. specified for new paint finish.
- .6 Painting of exposed metal ducts, grilles, louvers and related equipment as indicated on the drawings and schedules.
- .7 Painting of steel structural items throughout.
- .8 Painting of miscellaneous non-prefinished steel and metal items (bench supports, countertop supports, lintels etc.)
- .9 Other associated work as indicated on drawings and schedules.

1.3 Related Work by Others

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|----|------------------------------------|---------------|
| .1 | Shop priming structural steel | Section 05120 |
| .2 | Shop painting miscellaneous metals | Section 05500 |
| .3 | Steel Doors & Frames | Section 08100 |
| .4 | Metal Stud and Gypsum Board | Section 09111 |
| .5 | Concrete Masonry Units | Section 04220 |
| .6 | Sealants | Section 07900 |

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|------------|--|----|---|
| 1.4 | Requirements
of Regulatory
Agencies | .1 | All finishes shall meet the flame spread and smoke development requirements of the Ontario Building Code for the specific location and application for all parts of the Work. |
| 1.5 | Environmental
Requirements | .1 | Apply finishing materials only when air and surface temperatures have reached the minimum level recommended by the manufacturer's specification for each product, and have been maintained at this temperature for a minimum of 24 hours. |
| | | .2 | Do not apply exterior finish in direct sunlight that raises surface temperatures above that for proper application and drying, nor in rainy, foggy or windy weather. |
| | | .3 | Do not apply finishes when relative humidity is over 50%, when condensation has formed or is likely to form, nor immediately following rain, frost or dew. |
| | | .4 | Do not apply paint where moisture content, in gypsum board, pipe insulation or wood is above paint manufacturer's recommended maximum allowances. Confirm results of moisture test with Architect before proceeding. |
| | | .5 | Do not apply paint finish in areas where dust is being generated. |
| 1.6 | Colours and
Samples | .1 | All colours shall be as scheduled by the Architect on the Colour and Finish Schedule or as specified herein. |
| | | .2 | Paint samples shall be prepared as directed by the Architect in accordance with Section 01340 and 1.11 of Section 09900. All site work on site must be completed to match approved sample. All product mixing and work on-site must be preceded with Architect's approved samples for paint & stain, lacquer and varnish, etc.

Acceptable paint and stain samples include 8" x 11" (minimum) sample size. Only "draw down" samples of actual paints will be accepted for paint colours. Minimum requirements are 2 draw down samples per paint colour per different paint product and per different paint finish. Stain samples to be applied to wood sample of wood species specified for use in the project. |
| 1.7 | Cooperation
with Others | .1 | This contractor shall examine all drawings and specifications of all trades throughout the building for information affecting the work of this trade. |
| 1.8 | Plant and
Scaffolding | .1 | The contractor shall provide all plant and scaffolding necessary for proper and efficient performance of the work. |

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| 1.9 Field Quality Control | .1 | Arrange for periodic visits to site by paint manufacturers' representatives while work is in progress. On each visit he shall verify that specified materials and methods are used, and that procedures agreed upon at the initial site meeting are followed. |
| 1.10 Product Delivery, Storage and Handling | .1 | Deliver to site each container sealed and labeled with manufacturer's name, catalogue number or brand name, colour, and formulation type, reducing instructions, and reference standard specification number if applicable |
| | .2 | Store materials on site, and in an area specifically set aside for purpose, that is locked, ventilated, maintained at a temperature of over 4 degrees C (40 degrees F) and protected from direct rays of sun. |
| | .3 | Ensure that health and fire regulations are complied with in storage area. Provide carbon dioxide fire extinguishers of 9 kg (20 lbs.) minimum capacity in each storage area while materials are contained within. |
| | .4 | On each container, for materials requiring a fire hazard classification, attach an Underwriter's label verifying that the material is listed under their label service, and giving the hazard classification. |
| 1.11 Protection | .1 | Cover or mask surfaces adjacent to those receiving treatment and finishing to protect work of others from damage and soil. Mask instruction and specification plates attached to equipment being painted. |
| | .2 | Take particular care in storage and mixing areas that floors are protected by tarpaulins and metal pans. |
| | .3 | Place cloths and other disposable finishing materials, that are a fire hazard, in closed metal containers containing water, and remove from building every night. |
| | .4 | Coordinate with the appropriate trades for the removal from finished surfaces, storage and reinstallation after finish work is completed of finish hardware, switch and receptacle plates, escutcheons, luminaries frames, and similar items. |
| | .5 | Post "No Smoking" signs and ensure that spark-proof electrical equipment is used in areas where flammable painting materials are being applied. |
| | .6 | Post "Wet Paint" signs throughout freshly finished areas and remove when finishes are dry. |

**1.12 Colour and Product
Fidelity and Finish**

- .1 Draw Down samples of each paint colour and paint sheen for each different paint product must be approved by the Architect prior to installation. The Contractor will retain 1 full set of the approved samples on site and is responsible to verify the application of the proper colours and products throughout the project. The Architect reserves the right to enforce full conformance of the finished work to the approved samples and specified products as shown on drawings, Schedules, Addenda's, and all Contract Documents. Any colours or products which the Architect deems unsuitable due to lack of colour or sheen fidelity, improper application, poor workmanship or any conditions not in strict accordance with the Contract Documents will be rectified by the Painting Contractor to the full satisfaction of the Architect in accordance with the Contract Documents at no cost increase.

PART 2 - PRODUCTS**2.1 Paint Materials**

- .1 Painting materials such as primers, paints, rust-inhibiting agents, stains, fillers, varnishes, lacquers, etc., to be supplied by Benjamin Moore, Sherwin Williams or ICI/Dulux only. All paint to be highest professional/commercial grade products available from each manufacturer as prescribed in PART 3 below, relative to the intended application. Only OPCA/CPCA/CGSBQ approved equivalents within the noted manufacturers will be accepted.
- Painting contractors must inform the Architect in writing which product line he intends to use and is to receive approval prior to mixing. Selection of final product line is completely at the Architect's discretion and the Architect reserves the right to select any of the specified product lines at no cost increase.
- .2 All materials to be the highest professional/commercial grade available from the manufacturer for each finish type, to meet or exceed CGSB Specifications, as outlined in PART 3 herein.
- .3 Materials for application of each finish type shall be products from a single manufacturer.
- .4 Materials such as putty, linseed oil, shellac, turpentine, etc., shall be pure, or of the highest quality produced or recommended by the paint manufacturer, and bear an identifying label on the container.
- .5 Gypsum Board patching compound: Resurfo by Reardon or alternate.

PART 3 – EXECUTION & INSTALLATION

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|--------------------------|-----------|--|
| 3.1 Paint Colours | .1 | All paint/pigment colours and locations to be in full and strict accordance with Architect's drawings, Room Finish Schedule and Colour Finish Schedule. Any areas or items requiring paint finishes which appear unclear or which are insufficiently documented, are to be reported to the Architect for direction prior to paint mixing and installation. Any site work relative to such items undertaken by the Contractor or trades without the consultation of the Architect is the sole responsibility of the Contractor and is subject to further rectification of the work for unacceptable materials, colours, or finishes, as per the Architect's direction, at no cost increase. |
| | .2 | Except where noted otherwise within the Contract Documents, and excluding those surfaces featuring painted wall graphics, the Architect reserves the right to select any number of paint/pigment colours for each room, up to one individual colour per wall surface/wall plane (or ceiling surface/ceiling plane), at no cost increase. This applies only to wall and ceiling surfaces and excludes trims and other architectural features thereon. For all other architectural items associated with the walls, floors, ceilings, etc. in each room, the Architect reserves the right to select another paint colour differing from that of the adjacent surfaces at no cost increase. All paint colours to be noted on Colour/Finish Schedule (issued post-Tender). |
| 3.2 Examination | .1 | Verify that specified environmental conditions are ensured before commencing work. |
| | .2 | Ensure that surfaces to receive finishing materials are satisfactory for specified materials and will not adversely affect execution, permanence, or quality of work. |
| | .3 | Maintain on site at all times until work is completed a moisture meter, hygrometer and thermometer to verify surface and environmental conditions. Test all surfaces for moisture content with an electronic moisture meter, and concrete, masonry, exterior insulation and finish systems, plus plaster surfaces for acid alkali balance with appropriate equipment and procedures. |
| 3.3 Mixing | .1 | Unless specified otherwise paints shall be ready-mixed. All catalyzed products to be mixed on site to as required to provide a uniform and optimal finish quality. |

3.4 Workmanship

- .1 All work must be executed by skilled, experienced mechanics under the direction of a competent foreman. All paint and enamel shall be evenly spread and no coat shall be applied until the previous coat is perfectly dry.
- .2 All products are to be applied in full accordance with the paint manufacturer's recommendations, including surface preparations, recommended application tools, techniques, intermediate drying times, etc. All products are to be applied in full accordance with the manufacturer's maximum recommended dried film thicknesses (dft) throughout.
- .3 There shall not be any drips or runs of materials. The woodwork shall be well-rubbed down before the first coat and between all coats. All work shall be to the satisfaction of the Architect.
- .4 Brush on all painting materials covered by this division, except where noted in 3.4.8 below. If this contractor wishes to spray certain surfaces, obtain prior approval from the Architect. Apply painting materials evenly and smoothly.
- .5 Sand and dust between each coat to remove defects visible from distance up to 1.0m (3' -0").
- .6 Finish bottoms, tops, edges and sides of all doors, including returns to cutouts where applicable.
- .7 In the opinion of the Architect, the number of coats of paint specified should produce a superior finish. However, if more coats than the number specified are required to meet the approval of the Architect, they shall be supplied and applied at no extra charge. Painting contractor may be required to verify dry film thickness (dft) of any products applied under this Section, at no cost increase.

3.5 Preparation

- .1 All surfaces or materials to receive paint finish are to be prepped in full accordance with the finish manufacturer's specifications relative to the material substrate, using the finish manufacturer's recommended products. It will be assumed by the Architect that any improperly adhering paint finishes are the result of inadequate preparation or improper application, and are subject to full rectification at no cost increase.
- .2 Touch-up shop painted primer on steel with approved primer. Tint filler to match stains for stained woodwork.
- .3 Prepare galvanized steel and zinc coated surfaces with one coat of copper sulfate solution in water (1:16 proportion).
- .4 Prepare exposed concrete, plaster and masonry to make free of dust, dirt, grease, loose mortar on face, etc. Apply filler to concrete block of sufficient density to eliminate pinholing.

- .5 Interior gypsum board to be prepared by cutting out minor imperfections, such as scratches, cracks, abrasions in surface, and filled with patching compound; sand smooth when dry. Seal before prime coat application.
- .6 Prepare wood finishes (designated for stain and/or clear topcoat finish) by applying matching (or stainable) wood filler to suit, at nail holes, gaps, cracks and imperfections, blending filled spots with adjacent surfaces. Sand all filler smooth and flush with adjacent surface, applying in multiple coats as required. Ensure that all wood is adequately sanded and free of contaminants which may adversely affect quality and consistency of subsequent stain and/or topcoat finishes.
- 3.6 Mechanical and Electrical Equipment**
- .1 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment in and adjacent to finished areas. Colour and sheen to match adjacent surfaces.
- .2 Paint both sides and all edges of plywood backboards for electrical equipment before installation. Leave equipment in original finish except for touch-up as required.
- 3.7 Exterior Coatings**
- The items noted in this section below are provided for reference as/if required.*
- .1 Miscellaneous Steel Lintels and Non-prefinished Steel Items:
- 1 coat Sherwin Williams "Kem Bond Hi-Solids" Universal Metal Primer (alkyd); VOC compliant
 - 2 coats Sherwin Williams "Industrial Enamel Urethane" topcoat (alkyd), B54W151 Series, gloss finish; VOC compliant [spray applied finish at steel doors]
- .2 Miscellaneous Ferrous Metals:
- 1 coat Sherwin Williams "Kem Bond Hi-Solids" Universal Metal Primer (alkyd); VOC compliant
 - 2 coats Sherwin Williams "Industrial Enamel Urethane" topcoat (alkyd), B54W151 Series, gloss finish; VOC compliant
- .3 Miscellaneous Galvanized Items:
- 1 coat Sherwin Williams "Galvite HS" acrylic primer, B50 WZ30 Series, spray applied
 - 2 coats Sherwin Williams "Industrial Enamel Urethane" topcoat (alkyd), B54W151 Series, gloss finish; VOC compliant

- .4 Exterior Steel Door Frames & Sidelight Frames and Hollow Structural Steel Posts (HSS-P):
- 1 coat Sherwin Williams "Kem Bond Hi-Solids" Universal Metal Primer (alkyd); VOC compliant
 - 2 coats Sherwin Williams "Industrial Enamel Urethane" topcoat (alkyd), B54W151 Series, gloss finish; VOC compliant
- 3.8 Interior Coatings**
- .1 Concrete Block - Paint Finish [general use u.n.o.):
- 2 coats Sherwin Williams "Prep Rite" Blockfiller, B25 Series
 - 2 coats Sherwin Williams abrasion resistant "Duration Interior Latex" A98 Series *or* Dulux "Diamond Interior 100% Acrylic", satin finish
- .2 Concrete Block – Paint Finish in Gymnasium Lower Walls (up to 7'-10 1/2" a.f.f.):
- 2 coats Sherwin Williams "PrepRite Block Filler" @ 10.0 – 18.0 mils dft/coat
 - 2 coats Sherwin Williams "Pro Industrial Zero VOC Waterborne Catalyzed Epoxy" @ 2.5 – 3.0 mils dft/coat
- .3 Gypsum Wall Board Walls – Paint Finish
- 1 coat Sherwin Williams "Prep Rite 200" Primer, B28W200 Series
 - 2 coats Sherwin Williams abrasion resistant "Duration Interior Latex" A98 Series *or* Dulux "Diamond Interior 100% Acrylic", satin finish
- .4 Gypsum Wall Board Ceilings/Bulkheads - Paint Finish:
- 1 coat Sherwin Williams "Prep Rite 200" Primer, B28W200 Series
 - 2 coats Sherwin Williams "Promar 200 Zero VOC" Interior Latex" Interior Acrylic, eggshell finish
- .5 Steel Door and Frames and All Miscellaneous Non-prefinished
- Steel Items (u.n.o.) – Paint Finish:
 - 1 coat Sherwin Williams "Kem Bond Hi-Solids" Universal Metal Primer (alkyd); VOC compliant
 - 2 coats Sherwin Williams "Industrial Enamel Urethane" topcoat (alkyd), B54W151 Series, gloss finish; VOC compliant
- .6 Galvanized and Zinc coated Metals – Paint Finish:
- 1 coat Sherwin Williams "Galvite HS" acrylic primer, B50 WZ30 Series, spray applied
 - 2 coats Sherwin Williams "Industrial Enamel Urethane" topcoat (alkyd), B54W151 Series, gloss finish; VOC compliant
- .7 Exposed Underside of Metal Deck, Open Web Steel Joists, Steel Roof Structure, Exposed Metal Ducts, Conduit, etc. – Paint Finish:

- 2 coats Sherwin Williams "Waterborne Acrylic Dryfall", B42 Series, eggshell finish, spray applied

- .8 Solid Maple Hardwood Trims [Clear Topcoat Finish]:
 - 1 Coat Sanding Sealer [as/if required]
 - 4 coats Minwax Ultimate Floor Finish, Water-Based Urethane Topcoat, Satin sheen

3.10 Touch-Up & Cleaning

- .1 Touch up and finish visible defects in the work. Refinish entire wall, ceiling or finished surface where substrate and/or finish is significantly damaged or not deemed acceptable by the Architect.
- .2 Remove all overspray paint or similar finish from prefinished or unpainted items throughout. Clean and remove any paint overspray of one colour on a painted surface of dissimilar colour or finish. Repaint and restore finishes as required to blemish-free state.
- .3 Leave storage and mixing areas clean and in same condition as adjacent spaces in project.

END OF SECTION 09900

PART 1 - GENERAL

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| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. |
| 1.2 Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:</p> <ul style="list-style-type: none"> .1 Preparation of new and existing concrete floors as required to accommodate new epoxy paint floor finishes specified herein, including removal of residue from all pre-existing flooring (to be removed) and all subsequent subfloor preparation including grinding, scraping, cleaning, patching and filling etc. to ensure seamless consistency and correct adhesion of new epoxy floor finishes. .2 Supply and installation of new epoxy floor finishes as specified herein. |
| 1.3 Related Work by Others | <ul style="list-style-type: none"> .1 Demolition Section 02100 .2 Cast-in-place Concrete Section 03300 |
| 1.4 Requirements of Regulatory Agencies | <ul style="list-style-type: none"> .1 All finishes shall meet the flame spread and smoke development requirements of the Ontario Building Code for the specific location and application for all parts of the Work. |
| 1.5 Environmental Requirements | <ul style="list-style-type: none"> .1 Apply finishing materials only when air and surface temperatures have reached the minimum level recommended by the manufacturer's specification for each product, and have been maintained at this temperature for a minimum of 24 hours. .2 Do not apply finishes when relative humidity is over 50%, when condensation has formed or is likely to form, nor immediately following rain, frost or dew. .3 Do not apply finish where moisture content, in substrate above finish manufacturer's recommended maximum. Confirm results of moisture test with Architect before proceeding. .4 Do not apply finish in areas where dust is being generated. |

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| 1.6 Colours and Samples | .1 | Finish colours shall be as selected by the Architect and are to match Architect supplied sample. |
| | .2 | Samples shall be prepared as directed by the Architect in accordance with Section 01340 and 1.11 of Section 09900. All samples are to be approved by the Architect prior to mixing any product and prior to related installation on site. |
| 1.7 Cooperation with Others | .1 | This contractor shall examine all drawings and specifications of all trades throughout the building for information affecting the work of this trade. |
| 1.8 Field Quality Control | .1 | Arrange for periodic visits to site by finish manufacturers' representatives while work is in progress. Visits shall verify that specified materials and methods are used, that substrates have been correctly prepared, and that procedures agreed upon at the initial site meeting are followed. |
| 1.9 Product Delivery, Storage and Handling | .1 | Deliver to site each container sealed and labeled with manufacturer's name, catalogue number or brand name, colour, and formulation type, reducing instructions, and reference standard specification number if applicable |
| | .2 | Store materials on site, and in an area specifically set aside for purpose, that is locked, ventilated, maintained at a temperature of over 4 degrees C (40 degrees F) and protected from direct rays of sun. |
| | .3 | Ensure that health and fire regulations are complied with in storage area. |
| | .4 | On each container, for materials requiring a fire hazard classification, attach an Underwriter's label verifying that the material is listed under their label service, and giving the hazard classification. |
| 1.10 Protection | .1 | Cover or mask surfaces adjacent to those receiving treatment to protect work of others from contamination. |
| | .2 | Place cloths and other disposable finishing materials, that are a fire hazard, in closed metal containers containing water, and remove from building every night. |

PART 2 - PRODUCTS**2.1 Materials****.1 Epoxy Paint Flooring (EPF):**

"Epoxal 100HP" high performance, two-part, high-build 100% solids epoxy coating c/w #55 medium-texture anti-slip aggregate. Colour to be determined by Architect from manufacturer's standard range. Product shall be as manufactured and supplied by Niagara Protective Coatings (NPC) or approved alternate.

.2 Materials for epoxy flooring finish shall be products from a single manufacturer and supplier.

.3 Any thinning mediums, cleaning agents, etc. are to be as recommended by the finish manufacturer for the intended application.

PART 3 - EXECUTION**3.1 Colours**

.1 All epoxy floor coating colours are to match Architect supplied sample, and/or existing adjacent terrazzo materials as directed by the Architect).

3.2 Examination

.1 Verify that manufacturer's required environmental conditions are met before commencing work.

.2 Ensure that surfaces to receive finishing materials are satisfactory for specified materials and will not adversely affect execution, permanence, or quality of work.

.3 Maintain on site at all times until work is completed a moisture meter, hygrometer and thermometer to verify surface and environmental conditions. Test all surfaces for moisture content with an electronic moisture meter, and concrete, masonry, exterior insulation and finish systems, plus plaster surfaces for acid alkali balance with appropriate equipment and procedures. Do not proceed with work unless all manufacturer requirements are met.

Moisture content should not be in excess of 4% and the surface temperature shall be a minimum of 15°C (59°F).

.4 Surfaces to be coated shall be sound, clean, non-dusting, fully cured and free from oil, efflorescence and any contaminants.

.5 Report to General Contractor in writing all defects and unsatisfactory conditions prior to beginning work on site. Commencement of work shall imply acceptance of the

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existing conditions.

- 3.3 Mixing** .1 Mix all finishes in accordance with manufacturer's recommendations, noting pot life and open times of product.
- 3.4 Workmanship** .1 All work must be executed by skilled, experienced mechanics under the direction of a competent foreman. All finished coatings shall be applied evenly, free of irregularities and blemishes.
- .2 All products are to be applied in full accordance with the paint manufacturer's recommendations, including surface preparations, recommended application tools, techniques, intermediate drying times, etc. All products are to be applied in full accordance with the manufacturer's recommended dried film thicknesses (dft) throughout.
- .3 There shall be no application marks visible in cured materials. All work shall be completed to the satisfaction of the Architect.
- 3.5 Preparation** .1 All surfaces or materials to receive epoxy floor finish are to be prepped in full accordance with the finish manufacturer's specifications relative to the existing conditions, and the material substrate using the finish manufacturer's recommended products. It will be assumed by the Architect that any improperly adhering floor finishes are the result of inadequate preparation or improper application and are subject to full rectification at no additional cost.
- .2 Minimum preparation procedures for each epoxy floor finish type to be as noted in 3.6 below and to be in full accordance with manufacturer's recommendations for the intended application.
- .3 Mechanical abrasion of existing concrete as well as new or existing concrete substrates is required to remove any loose conditions, and to create a surface profile sufficient for a correct mechanical bond of epoxy finish. This may require the use of shot-blast machinery, sand-blasting, scarifier or dustless diamond grinder. Ensure methods of mechanical abrasion are dust-free.
- .4 Previously coated surfaces may require special consultation from the epoxy flooring manufacturer. Ensure reporting and resolution of same for all indeterminate conditions prior to commencing with work on site.
- .5 Patch all subfloor irregularities and holes true and flush with NPC Epoxy Gel or Epoxy (as suited to the related conditions) to ensure seamless and consistent finish of epoxy floor finish

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specified.

**3.6 Epoxy Floor
Finish Application****.1 Epoxy Floor Paint (EFP) on
Concrete Sub-Floors:**

Ensure max. 4% moisture content in the all substrates including new and existing substrates and patching materials.

- ensure that min. temperature of substrate is 59°F
- prepare concrete substrates as/if required with a dustless diamond grinder (or alternate abrasion system as required) removing all ridges, residues and irregularities adversely affecting the appearance and adhesion of the finish system
- on properly prepared concrete substrates, apply 3 coats of NPC "Epoxal 100 HP" (each coat to be 7-9 mil dft. For a total finish thickness of 21 - 27 dft.); gloss finish
- apply each coat by mixing material, pouring mixed material onto floor, spreading to a uniform thickness with a rubber squeegee, and backrolling to remove squeegee marks and provide a uniform visual finish
- mix EPOXAL 100 HP as per manufacturer's recommendations, and use as prime coat for subsequent coats on properly prepared concrete and/or terrazzo substrates
- pour product onto floor; spread with manufacturer-recommended squeegee, and backroll with a medium-nap roller to eliminate squeegee lines
- after prime coat, apply 'Epoxal 100 Gel' filler to all cracks and irregularities, filling them flush and level with adjacent surfaces
- second coat of EPOXAL 100 HP must be applied within 24-48 hours after initial coat is complete to ensure proper bond, utilizing same application technique (mix, pour, squeegee and backroll) as utilized for prime coat
- following second coat, apply 'Epoxal 100 Gel' filler to all remaining cracks and irregularities, filling them flush and level with adjacent surfaces
- apply third coat of EPOXAL 100 HP, utilizing same application technique (mix, pour, squeegee and backroll) as utilized for prime coat
- textured finish in third coat to be #55 medium texture, using a hopper blower to broadcast #55 silica grit into the wet floor, following rubber squeegee application
- back roll the coating immediately with manufacturer-recommended nap roller to encapsulate the grit and to achieve a uniform finish

- 3.7 Adjustment, Cleaning & Protection**
- .1 Prohibit foot traffic on all floor finishes until fully cured.
 - .2 Touch-up any minor defects in floor finishes with manufacturer recommended product.
 - .3 Clean-up all mixing and storage areas.

END OF SECTION 09950

PART 1 - GENERAL

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|--------------------------------|---|--------------------|---------------|---------------------|---------------|-------------|---------------|----------------------------|---------------|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | | | | | | | | |
| 1.2 Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:</p> <ul style="list-style-type: none"> .1 Supply and installation of all white boards indicated as 'WB' on Architectural floor plans, and/or as illustrated on interior elevation drawings. White board sizes, locations and quantities are to be as indicated on the Architectural drawings. .2 Supply and installation of all tack boards indicated as 'TB' on Architectural floor plans, and/or as illustrated on interior elevation drawings. Tack board sizes, locations and quantities are to be as indicated on the Architectural drawings. .3 Allow for additional boards as noted in schedule following this section. | | | | | | | | |
| 1.3 Related Work | <table border="0"> <tr> <td style="padding-right: 20px;">.1 Rough Carpentry</td> <td>Section 06100</td> </tr> <tr> <td>.2 Finish Carpentry</td> <td>Section 06200</td> </tr> <tr> <td>.3 Millwork</td> <td>Section 06400</td> </tr> <tr> <td>.4 Steel Stud & Gypsum Bd.</td> <td>Section 09111</td> </tr> </table> | .1 Rough Carpentry | Section 06100 | .2 Finish Carpentry | Section 06200 | .3 Millwork | Section 06400 | .4 Steel Stud & Gypsum Bd. | Section 09111 |
| .1 Rough Carpentry | Section 06100 | | | | | | | | |
| .2 Finish Carpentry | Section 06200 | | | | | | | | |
| .3 Millwork | Section 06400 | | | | | | | | |
| .4 Steel Stud & Gypsum Bd. | Section 09111 | | | | | | | | |
| 1.4 Shop Drawings | .1 Submit shop drawings showing sizes, trim profiles etc., in accordance with Section 01340. | | | | | | | | |

PART 2 - PRODUCTS

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| 2.1 Whiteboards | <ul style="list-style-type: none"> .1 All whiteboards/marker boards shall be as manufactured by ASi Visual Display Products Series 9800 or Global School Products, consisting of a sandwich type construction composed of face panel, core and rear balancing steel. Product surface to be suited to projection from overhead short through projectors mounted above board and for use of dry-wipe markers from face. .2 Writing face to be white porcelain enamel coating fused to steel backing. .3 Core 11.1mm (7/16") impregnated fibreboard laminated under |
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heat and pressure to face panel and back sheet using adhesives that ensure no joint failure of the contact surfaces.

- .4 Backing (balancing) sheet to be 28 gauge zinc coated stretcher steel leveled in one unjointed section. Overall thickness of whiteboard to be 12.7mm (½").
 - .5 Aluminum trims as noted in 2.2 below.
- 2.2 Aluminum Trim**
- .1 Except where noted otherwise, aluminum trim to be Series 800 by ASi Visual Display Products or Global School Products. Aluminum to be 6063T5 alloy with clear etched and anodized 0.051mm (.002') satin finish free from extruding draw marks and surface scratches. All whiteboards to be supplied with full perimeter trims and accessories, as specified below.
 - .2 Marker tray: Series 800 complete with contour fitting end caps and castings by ASi Visual Display Products or Global School Products. Provide 1 marker tray at full bottom perimeter of each whiteboard.
- 2.3 Tackboards**
- .1 All tackboards shall be 12.7mm (1/2") factory prelaminated units consisting of 6mm (1/4") thick ASP Natural cork laminated to 6mm (1/4") particle board or masonite substrate as manufactured by ASi Visual Products or Global School Products. Units to be fabricated under mechanical pressure available in sizes up to 1219mm x 2438mm (4' -0" x 8' -0"). Unit dimensions as per Architect's drawings. Natural cork colour throughout. Bonding of materials by waterproof adhesive that will not delaminate or rupture at the contact surfaces. Finished unit to be trimmed all around with clear aluminum perimeter trim as note in 2.4 below.
 - .2 All tackboards shall meet the minimum requirements of the applicable building code and/or Ontario Fire Marshal's office.
- 2.4 Fabrication**
- .1 Fabricate panels to sizes as indicated on Architectural drawings and details shown therein. Site procession of panels is to be carried out in strict accordance to manufacturer's recommendations.

PART 3 - EXECUTION

- 3.1 Installation**
- .1 Install boards plumb and level in accordance with

manufacturer's instructions and specifications, to provide rigid, secure surface.

- .2 Install trim and framing around all tackboard panels. Make intersecting joints to hairline fit, free of rough edges. Use concealed brackets throughout, and to reinforce and hold joints tight and flush. No exposed fasteners permitted. Overlap trim 6mm onto panels.
- .3 Use surface fasteners of following types, except where specified type is indicated.
 - (a) To hollow masonry, plaster and panel surfaces use toggle bolt.
 - (b) To solid masonry and concrete use expansions shield with lag screw, jut fibre or lead plug with wood screw.

3.2 Cleaning

- .1 Clean all surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION 10120

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Complete custom fabricated room signs as per specification.

1.2 RELATED SECTIONS

- A. Section 08100 – Steel Doors and Frames.

1.3 REFERENCES

- A. Accessibility for Ontarians with Disabilities Act. (AODA)
- B. CAN-ASC-2.4 – Wayfinding and Signage

1.4 SUBMITTALS

- A. Product Samples: One full size sign sample illustrating the design, construction, colors, typestyles, mounting method and other details as specified.
- B. Drawings: Identifying all materials, sizes, construction details, graphics layouts, typestyle specifications and mounting methods.
- C. Signage Schedule: Complete with location of each sign and the required copy/text.
- D. Sign Program Maintenance Plan:
 - 1. Manufacturer shall provide details of software and system of color coated paper sign inserts allowing client to update and maintain signage graphics in-house.
 - 2. Manufacturer shall provide details of an Online Reordering & Maintenance Application whereby the client can submit sign reorders online and store/view relevant project information such as sign-type drawings, message schedules and product instructions.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Work required under this section from manufacturer regularly engaged in work of this type and scope for a minimum of 5 years.
- B. Product Warranty: Provide manufacturer's warranty against defects in materials and workmanship for a minimum of 1 year.
- C. Samples: One full size sign sample illustrating the design, construction, colors, typestyles, mounting method and other details as specified. Provide sample in small size sign.

1.6 DELIVERY, STORAGE & HANDLING

- A. Package signs to prevent damage during shipment, handling, storage and installation. Products are to remain in their original packaging (unless otherwise specified) until removal is necessary for installation.
- B. If installation site is not ready for signage upon delivery, store signs in a dry, air-conditioned environment.
- C. Handle signage in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

- A. General:
 - 1. Sign system shall feature solutions for all required sign types, including but not limited to primary room identification, directionals, overhead signs, restroom signs, regulatory and information signs and stair signs. All signs within the system must feature the same family of components and convey a uniform look throughout.
- B. Features:
 - 1. Construction: 3mm acrylic c/w reverse graphics and braille.
 - 2. Mounting: 2-way tape.
 - 3. Font: Helvetica Medium
- C. Graphics and Typography: As selected from manufacturer's standards. Reference sign drawings.
- D. Colors and Finishes: As selected from manufacturer's standards. Reference sign drawings
- E. ADA Compliance: Sign system shall comply with all current and applicable ADA regulations, including requirements regarding which sign types require Braille/tactile features, character heights, character stroke width, inter-character spacing, color contrast, installation locations and mounting heights within the facility.

2.2 FABRICATION

- A. Fabricate units as per specifications and details indicated on reviewed drawings.
- B. Include product instructions sheets for installation and removal/replacement of insert components.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions, in locations and with mounting methods as specified in sign and location drawings.
- B. Square, plumb and level all installed products.
- C. Install all signage in accordance with the Accessibility for Ontarians with Disabilities Act (AODA) and any applicable local regulations and/or codes.

- D. Upon completion of the work, sign installer shall remove any unused products, materials, packaging and debris from the installation site.

3.4 CLEANING

- A. Clean all exposed surface not more than 48 hours prior to Date of Substantial Completion in accordance with manufacturer's written cleaning instructions.

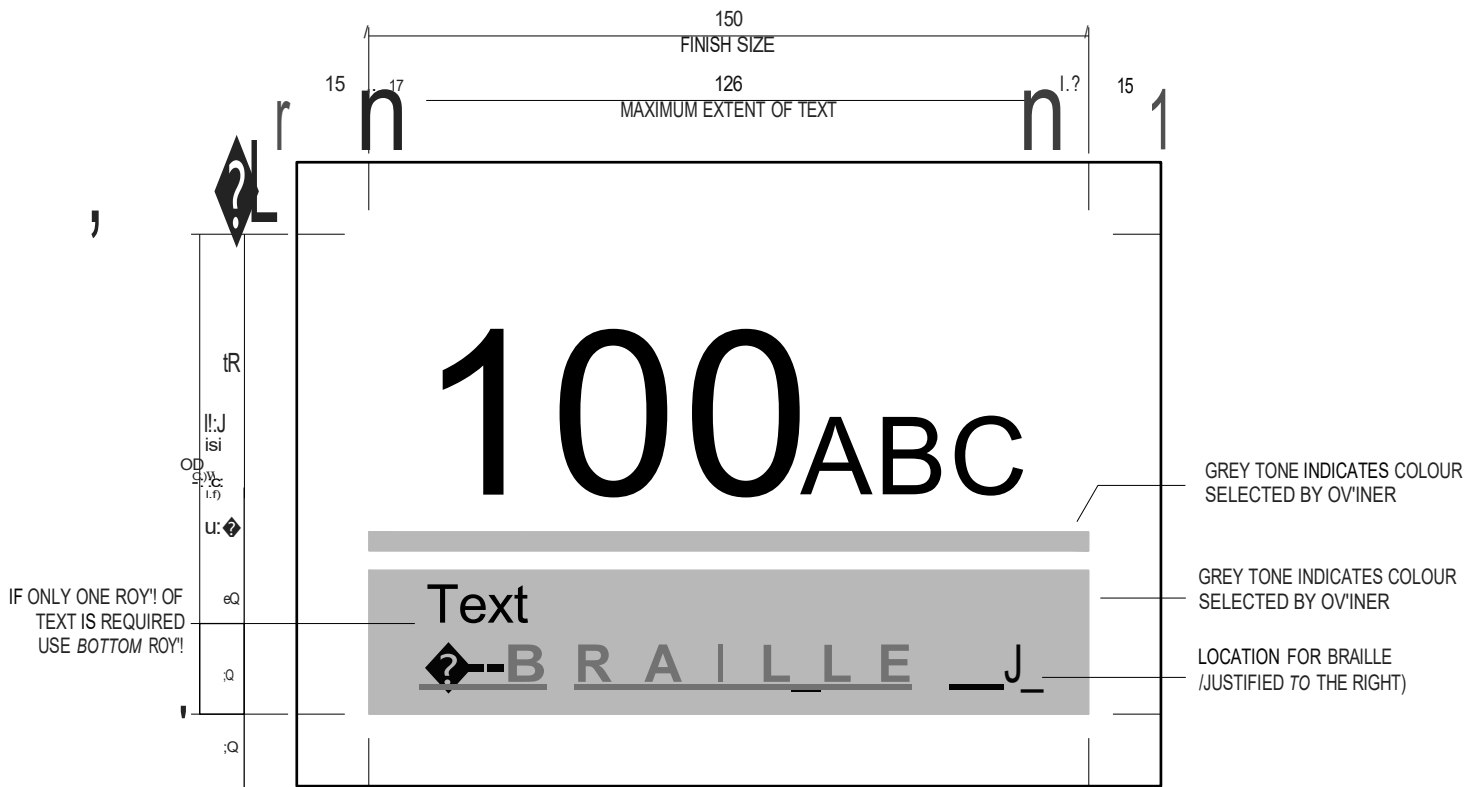
3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 SIGN SCHEDULES

- A. Refer to Drawings for locations.
- B. Refer to following pages for sign types, layouts, typography specifications, sign text/copy and sign graphics.
- C. SIGN S1 – All rooms unless noted otherwise.
SIGN S2 – Both Stairs A and B all floor levels.
SIGN S3 – All single use non-gendered washrooms.
SIGN S4 – All girl's washrooms that also include a barrier free stall.
SIGN S5 – All boy's washrooms that also include a barrier free stall.
SIGN S6 – All staff washrooms
SIGN S7 – All barrier free and universal washrooms.
- D. Note that room names and numbering will change prior to project completion. Allow for finalization by Owner and consultant prior to final signage approval.

END OF SECTION

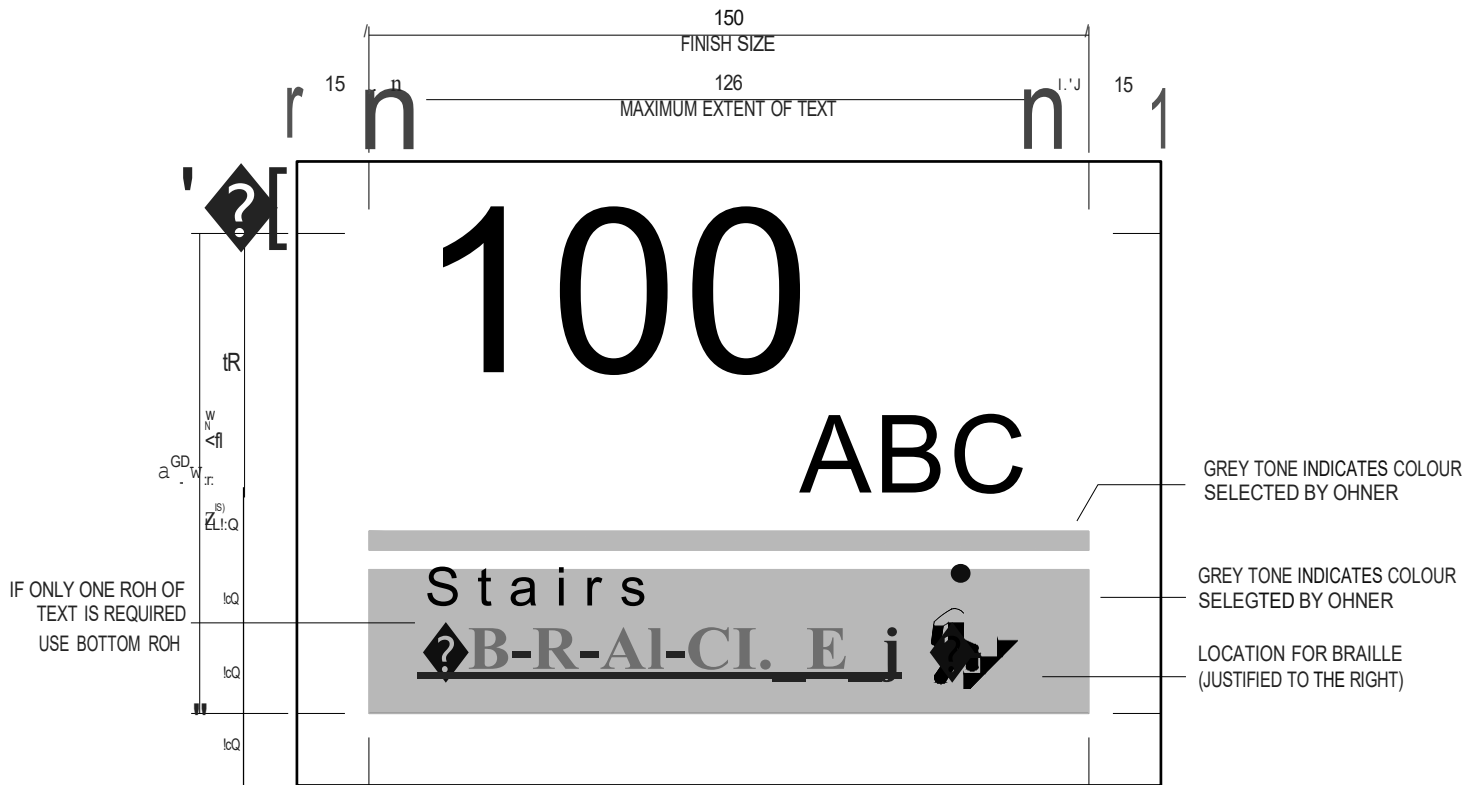


NOTE,
TEXT ON COLOUR BAND SHALL BE
WHITE, ALL OTHER TEXT SHALL BE
BLACK

S1

SPECIFICATION:

ITEM,	INTERIOR SIGN
COPY,	/AS PER LIST PROVIDED)
MATERIAL:	3mm THICK P15 ACRYLIC REVERSE PAINTED
	BACKGROUND
SIZE,	100mm x 150mm
STYLE,	HELvetica MEDIUM
MOUNTING	2-VIA TAPE
FINISH,	BLACK LETTERS ON WHITE BACKGROUND WITH 2
	ACCENT COLOURS



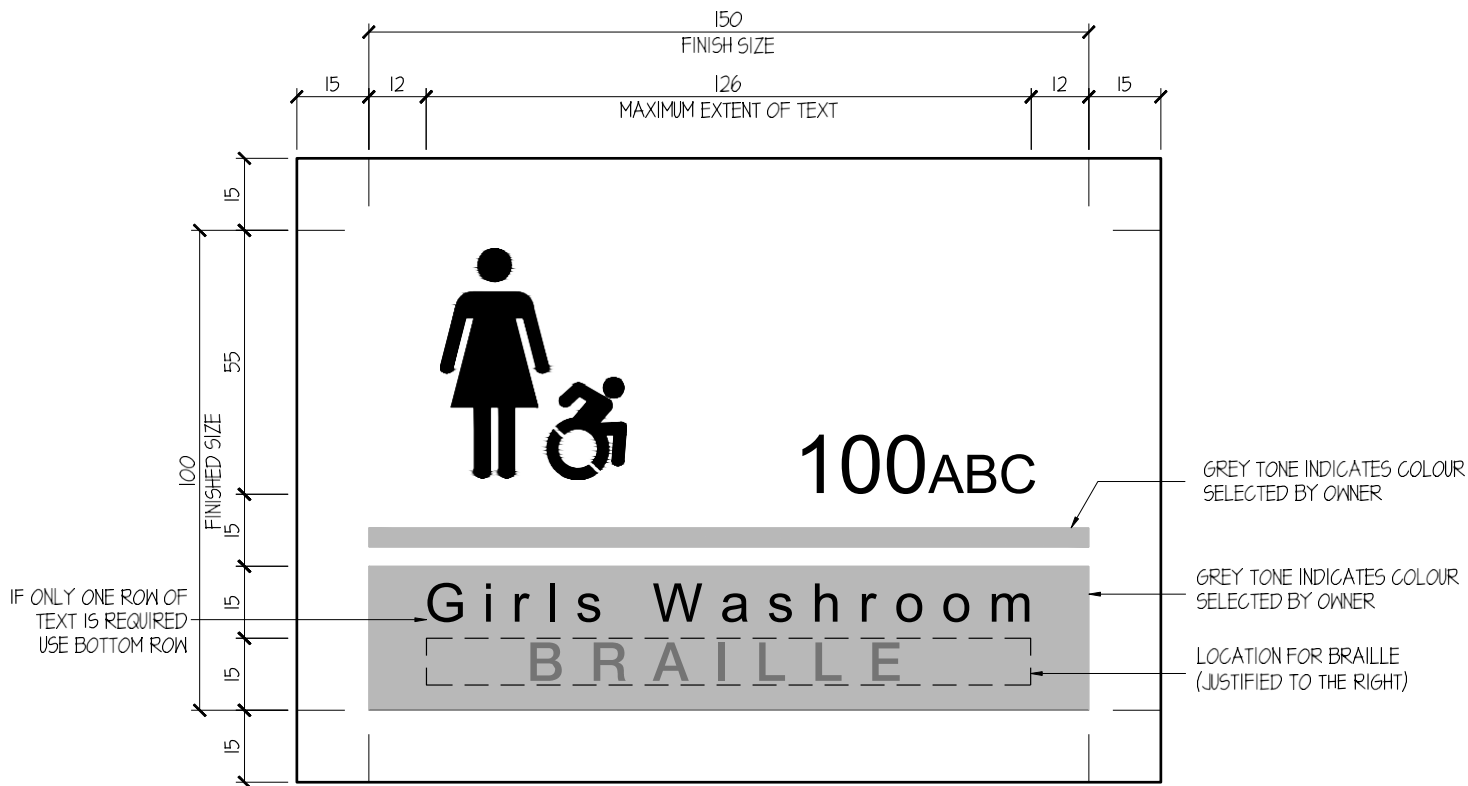
NOTE,
TEXT ON COLOUR BAND SHALL BE
WHITE, ALL OTHER TEXT SHALL BE
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S2

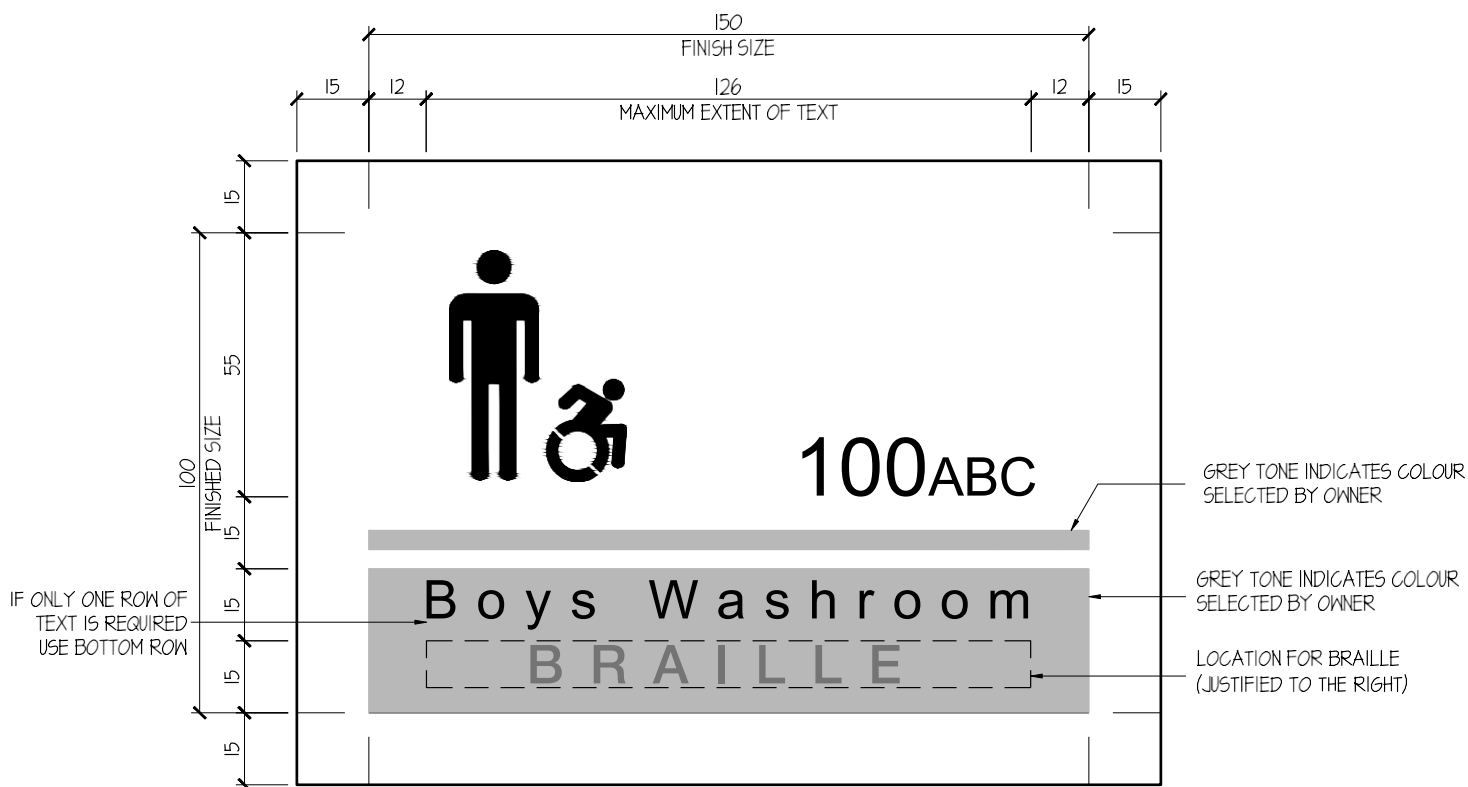


NOTE,
TEXT ON COLOUR BAND SHALL BE
WHITE, ALL OTHER TEXT SHALL BE
BLACK

S3



S4



S5

LOCKERS

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PART 1 - GENERAL

- 1.1 General** .1 Division One, General requirements, is part of this Section and shall apply as if repeated here.
- 1.2 Description of Work** The work shall consist of the following but not limited to:
- .1 Supply and installation of all metal lockers as located on the drawings.
- .2 Number of Single-Tier Lockers Required:
- | | |
|---|-------------|
| Ground Floor 100-4 (barrier free lockers) | 18 lockers |
| Third Floor 300 (half tier lockers) | 292 lockers |
| Total Lockers | 310 lockers |
- 1.3 Related Work** .1 Rough Carpentry Section 06100
- 1.4 Shop Drawings** .1 Submit shop drawings in accordance with Section 01340.
- .2 Clearly indicate dimensions, fabrication details, metal gauges, accessories, paint and colours.
- .3 Identify site dimensions as such.

PART 2 - PRODUCTS

- 2.1 Manufacturers** .1 Lockers to be 'Emperor' series by Hadrian or approved alternates by Mitchell Division 10, General Storage Systems or Lincora.
- .2 Lockers to be Single Tier, 12" wide x 15" deep x 72" high.
- 2.2 Materials** .1 Locker body parts to be made from ASTM A-366 cold-rolled sheet steel, free from imperfections and capable of taking a high grade powder-coated enamel finish.
- .2 Door Frame: Vertical members 16 gauge channel formed with a return flange to act as a positive door stop. Horizontal members 18 gauge with free flowing ventilating louvers.

- .3 Doors shall be made with the 16 gauge outer door panel formed panel formed with channels on both sides and the top and bottom. The 24 gauge full width inner door panel shall cover over the back of the pocket to eliminate vandalism, be formed with channels on both sides, interlocked with the outer panel, and mig welded together at the top, bottom and both sides on the back surface edges of the door. The box welded door assembly shall be 1-1/8" thick. Single pan outer doors with partial inner door reinforcing pans are not acceptable. The door shall close on the 16 gauge frame member with a 5/8" wide closure strike the full height of the door and shall fit flush with the outside of the frame.
- .4 Locking Method: Door and Frame to have 12 gauge (104") has arrangement for padlock. Door to have friction catch system.
- .5 Ventilation: Free flow ventilation to be provided through top and bottom members of door frame.
- .6 Door Handle: Handles shall be recessed stainless steel pocket. Separate number plate holer to be located to the right of the recessed handle. Number plates to be 12.5mm x 75mm (1/2" x 2 15/16") with 9.4mm (3/8") number and recessed in number plate holder.
- .7 Hinges: Continuous piano hinge. Hinges to be spot welded to doorframe and riveted to door. Hinges shall be a 16 gauge continuous one-piece integral right hand hinge and frame. Every other knuckle of the hinge shall be staked to the .125" diameter steel hinge pin so the pin cannot be removed.
- .8 Body: 22 rigid gauge Locker sides, backs, and tops, to be cold rolled steel with edges suitably formed to produce rigid assembly. Tops, bottoms, and shelves to be flanged on all four sides, with channel formation at front of shelves or partitions.
Bottoms and shelf to be 16 gauge.
- .9 Lockers are to be provided with 22 gauge slope tops and dust cap.
- .10 Interior Equipment: lockers to have one hat shelf and 2 - 2

wing hooks and single hook. Hat shelf to be at 3'-8" above locker bottom for 30 units in B100-4 and all of units in D100-5.

- .11 Barrier Free Lockers (as noted) to have two hat shelves, installed at a height accessible for persons in a wheel chair.
- .12 Finish: All locker components are to be thoroughly cleaned before painting and given a bonding, rust-resistant phosphate undercoating/primer, followed by one coat of polymer powder- coated finish.
- .13 Provide end closures as required.
- .14 **Locker Component Colours:**

Locker doors and carcasses will be painted in up to 2 different standard colours. Locations and specifications for door colours to be as directed by Architect on shop drawing submissions.

Locker interiors will be painted one single colour throughout, utilizing one of the colours already noted above.

PART 3 - EXECUTION

3.1 Examination

- .1 Take field dimensions of work upon which work of this Section depends before fabrication.

3.2 Installation

- .1 Erect work straight, plumb, level, and secure to wood furring strips as provided under Section 06100.

End of Section 10163

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core washrooms compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Washroom Accessories Section 10800.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet and urinal fixtures.
4. Show locations of floor drains.

C. Samples for Initial Selection: For each type of compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 3-inch square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.5 PROJECT WARRANTY

- A. Provide a copy of standard manufacturer's warranty data showing

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Where required by Code, comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency. Related requirements include:
 - 1. Flame-Spread Index: 75 or less
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the Ontario Building Code for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE WASHROOM COMPARTMENTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **ASI Global Partitions**, an ASI Group, Buddsteel or approved alternate [prior to Tender close].
- B. Toilet-Enclosure Style: Standard Floor anchored/overhead braced with pedestal legs with panels dimensions
- C. Urinal-Screen Style: Wall hung screens, 12" (305 mm) deep, 48" (1219 mm) high mounted 18" (457 mm) above floor
- D. Toilet Compartment Door Width: 24 inches (609 mm)
- E. Toilet Compartments in Kindergarten Washrooms: 58 inch (1473 mm) high doors and panels mounted 12 inches (305 mm) above floor
- F. Toilet Compartments in all Other Areas: 64 inch high doors and panels, 9 inches above floor
- G. Pilaster Height: 82 inches (2032 mm)

- H. Door Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system routed on door and adjacent pilaster. Provide minimum 3/4-inch (19-mm) thick doors.
- I. Screen Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide nominal 1/2-inch- (13-mm-) thick panels.
- J. Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. [Provide with integral no-sightline privacy system with routing on pilaster and adjacent door.] Provide nominal 3/4-inch- (19-mm-) thick pilasters.
- K. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, No. 4 satin finish. Shoe bottom enclosed and integral to compartment structure.
- L. Panel or Pilaster Pedestal Legs: Stainless steel and minimum 4 inches (102 mm) high. Pedestal legs adjustable in height to within 1 inch (25 mm). Secure to floor with 2-1/2-inch- (64-mm-) long, corrosion-resistant screws.
- M. Brackets (Fittings):
 - 1. Continuous Type: Manufacturer's standard design; stainless steel
- N. Phenolic-Panel Finish:

All panels to have standard black phenolic core visible on edge. Facing Colours to be in plastic laminates [from ASI Group standard range] as noted below:

 - (i) **White Ash #1841** in Rooms: Kindergarten 107-1, Kindergarten 109-1
 - (ii) **Aged Ash #9844** in Rooms: Boys Washroom 105b Kindergarten 105-1, Kindergarten 106-1, Kindergarten 108-1, Boys Washroom 206, Boys Washroom 306
 - (iii) **Kingswood Walnut #9218** in Rooms: Girls Washroom 105a, Girls Washroom 205, Girls Washroom 305
 - (iv) **Asian Night #9550** in Rooms: Changeroom 131-4, Changeroom 131-5

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's **heavy-duty operating hardware** and accessories.
 - 1. Material: Stainless steel throughout
 - 2. Hinges: Manufacturer's institutional-grade continuous hinge, cam type that swings to a partially open position allowing emergency access by lifting door.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit (on door for out-swinging doors and on pilaster for in-swinging door) designed for

occupancy indication and for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, stainless steel head rail with anti-grip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 3. Continuous Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging door to return doors to fully closed position.

END OF SECTION

Part 1 - General**1.01 Summary**

- A. This section includes the following types of wall protection systems:
 - 1. Corner Guards, Wall coverings on drywall as indicated on plans and interior elevations.

1.01 References

- A. National codes (IBC, UBC, SBCCI, BOCA and Life Safety)
- B. American Society for Testing and Materials (ASTM)
- C. Underwriters Laboratories (UL)

1.02 Submittals

General: Submit the following in accordance with conditions of contract and Division I specification section 01 33 00 "Submittal Procedures":

- A. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.
- B. Shop drawings showing locations, extent and installation details of wall covering products.
- C. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern, and thickness:
 - 1. Sample of each product specified available in 4" x 4" standard size.
- D. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.
- E. Maintenance data for wall protection system components for inclusion in the operating and maintenance manuals specified in Division I.

1.03 Quality Assurance

- A. Installer qualifications: Engage an installer who has no less than 3 years' experience in installation of systems similar in complexity to those required for this project.
 - B. Manufacturer's qualifications: Not less than 5 years' experience in the production of specified products and a record of successful in-service performance.
 - C. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, Life Safety and CA 01350.
 - D. Fire performance characteristics: Provide engineered PVC-FREE wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for composite (sheet and adhesive) Class A/I fire performance characteristics listed below:
 - 1. Flame spread: 25 or less
 - 2. Smoke developed: 450 or less
 - E. Impact strength: Provide wall protection components that have been tested for impact using a ram-type impact test in accordance with the applicable provisions of ASTM F476 -84 .
 - F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.
 - G. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture, and physical properties.
- Indoor Air Quality: Provide material that meets CDPH 01350 v1.2. Wall Protection shall meet the requirements of Intertek's Clean Air Gold Standards for Low-Emitting Products.

1.04 Delivery, Storage and Handling

- A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Store materials in undamaged packaging in a clean, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be

maintained.

- C. Materials must be stored flat.

1.05 Project Conditions

- A. Materials must be acclimated in an environment of 65-75°F (18-24°C) for at least 24 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.

1.06 Warranty

A. Acrovyn 5-year Limited Warranty

- Applies to Interior Wall Protection orders that do not include recommended components or accessories
 - Accessories = Primer, Adhesive, Caulk, Trims & Moldings

B. Limited Lifetime Systems Warranty

- Applies to CS Interior Wall Protection projects that include all recommended components and accessories related to CS Interior Wall Protection Products.
 - Accessories = Primer, Adhesive, Caulk, Trims & Moldings

Part 2 - Products

2.01 Manufacturers

- A. Interior surface protection products specified herein and included on the submittal drawings shall be manufactured by Construction Specialties, Inc., or approved alternate.
- B. Drawings and specifications are based on manufacturer's literature from Construction Specialties, Inc. drawings and specifications unless otherwise indicated. Other manufacturers must be approved equal by Architect/Owner.

2.02 Materials

- A. Engineered PVC FREE: Rigid sheet should be high-impact Acrovyn 4000 (post-consumer recycled content in select patterns) in standard Suede texture. Chemical and stain resistance should be per ASTM D543 standards as established by the manufacturer.
1. Nominal Thickness: .060" (1.52 mm) Solid color only
- B. Aluminum: Optional aluminum trims to be alloy 6063 T5 with clear or colored anodized finish; minimum strength and durability properties as specified in ASTM B221. The colored anodized finish is available in eight colors and is not covered under 1.04.G.
- C. Cured ColorFlex® II Bacteria Resistant Caulk has a Shore A value of greater than 55 (product considered "pick-resistant" based on industry standards) testing conducted by independent lab in accordance with ASTM C661 and ASTM C920.
- D. Acrovyn trim offering is available for .040" (1.02mm), .060" (1.52 mm) and .075" (1.91 mm) thickness. Vertical, Wainscot, inside and outside corner trims are available in 10' lengths. Visible trim width is 3/8" (9.53mm).

2.03 Wall Covering

- A. Engineered PVC FREE rigid sheet to be CS Acrovyn:
1. Sheet Size:
 - a) Suede Texture (standard) 4' x 10' (1.2m x 3.0M); 4' x 8' (1.2m x 2.4m) also available
 2. Finishes:
 - a) Colours from two (2) of Acrovyn® solid colors.
 3. Provide Acrovyn trims or aluminum trims as needed for joints/transitions.

2.04 Corner Guards

- A. Engineered PETG Corner Guards to be Acrovyn 4000 by Construction Specialties: Surface mounted guards consisting of a continuous retainer with snap-on Acrovyn 4000 cover. Color matched end caps to be provided for both partial and full height applications. Attachment hardware shall be appropriate for wall construction.
 - 1. Model SM-20N 90° surface mounted corner guard with 3" (76mm) legs, ¼" radiused cover and recycled PETG retainer. Colour from one of (64)* Acrovyn solid colors.

- 2.

2.04 Fabrication

- A. General: Fabricate wall covering to comply with requirements indicated for design, dimensions, detail, finish, and sizes.

2.05 Finishes

- A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applications and designations of finishes.

2.06 Accessories

- A. Adhesive and Primer: Acrovyn wall covering shall be furnished as a complete packaged system, including appropriate standard adhesive.
- B. Bacteria Resistant caulk and trims available for purchase. [*Specifier note: ColorFlex II bacteria resistant caulk, used to cover seams in Acrovyn sheet installation, is resistant to bacterial/mold when subjected to ASTM G21 & ASTM G22 requirements. ZERO bacteria or fungal growth was observed.*]

Part 3 - Execution**3.01 Examination**

- A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 Preparation

- A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris, and loose particles. Perform additional preparation procedures as required by manufacturer's instructions. Minimum Level 3 wall finish is required; for surfaces with Level 5 finish, ensure the surface and any surface coatings are fully dry and cured.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.
- C. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 Installation

- A. Install the work of this section in strict accordance with the manufacturer's recommendations using approved adhesive. Note there are special installation instructions for non-standard conditions: radius walls, tile, CMU block, etc.
- B. Temperature at the time of installation must be between 65-75°F (18-24°C) and be maintained for at least 48 hours after the installation to allow for proper adhesive set-up.
- C. Relative humidity shall not exceed 80%.
- D. Do not expose wall covering to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.

3.04 Cleaning

- A.** General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.
- B.** Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 Protection

- A.** Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 This section includes labor, materials and other services necessary to complete vinyl wall coverings.
- .2 Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section.

1.2 RELATED SECTIONS

- .1 Section 03300 - Cast-in-Place Concrete: Concrete finishing.
- .2 Section 06100 - Rough Carpentry: Plywood floor sheathing.
- .3 Division 7 - Thermal and Moisture Protection.
- .4 Division 9 – Steel Stud and Gypsum Wall Board

1.3 REFERENCES

- .1. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- .2. American Society for Testing & Materials (ASTM) & Various:
 - .1 AST ASTM E 84-05 Standard Test Method for Surface Burning Characteristics of Building Materials. CLASS A
 - .2 ASTM D5420 Gardner Impact Exceeds 198 inch pounds
 - .3 ISO 14644 9:12 Standard Laboratory Practice for Quantifying Air Cleanliness by Particle Concentrations
 - .4 CA 01350 Measures VOC Emissions
 - .5 DIN IEC 60 167 Surface Resistance
 - .6 ASTM G21 Fungi Resistance
 - .7 ASTM D3273 Mold Resistance
 - .8 ISO 62 Water Absorption
 - .9 ASTM G154 UV Exposure
 - .10 FDA Compliant
 - .11 USDA Compliant
 - .12 EN 684 Seam Strength Test (result 897 N/50 mm)
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics – ceiling mounted test
 - .2 CAN/ULC-S102.2 Standard Method of Test for Surface for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies
- .4 Plumbing Code Compliance
 - .1 2021, 2018, 2015, 2012 and 2009 International Plumbing Code (IPC)
 - .2 2021, 2018, 2015, 2012 and 2009 International Residential Code (IRC)
 - .3 2021, 2018, 2015, 2012 and 2009 Uniform Plumbing Code (UPC)
 - .4 2017 Uniform Illustrated Plumbing Code - India (UIPC-I)
 - .5 2020, 2015, 2010 and 2005 National Plumbing Code of Canada

1.4 SYSTEM DESCRIPTION

- .1 Performance Requirements: Provide hygienic Altro Whiterock Wall Designs wall cladding which has been manufactured by Altro and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01330 - Submittal Procedures.

- .2 Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Section 01330 - Submittal Procedures including but limited to the following:
 - .1 Submit a layout diagram indicating the location of each panel and joining method.
- .3 Samples: Submit duplicate sample pieces of Altro Whiterock Wall Designs material, as well as accessory pieces in accordance with Section 01330 - Submittal Procedures.
- .4 Quality Assurance Submittals: Submit the following:
 - .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Manufacturer's Instructions: Current published manufacturer's installation and maintenance instructions.
 - .3 Manufacturer's Field Reports: Specified herein.
- .5 Closeout Submittals: Submit the following:
 - .1 Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
 - .2 Warranty: 10 years from date of substantial completion.

1.6 QUALITY ASSURANCE

- .1. Installer Qualifications: Current Elite Installers who have passed the Altro Whiterock Academy and have successfully installed Altro Whiterock products.
- .2 Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
 - .1 Mock-Up Size: [Specify mock-up size.].
 - .2 Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - .3 Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.
- .3 Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE & HANDLING

- .1 Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- .2 Deliver, store and handle Altro Whiterock Wall Designs panels in accordance with Section 01610 - Basic Material Requirements.
- .3 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .4 Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Panels should be stored flat and be pre-conditioned a minimum of 72 hours in ambient temperatures similar to the prevailing operational conditions.
- .5 Store panels in temperature controlled environments. Leave protective blue film on panel until ready to use.
- .6 Altro Whiterock Wall Designs, adhesives and accessories must be stored in enclosed, dry conditions not subjected to freezing or excessive heat. Heat above 60C (140F) will distort and damage the material. Cold temperatures will make the material brittle and temperatures below -5C (23F) should be avoided during storage.
- .7 When stacking pallets, they should not be stacked more than 8 pallets high and stacked flat without

bumps or rolls and in a square and well aligned configuration. Safety precautions should be taken to secure pallets to prevent shifting or falling.

- .8 Panels and all Altro materials are to be acclimated on site 72 hours prior to installation. HVAC is to be up and running with ambient temperatures between 20C (68F) and 27C (80F) through to 24 hours after installation.
- .9 Maintain air temperature and structural base temperature at between 20C (68F) and 27C (80F) for 72 hours before, during and 24 hours after installation.
- .10 Verify permanent HVAC is operational. If temporary heat is required, use electric or indirect heat sources. Do not use kerosene or propane in direct contact with the ambient air.
- .11 Verify other finishing operations, including painting, have been completed.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Deposit all packaging materials in appropriate container on site for recycling or reuse.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Keep all discarded packaging away from children.

1.9 PROJECT CONDITIONS

- .1 Temperature Requirements: If storage temperature is below 20C (68F) the Altro Whiterock Wall Designs panels must be moved to a warmer place and allowed to reach this temperature before installation. For further information, refer to current Installation Guide.
- .2 Maintain air temperature and structural base temperature at flooring installation area between 20C (68F) and 27C (80F) for 72 hours before, during and 24 hours after installation.
- .3 Allow sufficient time for proper preparation, installation and curing.
- .4 Close spaces to traffic during installation until the installer is satisfied that the adhesive has set.
- .5 Verify permanent HVAC is operational. If temporary heat is required, use electric or indirect heat sources. Do not use kerosene or propane in direct contact with the ambient air.
- .6 Verify other finishing operations, including painting, have been completed.
- .7 If more than one pallet of material is used, use material in sequence.
- .8 Panels and all other materials must be checked for defects before installation. Do not install materials with visible defects.
- .9 Do not install product for use near open heat sources (ovens, etc.).

1.10 WARRANTY

- .1 Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- .2 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- .3 Warranty Period for Altro Whiterock Wall Designs shall be 10 years commencing on Date of Substantial Completion. Please see the current Altro Warranty online at www.altro.com/us.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturer: Altro
 - .1 CANADA: 6221 Kennedy Road, Unit 1, Mississauga ON, L5T 2S8
Toll-free: 800.565.4658 Tel: 905.564.1330 Fax: 905.564.0750
E-mail: support@altro.com Web Site: www.altro.com/us.

2.2 PROTECTIVE WALL PANELS [PWP]:

GWB Walls noted on drawings to receive Protective Wall Panels [PWP] are to be treated with:

Altro Whiterock Wall Design panels, (measurements and product weights given below are approximate):
Panel Thickness: 0.10" (2.5 mm); Panel Width: 4' (1.22m) Panel Height: Either 8'2"; Panel Weight: 24 lbs

Colour to be 'White Mineral' in size 4'-0" x 8'-2"; product to be supplied with all colour/pattern-matching manufacturer-supplied accessories as required for a complete installation.

All PWP panels are to be installed in full 4'-0" height running horizontally [above specified floor base] and are to be continuous along full runs of gwb [gypsum wall board] walls to which they are to be applied.

2.3 ACCESSORIES

Including but not limited to:

- .1 Vinyl welding rod: Acceptable material:
 - .1 Altro weld rod – WSR/99** colour
- .2 Joint Strips: 2-Part Joint Strip
 - .1 8' – A831/25/CT**
 - .2 10' – A831/30/CT**
- .3 Start and Edge Trim:
 - .1 2-Part Start and Edge Trim – [A833/25 White] [A833/25/** colour] Length 98.5"
 - .2 2-Part Start and Edge Trim – [A833/30 White] [A833/30/** colour] Length 118"
- .4 Stainless Steel Accessories:
 - .1 Stainless Steel Corner Protector – [A861/12] Dimensions: 4' x 3" x 3"
 - .2 Stainless Steel Corner Protector – [A861/12] Dimensions: 8' x 3" x 3"
- .5 Acrylic Adhesive: For porous, even substrates (and climate-controlled areas) use Altro W157, one-part, water-based, acrylic adhesive as recommended by manufacturer.
- .6 Polyurethane Adhesive: For wet, non-porous substrate (and areas subject to temperature fluctuations) use Altro W39 2-Part Adhesive
- .7 Sanitary Sealant Compounds and Tape Adhesion Promoter:
 - .1 Altro Sanitary Sealant – A803 Clear, A806/99** - 10.5 oz Tube
 - .2 Ecofix 75 Spray Adhesive
- .8 Double-Sided Tape:
 - .1 2" Double-Sided Tape A815/216 – 33 lm roll.
- .9 Wall-To-Floor Heat-Weld [as/if applicable]:
 - .1 WSBUE200 Vinyl Backer – 15lm coil – used behind coved flooring when welding panels to floor

2.4 SOURCE QUALITY

- .1 Source Quality: Obtain Wall products from a single manufacturer.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.

3.2 EXAMINATION

- .1 Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 SUBSTRATE PREPARATION

- .1 Walls should be smooth and level. High points must be removed and low points filled with filler intended for the substrate and environmental conditions.
- .2 Wall tiles must be fixed firmly to the wall. As long as the tile edges do not protrude you do not have to skim grout joints.
- .3 Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.
- .4 Remove loose paint and conduct an adhesive bond test with paint.
- .5 Exterior walls must be adequately damp-proofed and insulated.
- .6 Dry wall substrates should be paint ready.

3.4 PREPARATION

- .1 All surfaces must be free from dust and cleaned prior to Altro Whiterock Wall Designs installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate and may cause the panels to de-bond.
- .2 Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.
- .3 All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.
- .4 All plumbing should have pipework removed to a first fix or installation state and "tails" left protruding from the substrate. Altro Whiterock Wall Designs panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" (3mm) oversize to allow for expansion, then sealed with Altro Sanitary Sealant. Plumbing should always be done by a qualified plumber.
- .5 Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with Altro Sanitary Sealant.
- .6 All pipes, fixing bolts, etc. extending through the Altro Whiterock Wall Designs panels should have a minimum 1/8" (3mm) expansion gap and be sealed using Altro Sanitary Sealant.
- .7 If fitting to door frames, these must be in place prior to installation of Altro Whiterock Wall Designs.
- .8 Prior to installation, it is advisable to complete any painting which comes in contact with Altro Whiterock Wall Designs, as sealant used at junctions is non-paintable.
- .9 Panels should be stored flat and be pre-conditioned a minimum of 72 hours in ambient temperatures similar to the prevailing operational conditions.
- .10 The panels must be stored on a level, flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.
- .11 First, check the room using a 6' (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.5 INSTALLATION

- .1 Protective Wall Panel Installation: Install Altro Whiterock Wall Designs in accordance with the current Altro Whiterock Installation Guide and Altro Whiterock Wall Designs Quick Facts. All joints should be joined by approved methods as detailed in the installation guide. Failure to install Altro Whiterock Wall Designs in

accordance with the recommended procedures will void the Altro Limited Product Warranty.

- .2 Do not bevel, profile or chamfer the edges of the wall panels at seam locations as this will disturb the factory film, making it more difficult to achieve an aesthetically pleasing seam

3.6 FIELD QUALITY REQUIREMENTS

- .1 Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .1 Site Visits: [Specify number and duration of periodic site visits].

3.7 CLEANING

Note: Once all panels and joints are installed, remove protective film and clean all surfaces down with antistatic solution or antistatic wipes. This is required as the panel may have static build up and any dust in the atmosphere will adhere to the surface of the panel.

- .1 Altro Whiterock Wall Designs can be cleaned using a soft cloth with minimal amount of diluted soap/detergent solution - see current cleaning guide for printed + film walls at www.altro.com/us, *Technical Documents, Maintenance Guides*.
- .2 When cleaning the panel surface, the temperature of water should not exceed 140° F (60° C).
- .3 Do not use strong solvents such as acetone, MEK or toluene or strongly acidic or alkaline cleaning agents.
- .4 Avoid any abrasive agents that can scratch the surface.
- .5 A clean water wipe-down using a soft damp cloth s recommended after cleaning. Wipe the surface dry.
- .6 Remove construction debris from project site and legally dispose of debris.

3.8 PROTECTION

- .1 Protect installed panels as required prior to hand-over to building owner.

END OF SECTION 10260

PART 1 - GENERAL

- | | | | |
|------------|--------------------------------|-----------|--|
| 1.1 | Description
of Work | .1 | Supply and install Flag pole. |
| | | .2 | One Flag pole required. |
| 1.2 | Related
Work | .1 | Concrete foundation Section 03300 |
| 1.3 | Shop Drawings | .1 | Submit shop drawings in accordance with Section 01340. |

PART 2 - PRODUCTS

- | | | |
|------------|----------------------|---|
| 2.1 | Manufacturers | Flag Pole to be as manufactured by Ewing Flagpoles or approved equivalent. |
| 2.2 | Materials | Flag Pole shall be Model STA25N, 25' - 0" high pole, with fixed base #B5, econoline internal halyard system. Finish shall be clear anodized aluminum. |

PART 3 - EXECUTION

- | | | | |
|------------|---------------------|-----------|--|
| 3.1 | Examination | .1 | Ensure fixed base is level before erecting flag pole. |
| 3.2 | Installation | .1 | Erect work straight, plumb, level, and secure to foundation as provided under Section 03300. |

End of Section 10350

PART 1 - GENERAL

- | | | | | | | | | | | | | | | | | |
|--------------------------------|---|---------------|-----------------------|---------------|----|-------------------|---------------|----|---------------------------|---------------|----|----------|---------------|----|------------|-------------|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | | | | | | | | | | | | | | | |
| 1.2 Description of Work | <p>Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:</p> <p>.2 Supply and installation of the following:</p> <p>a) All functional architectural metal louvres designated as AML on the architectural drawings</p> <p>Louvres to be supplied complete with insulated blank-out panels with openings suited to the ducting requirements of the unit ventilators (Mechanical Division) specified elsewhere herein. All louvers are to include all related perimeter closures, setting blocks, spacers, and ancillary accessories required to ensure their fully-integrated fit into surrounding wall assemblies. Metal louver manufacturer to fully coordinate this with curtain wall manufacturer as required.</p> | | | | | | | | | | | | | | | |
| 1.3 Coordination | Product manufacturer shall coordinate with the General Contractor, and the Architect (as required) prior to and during the shop drawing stage, to ensure a full understanding of the project requirements. | | | | | | | | | | | | | | | |
| 1.4 Related Work | <table border="0" style="width: 100%;"> <tr> <td style="width: 5%;">.1</td> <td style="width: 80%;">Aluminum Curtain Wall</td> <td style="width: 15%; text-align: right;">Section 08150</td> </tr> <tr> <td>.2</td> <td>Glass and Glazing</td> <td style="text-align: right;">Section 08800</td> </tr> <tr> <td>.3</td> <td>Aluminum Composite Panels</td> <td style="text-align: right;">Section 07420</td> </tr> <tr> <td>.4</td> <td>Sealants</td> <td style="text-align: right;">Section 07900</td> </tr> <tr> <td>.5</td> <td>Mechanical</td> <td style="text-align: right;">Division 23</td> </tr> </table> | .1 | Aluminum Curtain Wall | Section 08150 | .2 | Glass and Glazing | Section 08800 | .3 | Aluminum Composite Panels | Section 07420 | .4 | Sealants | Section 07900 | .5 | Mechanical | Division 23 |
| .1 | Aluminum Curtain Wall | Section 08150 | | | | | | | | | | | | | | |
| .2 | Glass and Glazing | Section 08800 | | | | | | | | | | | | | | |
| .3 | Aluminum Composite Panels | Section 07420 | | | | | | | | | | | | | | |
| .4 | Sealants | Section 07900 | | | | | | | | | | | | | | |
| .5 | Mechanical | Division 23 | | | | | | | | | | | | | | |
| 1.5 Quality Assurance | <p>.1 Louvre Manufacturer: Louvres to be supplied by a single manufacturing firm that has had not less than ten (10) years experience in the design and manufacturing of the items specified.</p> <p>.2 Performance requirements: Louvre fabrication to accommodate all applicable Code requirements for wind loading (respective to the project location) across unsupported spans, respective to the louver sizes specified and to the orientations as shown on Architectural drawings.</p> | | | | | | | | | | | | | | | |
| 1.6 Shop Drawings | .1 Product Data: Submit specifications, performance data, | | | | | | | | | | | | | | | |

- and Submittals** loading calculations and installation instructions from the manufacturer of the specified louvres.
- .2 Submit shop drawings for all items. Show anchorage details and connections for all the component parts.
- a) Drawings shall include elevations, sections and specific details for each unit, and related anchoring conditions respective to the surrounding curtain wall assemblies.
- b) Manufacturer's Specifications for all materials and finishes.
- .3 Samples: Submit three sample coupons of the selected finish, on aluminum sheet stock, measuring 4" square minimum size.
- 1.7 Protection**
- .1 Ordering: Comply with manufacturer's ordering instructions and lead time requirements to prevent construction delays.
- .2 Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Storage and Protection: Store materials protected from exposure to harmful weather conditions.
- 1.8 Warranty** Provide written warranty to the owner that all products will be free of defective materials or workmanship for a minimum period of one year from date of installation.

PART 2 - PRODUCTS

- 2.1 Materials**
- .1 **Products (General) :**
- All metal louvres, are to be as manufactured and supplied by:
- C/S Construction Specialties Company
895 Lakefront Promenade
Mississauga, ON L5E 2CT
- The supplier must be a member of AMCA or BSRIA.
- Complete louver details shall be submitted to the Architect for approval prior to fabrication.
- All louver sizes, locations and quantities to be as illustrated on the Architectural drawings, and as verified on site prior to fabrication.
- All louvres are to be fabricated as horizontal "continuous line units" with integral perimeter frame and no intermediate vertical mullions on the exterior face.
- a) **Architectural Metal Louvres [AML]:**

All architectural metal louvres are to be C/S 5" Storm-Resistant Fixed Horizontal Louvre Model RS-5300 as manufactured by Construction Specialties Inc., Mississauga, ON.

All architectural metal louvers to be equipped with **insulated blank-out panels at the interior face of louver**. Blank-out panels are to be fitted tightly to the inside face of the louver. Blank-out panels are to be fitted with properly sized and positioned openings to accommodate intake and exhaust ductwork to the unit ventilators at building interior (as per Division 23 - Mechanical).

Blank-out panels are composed of 0.081 mm thick prefinished aluminum facing sheets on both sides of 3" of urethane or styrofoam insulation. Blank-out panel to have 2.03 mm thick aluminum perimeter frame complete with closed cell PVC perimeter compression gaskets to ensure tight closure of panel to louver.

Finish colours of interior and exterior aluminum sheet facings on the insulated blank-out panel to be as specified later herein.

2.1 Materials (Cont'd)

.2 Louvre Materials & Fabrication :

Model RS-5300 Louvres :

Frames and blades to be fabricated from 6063-T6 aluminum alloy. Blades to be minimum 1.52mm thick extrusions, and frames to be a minimum 2.03 mm thick. Louvre to be mechanically fastened using stainless steel or aluminum fasteners. Louvres to be supplied with 4" high by full depth sill flashing formed from min. 1.27mm thick aluminum. Sill flashing to have welded side panels. Louvres and sill flashing to be installed in accordance with the manufacturer's procedures to ensure water integrity performance of the louver system. Louvres to be furnished with 1/2" mesh screen, secured within a 12 B & S extruded aluminum frame.

.3 Louvre Finish:

All visible **exterior components of louvres** be finished in PPG "Duranar XL" 3-coat finish, meeting all related finish standards as specified in Section 08150. Louvre finish to be:

*PPG Duranar XL (3-Coat System) in colour
069 Silver Shadow UC106707XL*

Any interior components of the louver [i.e. only visible from the building interior] to be finished in:

clear anodized aluminum

The louver manufacturer shall supply a minimum 5 year warranty against failure of the coating system applicable from the date of shipment.

.4 Blank-Out Panel Finishes:

Exterior aluminum facing sheet of insulated blank-out panel to be finished in:

*PPG Duranar XL (3-Coat System) in colour
069 Silver Shadow UC106707XL
(to match exterior louvre finish/colour)*

Interior aluminum facing sheet of insulated blank-out panel to be:

*clear anodized aluminum
(to match interior face of curtain wall)*

The louver manufacturer shall supply a minimum 5-year warranty against failure of the coating system applicable from the date of shipment.

.5 Structural Design :

Structural supports shall be designed and furnished by the louver manufacturer to carry a wind load of not less than 0.43 kPa over the dimensions (and related area) of the louvres specified. Louvre manufacturer shall be responsible to verify actual wind-loads at the project site, ensuring all louvers supplied are structurally fabricated to comply with related environmental and windload requirements.

PART 3 - EXECUTION

- | | | |
|-------------------------|----|---|
| 3.1 Preparation | .1 | Protect adjacent surfaces from damage resulting from work under this specification. |
| 3.2 Inspection | .1 | Examine areas and conditions to receive the work. Do not proceed until any unsatisfactory conditions have been corrected. |
| 3.3 Installation | .1 | Comply with manufacturer's instructions and recommendations for installation of the work respective to the intended application and all details of the surrounding SSG Curtain Wall System. |

- .2 Site verify dimensions of supporting structure and surrounding openings by accurate field measurements so that the products will be accurately designed and fitted to the structure prior to fabrication.

- .3 Anchor louvres into curtain wall openings in accordance with manufacturer's recommendations for the intended application, supplying all related clips, closures, setting blocks etc.

Note that the finished exterior face of the louver is to be flush with the finished face of adjacent vision panes and spandrel glass panels throughout.

Note that the finished inside face of the insulated backpan (behind the louver) is to be flush with the finished inside face of aluminum curtain wall components throughout. Insulation thickness in the backpan to be maximized accordingly.

- .4 Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly as directed.

- .5 Set units level, plumb and true to line, with uniform joints.

3.4 Clean Up

- .1 Clean items at factory prior to shipping.
- .2 Final cleaning to remove job site soiling shall be the responsibility of this Contractor.

End of Section 10700

PART 1 - GENERAL

- 1.1 General** Division One, General Requirements, is part of this section and shall apply as if repeated here.
- 1.2 Description of Work** Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:
- .1 Supply and install caretaker accessories as specified.
 - .2 The installation of all washroom accessories supplied by Owner.
 - .3 The supply and installation of all washroom accessories as specified.

PART 2 - PRODUCTS

- 2.1 General**
- .1 Washroom accessories shall be supplied and installed by the Contractor unless noted otherwise below.
- 2.2 Items**
- .1 Washroom accessories shall be as manufactured by ASI Watrous, Bobrick, or approved equivalent.
 - .2 **Toilet Paper Dispensers:** to be supplied by Owner
Quantities:
 - 1 per toilet
 - .3 **Paper Towel Dispensers:** to be supplied by Owner
Quantities:
 - 1 for all single-use washrooms
 - 1 for all other sinks (daycare, classrooms, kindergarten, staff room, kitchens, etc..)
 - 2 for corridor sinks
 - .4 **Soap Dispensers:** to be supplied by Owner
Quantities:
 - 1 in each single-use washroom
 - 2 for all washrooms with more than one toilet
 - 1 for all other sinks (daycare, classrooms, kindergarten, staff room, kitchens, etc..)
 - 2 for corridor sinks
 - .5 **Sanitary Napkin Disposal Units:**
Bobrick Washroom Equipment Model# B-270.
Locations:

- 1 in each single-use washroom
- 1 in each stall of female washrooms

.6 Washroom Grab Bars at Barrier-Free Toilets:

1.5" diameter by 1.2 mm wall thickness, stainless steel tubing [18-8 stainless steel, type 304] with peened gripping surface, 3 1/8" [80 mm] diameter wall anchoring flanges with cover for concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories as required for proper mounting and capable of withstanding downward pull of 2.2 K/kN.

Grab bar at back of toilets to be 600 mm long.

Grab bar at side of toilets to be L-shaped 90 degree single piece unit, measuring 30" x 30".

Bars to have 2" minimum clearance from good walls. Acceptable product: Bobrick Washroom Equipment B-6898.99, Frost 1003NP or approved alternates.

.7 Grab Bars at Barrier Free Urinals:

Each urinal is to be bounded by one grab bar mounted on both sides of urinal. Each bar to be:

- 600 mm long Bobrick Model B-5806.99-24

.8 Mop Holders in Caretaker/Custodial/Janitor Rooms:

Bobrick Washroom Equipment Model# B-229x36 Shelf with Mop and Broom Holders and Hooks. One for required each custodian Room. Mount above janitor sink to allow mops to drain.

Locations: Janitor 110-4 / 112 / 128-3 / 130 / 213 / 313DD

.9 WASHROOM MIRRORS:

Standard Mirror:

Bobrick Washroom Equipment Model# B-165 2436, 24"x36" stainless steel-channel framed mirror with concealed wall hanger and tamper-proof mounting.

Locations:

- one per sink in Washrooms with 1 sink
- 2 mirrors in each of Washrooms with 2 or more sinks

Under-Sized Mirror:

Bobrick Washroom Equipment Model# B-165 1830, 18"x 36" stainless steel-channel framed mirror with concealed wall hanger and tamper-proof mounting.

Locations:

- Refer to interior elevations

All mirrors are to be mounted as per details and heights noted on drawings and/or as directed by Architect prior to installation.

.10 Coat Hook:

Bobrick Washroom Equipment Model# B-233 stainless steel clothes hook, mounted on back of washroom doors 1 for all single-use washrooms

2.3 Fabrication

- .1 Weld and grind joints of fabricate components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratched or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164-M1981.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

PART 3 - EXECUTION

3.1 Installation

- .1 Install and secure accessories rigidly in place as follows:
 - i) Stud Walls: install steel back-plate or 1.5" thick solid wood blocking anchored into stud wall assembly prior to gypsum wall board finish application. Provide plate with threaded studs or plugs.

- ii) Hollow masonry units or existing plaster/drywall: toggle bolts drilled into cell/wall cavity.
 - iii) Solid masonry, marble, stone, or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - iv) Toilet/shower compartments: use male/female through bolts
- .2 Install grab bars with mounting plates/mounting flanges provided by grab-bar manufacturer. Ensure provision of tamper-proof escutcheons/cover-plates throughout.
- .3 Use tamper-proof screws/bolts for fasteners throughout.

End of Section 10800

PART 1 - GENERAL

- 1.1 General** Division One, General Requirements, is part of this section and shall apply as if repeated here.
- 1.2 Description of Work** Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following:
- .1 Supply and install caretaker accessories as specified.
 - .2 The installation of all washroom accessories supplied by Owner.
 - .3 The supply and installation of all washroom accessories as specified.

PART 2 - PRODUCTS

- 2.1 General** .1 Washroom accessories shall be supplied and installed by the Contractor unless noted otherwise below.
- 2.2 Items**
- .1 Washroom accessories shall be as manufactured by ASI Watrous, Bobrick, or approved equivalent.
 - .2 **Toilet Paper Dispensers:** to be supplied by Owner
Quantities:
 - 1 per toilet
 - .3 **Paper Towel Dispensers:** to be supplied by Owner
Quantities:
 - 1 for all single-use washrooms
 - 1 for all other sinks (daycare, classrooms, kindergarten, staff room, kitchens, etc..)
 - 2 for corridor sinks
 - .4 **Soap Dispensers:** to be supplied by Owner
Quantities:
 - 1 in each single-use washroom
 - 2 for all washrooms with more than one toilet
 - 1 for all other sinks (daycare, classrooms, kindergarten, staff room, kitchens, etc..)
 - 2 for corridor sinks
 - .5 **Sanitary Napkin Disposal Units:**
Bobrick Washroom Equipment Model# B-270.
Locations:
 - 1 in each single-use washroom
 - 1 in each stall of female washrooms

.6 Washroom Grab Bars at Barrier-Free Toilets:

1.5" diameter by 1.2 mm wall thickness, stainless steel tubing [18-8 stainless steel, type 304] with peened gripping surface, 3 1/8" [80 mm] diameter wall anchoring flanges with cover for concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories as required for proper mounting and capable of withstanding downward pull of 2.2 K/kN.

Grab bar at back of toilets to be 600 mm long.

Grab bar at side of toilets to be L-shaped 90 degree single piece unit, measuring 30" x 30".

Bars to have 2" minimum clearance from good walls. Acceptable product: Bobrick Washroom Equipment B-6898.99, Frost 1003NP or approved alternate.

.7 Grab Bars at Barrier Free Urinals:

Each urinal is to be bounded by one grab bar mounted on both sides of urinal. Each bar to be:

- 600 mm long Bobrick Model B-5806.99-24

.8 Mop Holders in Caretaker/Custodial/Janitor Rooms:

Bobrick Washroom Equipment Model# B-229x36 Shelf with Mop and Broom Holders and Hooks. One for required each custodian Room. Mount above janitor sink to allow mops to drain.

Locations: Janitor 110-4 / 112 / 128-3 / 130 / 213 / 313DD

.9 WASHROOM MIRRORS:**Standard Mirror:**

Bobrick Washroom Equipment Model# B-165 2436, 24"x36" stainless steel-channel framed mirror with concealed wall hanger and tamper-proof mounting.

Locations:

- one per sink in Washrooms with 1 sink
- 2 mirrors in each of Washrooms with 2 or more sinks

Under-Sized Mirror:

Bobrick Washroom Equipment Model# B-165 1830, 18"x 36" stainless steel-channel framed mirror with concealed wall hanger and tamper-proof mounting.

Locations:

- Refer to interior elevations

All mirrors are to be mounted as per details and heights noted on drawings and/or as directed by Architect prior to installation.

- .10 **Coat Hook:**
Bobrick Washroom Equipment Model# B-233 stainless steel clothes hook, mounted on back of washroom doors 1 for all single-use washrooms
- .11 **Toilet_Backrest:**
15"L x 8"D x 4"H, wall-mounted (32mm dia.) Stainless steel tube, with a solid plastic laminate plate.
Backrest to be installed to allow full function of flushing mechanism. Acceptable product: Bobrick Washroom Equipment B-5892, Frost 1028 or approved alternate.
requirement: each barrier-free or universal washroom toilet to be equipped with 1 backrest at back of toilet.

2.3 Fabrication

- .1 Weld and grind joints of fabricate components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164-M1981.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

PART 3 - EXECUTION

3.1 Installation

- .1 Install and secure accessories rigidly in place as follows:
 - i) Stud Walls: install steel back-plate or 1.5" thick solid wood blocking anchored into stud wall assembly prior to gypsum wall board finish application. Provide plate with threaded studs or plugs.
 - ii) Hollow masonry units or existing plaster/drywall: toggle bolts drilled into cell/wall cavity.
 - iii) Solid masonry, marble, stone, or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - iv) Toilet/shower compartments: use male/female through bolts
- .2 Install grab bars with mounting plates/mounting flanges provided by grab-bar manufacturer. Ensure provision of tamper-proof escutcheons/cover-plates throughout.
- .3 Use tamper-proof screws/bolts for fasteners throughout.

End of Section 10800

PART 1 - GENERAL

- 1.1 General** .1 Division One, General requirements, is part of this Section and shall apply as if repeated here.
- 1.2 Description of Work** The work shall consist of the following but not limited to:
- .1 Supply and install recessed and surface mounted fire extinguisher cabinets at locations as shown in contract documents.
- .2 Locations for 18 cabinets are shown on plans. Allow for 24 in base bid as local Fire Department may request more during construction.
- 1.3 Related Work** .1 Painting Section 09900

PART 2 - PRODUCTS

- 2.1 Itemized** .1 Fire extinguishers cabinets shall be provided by National Fire Equipment or approved equal.
- Public Space Recessed** - 102F-SS for 5lb ABC
Kitchen Surface Mounted - 102F-SUR for 5lb ABC
Service Rooms Surface Mounted - CE950-3-SUR for 10lb ABC
- .2 Fire extinguisher cabinets shall be as shown on the Architectural drawings or as located by the Fire Department.
- .3 All Fire extinguishers for these cabinets to be supplied and installed by general contractor prior to municipal inspection.

End of Section 10801

PART 1 - GENERAL

- | | | |
|-----|---------------------|--|
| 1.1 | General | Division One, General Requirements, is part of this section and shall apply as if repeated here. |
| 1.2 | Description of Work | Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all of the trades, but not be limited to any of the following: General Contractor, Mechanical, Electrical. |
| 1.3 | Shop Drawings | .1 Submit Shop Drawings in accordance with Section 01340 if required. |
| 1.4 | Warranty/Guarantee | .1 Installation of all materials to be guaranteed for a period of one year. This warranty covers both labour and material for replacement of defective materials. Replacement of defective material at no cost to the owner is guaranteed for a period of one year. |

PART 2 - PRODUCTS

- | | | |
|-----|--|--|
| 2.1 | Kitchen Equipment | All kitchen equipment and other appliances indicated in all areas of the building are to be provided by and installed by General Contractor under Allowance. Dishwashers, washer and dryer are to be installed by plumber and electrician under base contract. |
| 2.2 | Child Care Centre Furnishings | Baby Change Tables:
Supply and install Jonti-Craft 'Changing Table with Stairs - Left' item #5131 JC, 48" wide x 39" high x 22.5" deep unit in clear natural wood finish. Qty = 2; Location: Child Care WR 149-4 and 153-4. |
| 2.3 | 1 st and 2 ND Floor Corridor | Corridor Coat and shoe Racks:
Supply and install Global School Products (or approved alternate) Model SCR 1001 c/w hooks and mounting brackets for coat racks and separate boot racks. Colour from standard range. Refer to drawings for lengths. |
| 2.4 | Office | Safe: Sapekity Brand - 4.5 ft3 Fireproof Depository Safe - 28"h x 16"w x 14"d. DSBN will purchase the safe and program it for the school and deliver to site. Installation shall be by general contractor. |

PART 3 - EXECUTION

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|-----|--------------------------------|--|
| 3.1 | Preparation | .1 Protect adjacent surfaces from damage resulting from work under this specification. |
| 3.2 | Installation | .1 Install equipment in accordance with manufacturer's instructions, by manufacturer's own staff. |
| 3.3 | Clean Up | .1 Final cleaning of equipment to remove job site soiling shall be the responsibility of the Owner. Leave surfaces reasonably clean of foreign material. Remove surplus materials and debris resulting from work related to this division. |
| 3.4 | Operation and Maintenance Data | .1 Upon completion of installation, supply standard parts, service kits and service manuals. Arrange with and demonstrate to the Owner operation and general maintenance procedures. |

FURNISHINGS AND EQUIPMENT

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END OF SECTION 11200

ATHLETIC EQUIPMENT

Section 11480
Page 1 DCES
2501

PART 1 - GENERAL

- | | | |
|--------------------------------|---|---|
| 1.1 General | Division One, General Requirements, is part of this section and shall apply as if repeated here. | |
| 1.2 Description of Work | Provide all labour, materials, and equipment required or called for in this specification, or which is necessary, to complete the work without any extra cost. This work may require any or all, but not be limited to any of the following: <ul style="list-style-type: none">.1 Floor Sockets.2 Basketball , posts, backstops, glass and steel backboards, fixed and break away basket hoops nets, safety straps..3 Electric winch and accessories. | |
| 1.3 Related Work | <ul style="list-style-type: none">.1 Cast-in-place Concrete.2 Gymnasium Wood Flooring.3 Painting | <ul style="list-style-type: none">Section 03300Section 09850Section 09900 |
| 1.4 Shop Drawings | <ul style="list-style-type: none">.1 Submit shop drawings in accordance with Section 01340. | |
| 1.5 Warranty | <ul style="list-style-type: none">.1 Two year warranty to be provided. | |
| 1.6 Workmanship | <ul style="list-style-type: none">.1 All work shall be neatly fitted, installed and fastened in place. Provide all parts and accessories required upon completion..2 All work shall be cleaned in a manner and with materials as directed by the manufacturer of the materials and equipment and left perfect in all respects. Co-operate with other trades. Temperature must be over 60° F..3 Employ only personnel skilled in the installation of the equipment..4 Install equipment in strict accordance with the manufacturer's printed specifications. Have these specification available on site..5 The completed installation shall show no objectionable joints between them and adjacent work. | |
| 1.7 Maintenance | <ul style="list-style-type: none">.1 Furnish written details of maintenance and care of installed | |

equipment.

1.8 Guarantee

- .1 Furnish written guarantees covering material and workmanship for a period of two years after occupation of the building by the Owner.

PART 2 - PRODUCTS**2.1 Materials**

- .1 The supply and installation shall be by Gymnasium and Health Equipment Limited, Forum Athletic Products, Centaur Products, or Lolimpin Equipment.
- .2 Design is based on the use of athletic equipment provided by Forum Athletic Products Inc., and the terminology used may include reference to that manufacturer's propriety products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.
3. Volleyball Posts: 48mm volleyball end post: Model F50202 by Forum Athletic Products Inc. (4 required);
4. Badminton Posts: 48mm badminton end posts: Model F50111 by Forum Athletic Products Inc. (6 required)
5. Volleyball nets: Model F50412 by Forum Athletic Products (2 required)
6. Badminton nets: Model F50413 by Forum Athletic Products (3 required)
- .7 Floor sockets:
Fixed Floor Sockets, consisting of a corrosion resistant brass lid, flange and heavy-duty plate (48mm) steel socket for badminton and volleyball posts by Forum Athletic Products Inc.; Fixed floor socket 48mm - F50401 - 12 required
- .8 Basket Ball Back Stops:
 - a) Ceiling Mounted Forward Folding Backstop: (Unit - A)
Forum Athletic products Inc, Model number F850-FB, complete with:

- I. rectangular glass back board F40209 Size 42"x72"
 - II. Breakaway Goal and Net F40115
 - III. Cushion Edge Padding F40210 - colour TBD
 - IV. Electronic Winch F49003
 - V. All structural and safety supports
 - VI. hardware, all necessary mounting and installation supports
 - VII. Autoloc Safety Strap F49026
- Two units required.

b) Wall Mounted Height Adjustable Backstop: (Unit B)

Forum Athletic products Inc, Model number F852, complete with:

- VIII. aluminum fan-shaped backboard F40205T Size 35" x 54" with border and target
 - IX. Breakaway Goal and Net F40115
 - X. Crank height adjuster F49001
 - XI. All structural and safety supports
 - XII. hardware, all necessary mounting and installation supports
- Four units required.

- 9. Ball Cage:
Model F59014 by Forum Athletic Products (2 required)
- 10. Ball Carrier:
Model F60301 by Forum Athletic Products (2 required)
- 11. Gymnasium Padding: 4'x6'x4" thick polyurethane core with 3/8" thick laminated mahogany plywood backing with heavy vinyl shell. Permanent mounting except Velcro at stage. Provide cut out for all services. See plans for locations. Model F80100 Permanent wall padding by Forum Athletic Products. Apple athletics is also an approved provider.
- 12. Volleyball Post Storage Stand:
Forum Athletic Model #F59012 (2 required)
Provide 2 - 6 post models
- 13. Outdoor Soccer Goal:
Model F60401 by Forum Athletic Products (2 required)
- 14. Outdoor Basketball post and goal:
Model F40101 / F40205 / F40445 by Forum Athletic Products (4 required)

15. Under stage chair storage carts:
Model 13-780-37 (144" x 40"x22") with 4" phenolic castors by
Ven-Rez Products or approved alternate. Black colour.
(5 required)

PART 3 - EXECUTION**3.1 Supply of
Anchors, etc.**

- .1 Furnish the masonry contractor with all anchors for building
into masonry walls. No exposed anchorage or bearing plates
permitted.
- .2 Coordinate with cast-in-place concrete work for floor socket
locations for building of box forms.
- 3 Provide for concrete base for basketball posts and soccer goals
as per manufacturer's standards.

**3.2 Setting of
Floor Sockets**

- .1 Set floor sockets plumb, true and accurately centred in
locations indicated on the drawings in accordance with
manufacturer's recommended installation instructions. Set to
provide flush finish with specified floor finish.

End of Section 11480

PART 1 - GENERAL**1.1 Scope****.1 Work Included in this Section:**

- .1 Includes the supply and installation of the Gymnasium Divider Curtain and includes without being limited to; overhead drive system, winch, curtain, accessories, mounting fasteners, and cradles.

.2 Related Work Specified Elsewhere:

- .1 Section 04200 - UNIT MASONRY
- .2 Section 05500 - METAL FABRICATIONS
- .3 Section 06100 - ROUGH AND FINISH CARPENTRY
- .4 Section 09900 - PAINTING
- .5 Division 16 - ELECTRICAL

1.2 System Description**.1 Gymnasium Divider Curtain:**

- .1 Work in this section is based on product as manufactured **Forum Athletic Products Inc.** telephone: (905) 405-1222 or Qued Centre Roll or approved alternate.

1.3 Quality Assurance**.1 General:**

- .1 Equipment provided shall incorporate the manufacturers latest design improvements and materials in place as of date of manufacture.
- .2 Bidders shall furnish with his bid a list and clarifications of deviations from the specifications.

.2 Contractor:

- .1 Shall be a firm experienced in the field of athletic equipment and approved by the manufacturer; and shall have completed at least 3 projects of similar magnitude and complexity.
- .2 Shall be registered with the local W.S.I.B. and Safety Certified.

.3 Warranty/Guarantee:

- .1 Provide a written warranty covering defects in materials and workmanship for a period of one year from the date of installation.

1.4 Submittals**.1 Shop Drawings:**

- .1 Provide as directed under [Section 01340]; show complete details, mounting dimensions, mounting details, and any additional backing required for proper mounting.

.2 Maintenance Information:

- .1 Provide copies of the care and maintenance information for incorporation into the Project Maintenance Manuals.

1.5 Product Delivery, Storage, and Handling**.1 Delivery:**

- .1 Do not deliver materials of this section until the building has been enclosed and is weather tight and dry.
- .2 Deliver materials of this section to suit construction schedules; ensure related trades have

completed their work.

- .2 Storage:
 - .1 Materials shall be stored in a secure location provided by the General Contractor.

1.6 Site Conditions

- .1 Building Conditions:
 - .1 Ensure the area is neat and clean and that there are no obstructions which may affect the safety of the installers.
 - .2 Ensure that all related trades which affect the work of this section have completed their work.
- .2 Surface Tolerances:
 - .1 Ensure that work is smooth and level and is adequately reinforced to take the loads imposed by the mounting this sections work.

PART 2 - PRODUCTS

2.1 Fabrication

- .1 Overhead Suspension:
 - .1 Provide custom designed mounting clamps or clips to be supported to the building superstructure at maximum [10'-0"] [3050mm] on centre.
 - .2 Where positioning does not permit direct attachment to the building structure, Metal Fabrications Section 05500 shall provide support structure for mounting curtain system.
- .2 Drive System:
 - .1 Overhead drive system shall consist of one continuous [5"] [127mm] diameter drive tube with electric drive unit located at one end.
 - .2 Universal joint assembly shall attach drive tube to winch.
- .3 Hoisting Mechanism:
 - .1 Drive tube shall be supported by precision laser cut and formed cradle assemblies fastened to building super structure at no more than [10'-0"] [3050mm] on centre.
 - .2 Rolling action shall be from the top, and shall be achieved without the use of belts and/ or cables.
 - .3 Drive pipe support assembly shall be compact to allow for stored dimension of approximately [14"] [356mm].
 - .4 Bottom edge of curtain to have pocket to accommodate [1 5/8"] [41mm] diameter round batten.
- .4 Electric Drive Unit:
 - .1 Shall be **electrically operated** by means of Forum F49003 Electric Winch 3/4 HP, 115 V, 11.5 Amp, instant reversible torque motor, limit switches, and flush mounted UP/DOWN/STOP constant contact single 3-position switch, 2300 inch pounds of torque, sealed gear case with precision ball bearings.
- .5 Curtain Fabrication:
 - .1 All seems to be electronically welded with a 1" full contact weld.
 - .2 All seems are horizontal to allow for even roll of vinyl around drive tube.
 - .3 Outer edge hems shall be turned with welds.
- .6 Curtain Materials:
 - .1 Solid vinyl materials shall be heavy duty 18 oz. per sq. yd.] [0.61 Kg. per sq. m.] [22 oz. per sq. yd.] [0.75 Kg. per sq. m.] vinyl coated, heat set polyester material, flammability rated as self-extinguishing by the California State Fire Code and Class A rated in accordance with requirements of NFPA-101. Colour from standards.

- .2 Open mesh vinyl materials shall be [9 oz. per sq. yd.] [0.306 Kg. per sq. m.] vinyl coated woven polyester fabric allowing for through mesh lighting, observation, and air circulation. Flammability rated as self-extinguishing by the California State Fire Code and Class A rated in accordance with requirements of NFPA-101. Colour from standards.

- .7 Accessories:

- .1 Provide Forum F49007 curtain lock safety belt system attached to the hoisting mechanism.

2.2 Divider Curtain Assembly

- .1 System:

- .1 Shall be F3100 Electrafold Top Roll Divider Curtain System by Forum or approved equal, with combination mesh/vinyl curtain, with the lower [10'-0"] [3050mm] of curtain being deluxe solid vinyl with the top section being open mesh vinyl coated woven polyester fabric.

PART 3 - EXECUTION

3.1 Inspection

- .1 Site Dimensions:

- .1 Verify by obtaining actual site measurements prior to any fabrication modification, or cutting, all dimensions as required for a complete first-class installation.

- .2 Receiving Surfaces:

- .1 Ensure that all receiving surfaces are smooth and level and adequately reinforced to support the work of this section; additional backing shall be provided as and where required to ensure a safe and proper installation.
 - .2 Report any discrepancies to the General Contractor who shall have deficient work corrected immediately.

3.2 Installation and Performance

- .1 Standard:

- .1 Installation to conform to the manufacturers latest approved installation methods and procedures.

- .2 Methods:

- .1 Install divider curtain systems to locations as shown on the architectural plans and in accordance with the approved shop drawings.
 - .2 Drive system is to be securely mounted to the building structure and sway braced as required to provide a safe and quality installation.
 - .3 Where drive is fixed to structural components, the system shall be mounted using manufacturers recommended mounting procedures or if required, fastening devices or methods custom designed to withstand the loads imposed by the equipment which shall not affect the structural requirements of the components.

- .3 Structural Supports:

- .1 Provided as required by the Structural Trade to locations as verified by this section, all structural supports required, but not necessarily shown, to safely support this sections work.

- .4 Electrical Wiring:

- .1 Provided as required by the Electrical Trade to locations as verified by this section, all electrical power, conduits, field wiring and connections of the electrical winch and controls.

END OF SECTION

STAGE CURTAIN

Section 11490

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PN2501

PART 1 - GENERAL

- | | | | |
|--------------------------------|----|---|---------------|
| 1.1 Description of Work | .1 | Supply and installation of valance, drapery and associated track, hardware, etc. at the Stage 131-2 proscenium in the Gymnasium 131. | |
| 1.2 Related Work | .1 | Structural Concrete Block Masonry | Section 04220 |
| | .2 | Painting and Decorating | Section 09900 |
| | .3 | Steel Stud and Gypsum Board | Section 09111 |
| 1.3 Shop Drawings | .1 | Provide shop drawings in accordance with supplementary and/or general conditions. Show dimensional layouts together with fabrication and installation details based on site conditions. | |
| | .2 | The general contractor, upon request, to forward to this sub-contractor a complete set of architectural drawings, specifications, addenda and colour schedule for use in preparation of shop drawings and execution of installation. | |
| 1.4 Samples | .1 | Samples to be provided to the architect and/or owner, for his perusal and approval of all materials to be utilized in this installation. | |
| 1.5 Warranty/Guarantee | .1 | Installation of all materials to be guaranteed for a period of one year. This warranty covers both labour and material for replacement of defective materials. Replacement of defective material at no cost to owner, is guaranteed for a period of one year. Warranty is extended to installation labour also, when installation performed by curtain erection crew. | |

PART 2 - PRODUCTS

- | | | |
|----------------------|----|---|
| 2.1 Materials | .1 | Stage curtain and associated track, hardware, etc. shall be by Jandra or approved alternate. |
| | .2 | Provide one (1) pair of Jandra front MainDraw Stage drapery and one (1) S/P main valance complete with 50% fullness and double grommet pleat. |
| | .3 | Provide one (1) Jandra ADC #170 cord drawn stage track with ¼" nylon braided stage cord, tension pulley control, suspended with 2/0 tenso chain from metal deck ceiling and all necessary hardware. |

- .4 Colour: 21 oz. velour flame retardant. Colour - Black Velvet.

PART 3 - EXECUTION

3.1 Examination

- .1 Prior to commencement of erection, all surfaces to be checked for irregularities, trueness, rigidity and projections. Defects to be reported immediately to the general contractor for correction.

3.2 Installation

- .1 Erection of materials shall be carried out in a substantial manner to ensure a rigid, straight, square, plumb, and level assembly following supplier's printed installation instructions.
- .2 On completion of the installation, all materials and workmanship to be inspected for proper operation, rigidity and appearance, and any defective materials are to be replaced with new materials prior to final inspection.

3.3 Special Cleaning

- .1 Upon completion of all work - clean down, remove all dirt and leave all elements in a first class conditions at the point of handing over to the owner.

End of Section 11490

PART 1 - GENERAL

- 1.1 Description of Work**
- .1 Supply and installation of new chain-driven sheer-weave roller blinds and all related mounting and operating hardware in the types at all exterior window locations except those serving Stairs, Corridors, Vestibules, Gymnasium/General Purpose Room and Main Entry Foyer/Lobby.
It shall be up to the installer to site measure all locations for sizes and installation requirement.
 - .2 For new windows refer to drawings for sizes.
- 1.2 Related Work**
- .1 Painting and Decorating Section 09900
 - .2 Aluminium Windows Section 08150
- 1.3 Shop Drawings**
- .1 Provide shop drawings in accordance with supplementary and/or general conditions. Show dimensional layouts together with fabrication and installation details based on site conditions.
 - .2 The general contractor, upon request, to forward to this sub-contractor a complete set of architectural drawings, specifications, addenda and colour schedule for use in preparation of shop drawings and execution of installation.
- 1.4 Samples**
- .1 Samples to be provided to the architect and/or owner, for his perusal and approval of all materials to be utilized in this installation including shading fabrics, cassette finishes etc.
- 1.5 Warranty/Guarantee**
- .1 Installation of all materials and products is to be guaranteed for a period of one year from date of Building Occupancy. This warranty covers both labour and material for replacement of defective items and/or components.

PART 2 - PRODUCTS

- 2.1 Materials/Design**
- .1 Acceptable products include "Teleshade" smooth chain-operated sprocket roller blinds as manufactured by: Jandra Shades, G-Line Solar Shading Inc. or approved alternate.

All products to be manually operated complete with all related operating hardware, mounting hardware and screening fabrics providing the transmission percentages specified in Part 1 earlier herein.

All shades specified herein will be provided by one manufacturer who shall take full responsibility for the supply and installation of the product.

All shades shall be mounted as per section details.

All roller blinds are to be **inset-mounted** into framed window openings/recesses throughout, with minimal gapping between shades and adjacent walls. Overlay mounting of blinds (over top of framed window recesses) will not be accepted unless specifically approved.

Rectangular headers/shade tubes/cassettes to be approx. 79mm deep x 96 mm high throughout. All window blinds are to be securely anchored into suitable architectural materials in/within wall or ceiling assemblies and are NOT to be mechanically fastened to aluminium or metal curtain wall or window frames throughout.

Installations in continuous/long window runs are to be comprised of multiple blinds neatly and tightly mounted side-by-side. Ensure that joints between adjacent blinds align with vertical window frames throughout. No vertical seams between adjacent blinds falling in the middle of a vision pane will be accepted.

All shades are to be sufficiently long to reach existing sill height in each room. Sill heights to be as shown on the Architectural drawings [Building Elevations] and related window sections provided therein. Site verify actual sill heights to suit, allowing for same herein. Widths are to be as tight as possible to reduce sight lines from exterior.

.2 Operation/Action

Manual: Easy-Lift (Chain-operated) Action with stainless steel ball chain operation for infinite positioning. Left or right hand operation available to be determined by installer relative to site-conditions and/or as directed by Architect or Owner.

At all pull chain locations, provide a commercial grade child safety cord tensioner screwed to wall at bottom of chain to allow for smooth chain operation.

.3 Product Assembly

- a) Provide fully factory assembled shade unit consisting of 2 end brackets, shade tube, extruded aluminium fascia, hembar and fabric specified. Removal must not require the disassembly of the shade unit.

- b) End Bracket: the 77 x 96 mm end bracket shall be a two piece moulded ABS construction with a 64 mm diameter nylon drive sprocket. Brackets colour shall co-ordinate with the fascia colour.
- c) Shade Tube: 38 mm extruded aluminium shade tube shall be 1.52 mm thick with three internal continuous fins 4.82 mm high, for strength and drive capabilities when attached to the nylon sprocket. The fins shall be spaced 120 degrees apart.
- d) Header/Cassette: the extruded aluminium header/cassette shall be 1.7 mm thick rectangular profile measuring approx. 77 mm deep x 96 mm high. Header to fully conceal internal shade tube/roller. Header finish to be anodized aluminium or paint colour selected by Architect from manufacturer's full colour range.
- e) Drive Assembly: Shall be factory set for size and travel of shades. Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware. Provided with a built-in shock absorber system to prevent chain breakage, under normal usage conditions, Clutch to be heavy duty metal.
- f) Drive Chain: Shall be No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have a 90# (lb.) test. Supply wall-mount brackets/loops for loose end of chain where directed by the Architect. Ensure that underside of operating chains are mounted at a reasonable height above finished floor level to be readily accessible. No chains to be higher than 4'-6" a.f.f.
- g) Bottom-Weighted Hembar: extruded aluminium with plastic end finials. Finish to be clear anodized aluminium throughout.

.4 **SHADING FABRIC:**

All screening fabric transmission requirements respective to locations to be as specified in Part 1 above. Fabrics based upon percentages of light transmission to be:

General Use Shades throughout [u.n.o.]:

Dow 'Phifer Shearweave' woven PVC fabric in the openness

factor (1% of light transmission) specified elsewhere herein.

Daycare Area Shades [in all Daycare Rooms 100-#]:

Dow 'Phifer Sheerweave' woven PVC black-out fabric with 0% openness factor and opaque white interior backing.

Transmission shade fabrics shall be woven of .018 opaque, vinyl coated polyester yarn consisting of approximately 79% vinyl and 21% 500 denier polyester core yarn. The fabric shall be tensioned in the finishing range prior to heat setting to keep the warp ends straight and minimize or eliminate weave distortion to keep the fabric flat. The fabric shall be dimensionally stable.

All fabric colours to be as selected by Architect from manufacturer's full colour range.

As a "shade cloth" the fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without ravelling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than + 1/8" in either direction due to warp distortion or weave design.

Fabric shall be certified by an Independent Laboratory to pass the Small Scale Vertical Burn Requirements test CAN and UCL-S109-M87 and NFPA 701.

PART 3 - EXECUTION

- | | |
|-----------------------------|--|
| 3.1 Examination | .1 Prior to commencement of erection, all surfaces to be checked for irregularities, trueness, rigidity and projections. Defects to be reported immediately to the general contractor for correction. |
| 3.2 Installation | <p>.1 Erection/Installation of product shall be carried out in a to ensure a rigid, straight, square, plumb, and level assembly and operation of shades in accordance with the supplier's installation instructions. Supplier/installer is responsible to provide all related anchors and fasters suited to the applicable substrates throughout.</p> <p>.2 On completion of the installation, all materials and workmanship are to be inspected for proper operation, rigidity and appearance, and any defective materials are to be replaced with new materials prior to final inspection.</p> |
| 3.3 Special Cleaning | .1 Upon completion of all work clean and remove all dirt from blind components, and leave all elements in an unblemished |

WINDOW ROLLER BLINDS

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factory condition at the time of handing over to the Owner.

END OF SECTION 11500

Part 1 General**1.1 GENERAL REQUIREMENTS**

- .1 Comply with Division 01 - General Requirements.

1.2 SECTION INCLUDES

- .1 Partially buried waste and recycling collection containers

1.3 RELATED SECTIONS

- .1 Section 03300 - Cast-in place Concrete.
- .2 Section 03200 - Concrete Reinforcing.

1.4 REFERENCES

- .1 ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate installation with other site works.

1.6 SUBMITTALS FOR REVIEW

- .1 Section 01300 – Submission Procedures.
- .2 Product Data: Information to include unit dimensions and capacity, materials and colour options.

1.7 SUBMITTALS FOR INFORMATION

- .1 Section 013300 – Submission Procedures.
- .2 Shop Drawings: Detailed product data, including components, materials and finish/colour options.
- .3 Installation Data: Manufacturer's special installation requirements including special procedures, site location details requiring special attention.

1.8 CLOSEOUT SUBMITTALS

- .1 Section 01730 – Submission Procedures.
- .2 Operation and Maintenance Data:
 - .1 Include description of system operation, adjusting and testing requirements.
 - .2 Identify system maintenance requirements, servicing cycles, lubrication requirements and spare parts listings.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver materials in original packaging clearly labelled with project information, and other pertinent information clearly identified (if applicable).
- .2 Storage and Handling Requirements:
 - .1 Handle containers carefully, ensuring not to drop or roll the containers. Lift from delivery truck using the pallet only, with a tether through each side pocket and connected to a spread bar. Ensure that the spread bar and tethers do not make contact with the lid or sides of the container.

Part 2 Products**2.1 MANUFACTURERS**

- .1 EarthBin Products, Hamilton, ON. Product: EarthBin Model EB500.
- .2 Product Description: EarthBin Front-load Semi-in-ground garbage container. Rectangular above ground container with doors, round below ground sleeve liner and container.

2.2 MATERIALS & COMPONENTS

- .1 Waste Container:
 - .1 Rigid roto-moulded premium virgin polyethylene ground sleeve liner
 - .2 Rigid roto-moulded premium virgin polyethylene two (2) piece bin, 6.5 cu. yd. (5000 lt. capacity)
 - .3 Vacuum formed polyethylene architectural panels, brown in colour (other colour options available).
 - .4 100% recycled plastic lockable service lid with textured surface finish, black in colour
 - .5 Vacuum formed polyethylene lockable feed doors with textured surface finish, grey in colour. Two (2) lockable feed doors per container.
 - .6 Steel frame with a super durable powder coated body colour matched finish.
 - .7 Aluminum "GARBAGE" signage.
 - .8 Black protective bumpers.
 - .9 Manual lid strut on both feed doors.
 - .10 Automatic gravity latches both sides on main service lid.
- .2 Cardboard Container:
 - .1 Rigid roto-moulded premium virgin polyethylene ground sleeve liner.
 - .2 Rigid roto-moulded premium virgin polyethylene two (2) piece bin, 6.5 cu. yd. (5000 lt. capacity)
 - .3 Vacuum formed polyethylene architectural panels, brown in colour (other colour options available).
 - .4 100% recycled plastic lockable service lid with textured surface finish, black in colour.
 - .5 Vacuum formed polyethylene lockable feed doors with textured surface finish, blue in colour. Two (2) lockable feed doors per container.
 - .6 Steel frame with a super durable powder coat body matched finish.
 - .7 Aluminum "CARDBOARD" signage.
 - .8 Covered and lockable cardboard slot.
 - .9 Black protective bumpers.
 - .10 Manual lid strut (optional).
 - .11 Automatic gravity latches both sides on main service lid.
- .3 Mixed Recycling Container:
 - .1 Rigid roto-moulded premium virgin polyethylene ground sleeve liner.
 - .2 Rigid roto-moulded premium virgin polyethylene two (2) piece bin, 6.5 cu. yd. (5000 lt. capacity)
 - .3 Vacuum formed polyethylene architectural panels, brown in colour (other colour options available).
 - .4 100% recycled plastic lockable service lid with textured surface finish, black in colour.
 - .5 Vacuum formed polyethylene lockable feed doors with textured surface finish, green in colour. Two (2) lockable feed doors per container.

- .6 Steel frame with a super durable powder coat body matched finish.
- .7 Aluminum "MIXED RECYCLING" signage.
- .8 Covered and lockable cardboard slot.
- .9 Black protective bumpers.
- .10 Manual lid strut (optional).
- .11 Automatic gravity latches both sides on main service lid.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify actual site dimensions and conditions prior to commencing work. Ensure that the ground slope is no more than 5%.
- .2 Ensure the area is clear of overhead obstructions (powerlines, trees, etc.), and clear of fire hydrants, transformers, and other utility boxes.
- .3 Ensure that there are no underground services and utilities under the proposed locations.
- .4 Refer to a geotechnical report if available for soil and groundwater conditions. If the report indicates a high water table, contact the manufacturer for an engineered solution (additional fees will be charged for the design).
- .5 Report conditions contrary to contract requirements that would prevent installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- .6 Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2 EXCAVATION

- .1 Ensure that site area is clear of all above and below grade obstructions. Owner is responsible for removal of obstructions prior to commencement of work.
- .2 Excavate trench 84" (2135mm) wide by 66" (1676mm) deep (measured from highest finished grade). Length of trench is dependant on the proposed number of containers and the truck approach angle.

3.3 INSTALLATION

- .1 Place 4" (100mm) deep granular base to bottom of trench, compacted to a Standard Proctor Density of 95%
- .2 Place eight (8) 12" (300mm) long lengths of 15M rebar into openings at the base of the ground sleeve liner
- .3 Lift liner and place in trench. Use a lifting strap around the top of liner beneath the top lip.
- .4 Centre liner in trench. If installing more than one liner ensure they are in line. Distance between liners to be dependant on the truck approach angle.
- .5 Level liner, using plastic shims if necessary.
- .6 Pour 0.65 cu. yd. (0.5 cu. m.) of 20 Mpa (2600 psi) concrete per container around the ground sleeve liner. Concrete to have a minimum cover of 4" (100mm) above the rebar. Vibrate concrete to ensure that the rebar is bedded and that there are no voids.
- .7 Recheck level and position of liners before concrete sets. Backfill once concrete has set sufficiently to be stood on.

- .8 Recommended backfill material is as defined by ASTM D2321 – Class 1 or Class 2. If frost heave is anticipated Class 1A or Class 1B are recommended, with Class 1B if a high or fluctuating water table is anticipated. Ensure that the backfill material contains no sharp objects, tree roots, or rocks larger than 4" (100mm) in diameter.
- .9 Low slump concrete is a backfill option, especially where space makes backfilling and compaction is difficult. Ensure that the low slump concrete is not dropped more than 48" (1200mm) from the discharge nozzle.
- .10 Backfill in 12" (300mm) lifts, compacting to a Standard Proctor Density of 95%. Ensure no backfill or debris falls into the liner.
- .11 Backfill to a depth of 24" (600mm) and check roundness of ground sleeve liner. Measurements are not to differ by more than 1" (25mm). If necessary cut 2" x 4" timber to appropriate length, and insert in a cross pattern at top rim to maintain roundness.
- .12 Continue backfilling to approximately 4" (100mm) of finished grade. Distance from top of grade to top of ground sleeve liner to be minimum 3" (75mm).
- .13 Set up concrete forms as required and install 4" (100mm) wide foam bond break around top of liner.
- .14 Pour minimum 4" (100mm) slab (actual depth as determined by Contractor or Engineer) of 25 Mpa (3600 psi) concrete with a broom finish. Ensure a minimum 4% slope from liner.
- .15 Once concrete has set, remove formwork and saw cut concrete as required.

3.4 PROTECTION OF FINISHED WORK

- .1 Protect ground sleeve liner and garbage container from other site works until completion of project.

3.5 SCHEDULES

- .1 Refer to Site Plan for location of waste collection containers and enclosures.

END OF SECTION



HYDRAULIC ELEVATOR SPECIFICATION

Section 14 20 06

Dain City School

Prepared By:

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PART 1 - GENERAL

1.1 Related Work

- .1 Coordinate work with related trades, including:
 - .1 Section 01 01 00 - General Instructions
 - .2 Section 01 61 00 - Common Product Requirements
 - .3 Section 05 12 23 - Structural Steel
 - .4 Section 05 50 00 - Metal Fabrications
 - .5 Section 06 10 11 - Rough Carpentry
 - .6 Section 26 - Electrical Service

1.2 Reference Standards

- .1 Perform work to the following minimum standards:
 - .1 ASME A17/CSA-B44-19 Safety Code for Elevators and Escalators
 - .2 CSA C22. No. 77 Motors with Inherent Overheating Protection
 - .3 CSA C22 No. 141 Unit Equipment for Emergency Lighting
 - .4 Technical Standards and Safety Act 2000, Ontario Regulation 209/01, and Ontario Regulation 223/01
 - .5 TSSA Code Document Amendment 295-22 or latest amendment
 - .6 C22 Canadian Electrical Code, particularly Section 38
 - .7 National Building Code
 - .8 CAN/CSA B651 Barrier-Free Design Guidelines
 - .9 CAN/CSA Z320 Building Commissioning Standards
 - .10 Canada Labour Code, Part 2, Occupational Health and Safety Regulations including Section 13.13
 - .11 Occupational Health and Safety Act including Section 109 of Ontario Regulation 213/91
 - .12 CSA Z432-04 Safeguarding of Machinery
 - .13 TSSA document: Elevator Machine room Equipment Guarding - Best Practices
 - .14 Addendum to ANSI/ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings
 - .15 Elevator shall accommodate a stretcher in the prone position as defined by local building code authority.
- .2 Finished elevator installations are to have appropriate guards and be compliant with Occupational Health and Safety Regulations with respect to physical and electrical hazards to persons in the elevator machine rooms.
- .3 In case of discrepancy, the above standards take precedence over details elsewhere in this specification.

1.3 Type of Elevators

- .1 One (1) holeless hydraulic elevator.
- .2 Power Supply
 - .1 Motor and controllers: Verify voltage with drawings, 3 Phase, 3 Wire, 60Hz.
 - .2 Include any required transformers to accommodate supply voltage.
 - .3 Lighting supply: 120 volts, 1 phase, 60Hz (dedicated)

1.4 Permits and Inspections

- .1 Complete Design Submission and related research necessary for regulatory approval of Work.
- .2 Obtain and pay for necessary Municipal or Provincial inspections and permits and make such tests as are called for by the regulations of such authorities. Make tests in the presence of the authorized representatives of authorities.
- .3 Provide the Owner and the Consultant with copies of inspection reports the same day they are received from authorities.

1.5 Taxes

- .1 Pay all taxes properly levied by law including Federal, Provincial and Municipal. Taxes to be invoiced as an identified extra.

1.6 Measurements

- .1 Before the execution of the work, verify all dimensions with the actual site conditions.

1.7 Quality of Work

- .1 Perform work by mechanics skilled in the installation of elevators and escalators. Provide adequate supervision.
- .2 Guard and protect the hoistway, from commencement to completion of the work.
- .3 Comply with all applicable provisions of all federal, provincial, and local labour laws.
- .4 Provide a completed system with an engineered design lifespan of 25 years.

- .5 Provide equipment, including mechanical and electrical as readily-maintainable with a minimum 98.5% availability expected over the 25 year life and maintenance repairs not expected to exceed 24 hours more than one per year and 8 hours more than 4 times per year.

1.8 Samples

- .1 Submit to the Architect or Consultant for approval, upon request, samples of any visible elevator finishes including:
 - .1 Cab wall finishes.
 - .2 Cab ceilings.
 - .3 Cab doors.
 - .4 Hoistway entrance doors and frames.
 - .5 Signal and operating fixtures.

1.9 Shop Drawings and Product Data

- .1 Submit shop drawings in accordance with Section 01 - Submittal Procedures.
- .2 Before beginning work, prepare all drawings necessary to show the general arrangement of the elevator equipment and other data which is called for and is to be submitted for review. Provide these drawings within two (2) weeks after notification of award of contract.
- .3 Drawing review is for the sole purpose of ascertaining conformance with the general design concept and does not constitute approval of the design details inherent in the shop drawings, responsibility for which shall remain with the Contractor. Review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents.
- .4 Indicate on shop drawings:
 - .1 Size and location of machine, controller, and drive.
 - .2 Size and location of car, hoisting beam, guide rails, buffers, and other components in hoistway.
 - .3 Rail bracket spacing and maximum loads on guide rails.
 - .4 Reactions at points of support.
 - .5 Weights on principal components.
 - .6 Top and bottom clearance and overall travel of car.
 - .7 Location of circuit breaker, switchboard panel or disconnect switch, light switch, and feeder extension points in machine room.
 - .8 Include on general arrangement drawings:

- .1 Type, size, location of hoistway entrances showing details of fastening to hoistway structure.
- .2 Plan and section view of hoistway and machine room.
- .9 Location and size of access doors.
- .10 Loads on hoisting beam.
- .11 Heat generation of equipment in machine room.
- .5 Provide product data for:
 - .1 Signal and operating fixtures, operating panels, and indicators.
 - .2 Cab design and components.
 - .3 Doors and frame details.
 - .4 OHSA/MOL and TSSA compliant equipment guarding.
- .6 Detailed drawing showing all fixtures, position indicators, push buttons, car operating stations, corridor control panels, and any other special fixtures pertaining to the project.
- .7 Include catalogue illustrations of operating and signal fixtures.
- .8 Do not commence manufacture or order materials before shop drawings are reviewed.

1.10 Project Record Documents

- .1 Before final acceptance of equipment, provide three (3) sets of reproducible as- built wiring diagrams as well as three (3) sets of all final issue shop drawings including General Arrangement Drawing. One set of drawings to be laminated or enclosed in plastic protectors and marked "as-built". Provide all drawings stamped as "as built" by a Professional Engineer registered in the province.
- .2 Record actual locations of equipment, names of equipment manufacturers and suppliers, concealed conduit and boxes, concealed devices, disconnects and shut-off valve.
- .3 Mark up all field changes or additions to original wiring diagrams in red.

1.11 Operation and Maintenance Data

- .1 Within 24 hours of final inspection by Provincial authority, provide consultant with a copy of the inspection report.
- .2 Provide one (1) hard copies and one (1) soft copy of the Operation and Maintenance manuals, including complete Maintenance Control Program (MCP). Include in the manuals a copy of the safety authority registered design submission and inspection reports.

- .3 Bind data in vinyl hard cover 3 D ring type loose leaf binders for 212 x 275 mm size paper. Binders must not exceed 75 mm thick or be more than 2/3 full.
- .4 Enclose title sheet labelled "Operation Data and Maintenance Manual", project name, date, and list of contents. Show project name on binder face and spine.
- .5 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .6 Include the following maintenance data for each elevator:
 - .1 Description of elevator system's method of operation and control including, but not restricted to, motor control system, emergency power operation, door operation, and special or non-standard features provided.
 - .2 Consolidated replacement parts list.
- .7 Include in the manuals a copy of the registered design submission and TSSA inspection reports.
- .8 Provide legible schematic wiring diagrams covering all electrical equipment as supplied and installed, including all changes made to final work, with all symbols listed corresponding to identity or markings on both machine room and hoistway apparatus. Cover one (1) copy in plastic or glass, frame, and mount in machine room. Include lubrication chart.
- .9 Include all wiring diagrams for all equipment on controllers.
- .10 List information on each piece of equipment including:
 - .1 Approval drawing number.
 - .2 Model, part, and serial number.
- .11 Detail the following maintenance information:
 - .1 Lubrication products and schedules.
 - .2 Trouble shooting procedures.
 - .3 Adjustment techniques.
 - .4 Operational checks.
 - .5 Maintenance of special finishes.
 - .6 Planned maintenance tasks and their frequencies.
- .12 List recommended spare parts to be maintained on site to ensure optimum efficiency. List all special tools and appropriate unique applications. Detail manufacturer and supplier names and addresses.

1.12 Maintenance Service

- .1 Provide complete full parts and labour maintenance of the elevator for a 12-month period following TSSA approval.
- .2 This maintenance will include web monitoring, phone, service and parts/labour for any issues that may arise during this period. Phone number in elevator will go directly to installer.
 - .1 Provide 24-hour callback service without additional charges to the Owner.
 - .2 Provide emergency response time to remove trapped persons of thirty (30) minutes maximum at any time of day or night.
 - .3 Provide emergency response time for emergency callbacks (not including trapped passengers) of forty-five (45) minutes maximum during regular working hours and one (1) hour maximum after 5:00 PM or on weekends
 - .4 Answer non-emergency call backs within ninety (90) minutes from receipt of call during regular working hours - 7:00 AM to 5:00 PM.
- .3 As a minimum all inspections, tests and maintenance procedures are to be carried out monthly and in accordance with the CSA Standard B44-19 and Elevating Devices Code Adoption Document, active TSSA rulings, the Maintenance Control Program, and the Owner's maintenance contract.
- .4 After ten months has passed a commissioning audit will be done by an Elevator Contractor of DSBN's choice to provide a final deficiency list and prepare for transfer of monitoring/service warranty from the installer.
 - .1 Any deficiencies from this audit will be given to the Installer for completion before the 12-month period has ended.
 - .2 Once the 12-month period has ended, DSBN's Elevator Maintenance and Repair Contractor will take over the maintenance. The phone number in the elevator will be transferred over to the Elevator Maintenance Contractor.
- .5 Systematically, clean, lubricate, and adjust all of the equipment as required.
- .6 Repair or replace electrical and mechanical parts of any equipment as required, whether due to defect or normal wear and tear.
- .7 Perform work by competent personnel under supervision and in direct employ of manufacturer, or manufacturer's licensed agent.
- .8 Schedule work during regular Elevator Trade working hours with Owner.
- .9 Maintain locally an adequate stock of parts for replacement or emergency purposes and have qualified staff available to ensure fulfilment of parts requirements in a timely fashion.

- .10 Remove garbage at each examination.
- .11 Provide a logbook in the machine room and record all callbacks and repairs as work is carried out. Provide an "acknowledgement of inspection" form at each inspection. Do not employ a computerized logbook.

1.13 Layout

- .1 Design equipment to suit space as shown on Architectural drawings distributed at time of project tender, including hoistway cross-sections, overhead dimensions, pit depths, machine room dimensions and machine room location.
- .2 In the event that design changes are proposed by the Contractor with respect to any of the above-noted dimensions, required either for convenience or by physical necessity, explicitly notify Consultant and Architect in writing without delay.

1.14 Warranty

- .1 Provide a warranty that the materials and workmanship of the apparatus installed under these specifications are first-class in every respect and make good any defects, not due to improper use or care, which may develop within one (1) year from the date of acceptance.
- .2 Provide an extended warranty of two (2) years for non-maintainable finished surfaces visible to elevator passengers. Warranty coverage to include imperfections that may develop on painted and architectural steel surfaces, as well as shifting, delamination, bending or other imperfections of joints, panels and skins. Warranty does not cover damage by misuse.
- .3 Commence warranty of work at date of certification of Final Completion, as certified by the Consultant.
- .4 During the warranty period, provide two-way emergency communication call and video monitoring at no additional cost to the Owner.

1.15 Barrier-Free Accessibility

- .1 Meet all requirements of Appendix E of the CAN/CSA-B44 Safety Code for Elevators.
- .2 Provide flush-mounted Arabic numerals 16 mm in height raised 0.8 mm immediately to left of floor buttons to identify floor buttons.
- .3 Provide tactile indications (Arabic), 50 mm floor numerals raised 0.8 mm, on the hoistway door panel jambs. Locate 1.5 metres above finished floor.

- .4 Locate uppermost button in elevator cab control panel at less than 1220 mm above floor level.
- .5 Include braille markings on car operating panel fixtures.
- .6 Provide new vandal-resistant car lanterns. Lanterns to illuminate/chime, green/once for UP direction, and red/twice for DOWN.
- .7 Provide bar-type handrail, 6.35 mm x 102 mm solid aluminium on all non-access sides of cab with space of 40 mm between rail and cab wall. Mount at 900 mm above floor. Return ends to wall.
- .8 Provide voice annunciation indication of each floor when served, and of car direction. Provide volume control adjustable from behind car station. Provide high-power speakers, minimum of two (2) per car, so no distortion is readily noticeable to passengers. Provide sample of annunciations, to be in English language and in a female voice, with shop drawings.

1.16 Consultant's Certification of Payment

- .1 The Consultant will certify progress payments for work only after it has been installed.
- .2 Progress payments may be withheld for, whether or not certified by the Consultant, for any of the following:
 - .1 Defective work or deficiencies not corrected.
 - .2 Failure of Contractor to make payments properly to Sub-contractor(s) or for material and labour.
 - .3 Failure to work to schedule.
 - .4 Damage to the building or another contractor.
 - .5 Failure to meet specifications or performance criteria.

1.17 Elevator Performance

- .1 With equipment adjusted to the required parameters, operate elevator with smooth acceleration and provide a comfortable and agreeable ride to the passengers.
- .2 Meet required parameters in conjunction with dependable, consistent elevator operation and without undue wear or excessive maintenance over the life of the elevator installation.
- .3 Provide quiet power unit operation not to exceed 82 dB as measured 1 m from the centre of mass of the power unit, set on the 'A' scale with an 'F' response.
- .4 Set single-side opening doors to safely open in 2.7 seconds and close in 3.8 seconds.

- .5 Provide adjustable dwell times and independent dwell settings for car and hall calls. Set the dwell times to 2 seconds for car, and 3 seconds for hall initially.
- .6 Maintain floor levelling accuracy of 5 mm or better.
- .7 Set door detector interrupt and nudging time to 20 seconds. Set door to close at reduced speed in nudging mode.
- .8 Limit cab noise levels to 60 dB when moving and 68 dB during a door operation cycle, as measured by a sound meter located in the centre of the cab and set on the "A" scale with an "F" response.
- .9 Limit horizontal vibrations in both the post-to-post and front-to-back axis to 20 milli-g in the 2 - 10 Hz range.
- .10 Limit vertical vibrations to 20 milli-g.
- .11 Adjust typical acceleration rate to 0.04 g.
- .12 Limit jerk rate (change in rate of acceleration) to 2.44 m/s³.
- .13 Provide car speed to within 10% of contract speed in the UP direction and 15% in the DOWN direction.

PART 2 - PRODUCTS

2.1 Description of Elevators and Features

Table 2.1 – Overview

FIELD	REQUIRED
Type	Holeless hydraulic
Class	Passenger
Capacity	1587 kg (3500 lbs)
Cab Interior Min.	6' 8" wide x 5' 5" deep
Speed	0.508 m/s (100 fpm)
Landings	3 stops, See Architectural drawings
Hoistway Size	8' 7" wide x 7' 5" deep, See Architectural drawings
Overhead Size	4520 mm clear, See Architectural drawings
Pit Depth	1525 mm, See Architectural drawings
Door Opening	1067mm (42") wide, 2134 mm (84") high
Hall Entrance Finish	Brushed stainless steel doors and frames
Type of Control	Microprocessor based
Type of Operation	Simplex selective collective

Table 2.2 – Special Features

FIELD	REQUIRED
Fire Fighters' Operation	Phase I recall and Phase II in-car operation
Emergency Power	Automatic battery lowering
Independent Service	Include in each cab
Remote Monitoring	Not required – during warranty period
Card Reader	Not required
Security Camera	Not required

Table 2.3 - Signals

FIELD	REQUIRED
Push Buttons	Stainless steel, LED illuminated
Car Operating Panels	Single car operating panel
Position Indicators	Required in car operating panel and main lobby
Lanterns	Required in each car door jamb
Appendix "E" of B44	Full compliance required
Emergency Phone	Provide two-way voice, video, text communication in cab

2.2 Components

- .1 Use major elevator components from standard product line of one manufacturer unless otherwise approved.
- .2 Use components only which have performed satisfactorily together under conditions of normal use in not less than three (3) other elevator installations of similar design and for a period of at least two (2) years. Furnish names and addresses of owners or managers of buildings, in which proposed combination of major components has so performed.
- .3 Major components are defined to include motors, motor drives, controllers, and machines.
- .4 Furnish materials and equipment new, the best of their respective kinds, and installed in a neat, accurate, workmanlike manner.
- .5 Provide only system designs field tested for the application, with adequate capacity to meet all performance criteria and to provide long term, reliable operation.
- .6 Provide metal hydraulic pipe and fittings to CAN/CSA-B44.
- .7 Provide stainless steel to ASTM A480M, type 304, no. 4 satin finish or XL-Blend S as specified.
- .8 Use paint with CGSB 1-GP-104Ma, alkyd enamel semi-gloss, for machinery, colour to be selected by Architect.
- .9 Provide elevator control equipment manufactured by one of the following:
 - .1 Automatisation JRT Inc.
 - .2 GAL Manufacturing
 - .3 Motion Control Engineering (MCE)
 - .4 Smartrise
- .10 Other manufacturers are not acceptable unless approved in writing by tender-issuing authority.

2.3 Electrical Components

- .1 Provide insulated wiring to connect all parts of the equipment.
- .2 Use steel compression type fittings where electrical metallic tubing is used. Fittings with set screws are not acceptable unless a separately identified grounding conductor is also installed inside raceway.

- .3 Provide suitable communication system and any security system junction boxes on the outside of the controller. Provide uninterrupted shielded wiring from the communication system in car to junction box located at controller in machine room. Clearly label junction boxes accordingly.
- .4 Provide a separately identified box for the fire alarm connection and emergency power signal.
- .5 Include at least 10% spare conductors in each cable. Terminate spares at terminal blocks, suitably identified.
- .6 Include spares of at least six (6) pairs of shielded wires and one (1) CAT 6 cable for audio, video, or other electronic equipment, such as a card reader system.
- .7 Do not parallel conductors to increase capacity unless individually fused.
- .8 Do not use armoured flexible metal conduit as grounding conductor.
- .9 Install anti-shorts at all wiring entry points.
- .10 Provide additional disconnect switches and wiring as required to suit machine room layout. Provide and install all required conduit and wiring from disconnect switches to elevator controllers.
- .11 Include wiring for run in conduit, by others, for connections to elevator-related devices remote from hoistway.
- .12 Connect all wiring where required to building fire alarm system. Fire alarm signal are to be brought to a demarcation point and labeled in the elevator machine room by Division 16.
- .13 Limit use of flexible conduit on car top to items that require movement or periodic adjustment.
- .14 Provide insulated wiring having a flame retarding and moisture resisting outer cover. Run wiring in metal conduit or tubing or wire ducts.
- .15 When using conduits or troughs through floor, extend conduit or trough at least 100 mm (4") above floor.
- .16 Do not run conduit or wiring along the pit floor. Install all conduit and wiring a minimum of 300 mm (12") above pit floor.
- .17 Use type ETT travelling cables.
 - .1 Suitably suspend the travelling cables to relieve strain in the individual conductors.

- .2 Install travelling cables with a continuous run from the controller to the elevator cab. Do not terminate or couple the travelling cables under the car or in the hoistway.
- .3 Suitably protect travelling cables from damage where they make contact with the hoistway, hoistway equipment or trimmer beams.
- .18 Run high voltage wiring in electrical metallic tubing or other galvanized steel raceway. Include a covered ground wire same size as feeders in the raceway.
- .19 For wiring that is run in conduit or tubing, comply with Table 6 of CEC Part 1.

2.4 Hydraulic Jacks

- .1 Provide cylinder of steel pipe, factory tested for 600 pounds per square inch working pressure. Sandblast or wire brush outside of cylinder to remove rust and scale. Paint with heavy coat of epoxy.
- .2 Provide plunger of seamless steel pipe or tubing. Manufacture as no more than 0.254 mm out of round and straight within 1.59 mm. Construct plunger of selected steel tubing machined true and finished to surface finish of 0.0008 mm roughness height rating or better.
- .3 Isolate plunger top from car frame.
- .4 At the top of cylinder include stuffing box and packing gland with seal or self-adjusting packing which does not require external adjustment.
- .5 Set jack assembly plumb within 3.17 mm.
- .6 Operate with minimum friction. Provide high quality construction with appropriate clearances for smooth and quiet operation with no distinct knocks or vibrations evident to passengers at any point in the full travel.
- .7 Do not use a plunger follower guide, do not employ telescoping pistons, and do not employ cantilevered cylinder connection.
- .8 Use glycol or ester-based fluids or similar fluids specially formulated for high fire resistance and low smoke production as operating fluid. Ensure seals, packing, and plastic materials used are unaffected by fluid used.
- .9 Include for replacement of gland packing at completion of project and whatever subsequent replacements are required within the 12-month warranty of this project.
- .10 Provide all required adjustments to rails, guides, and car frame including plumbing, squaring, and making true for smooth low friction operation of car at rated speed in both directions.

2.5 Above Ground Jacks

- .1 Provide dual piston roped hydraulic or holeless hydraulic passenger elevator.
- .2 Provide hoist ropes with fibre core from same factory production run and governor rope, in accordance with good practice and the CSA B44 Elevator Code. Provide a minimum of three (3) hoisting ropes.
- .3 If Lang's Lay rope is used, provide means to prevent the rope from turning. Do not use swivel connections.
- .4 Provide springs on at least one end of hoist ropes.
- .5 Use wedge clamp type sockets, as follows:
 - .1 Do not use pole line hardware type.
 - .2 Manufacture rods to be part of the sockets or wedge clamp.
 - .3 If a separate rod is used, it is to be threaded into the socket or clamp portion and a steel pin is to be part of the assembly, to prevent the rod from turning.
 - .4 The returned end of the wire ropes on clamp type are to be secured with two retaining clips. First clip set approximately 2" above top of wedge clamp, second clip 4" above first clip and the end of the wire rope is to be bound and taped to prevent injury.
- .6 Provide car safety device, designed to release when car moves in the "UP" direction.
- .7 Provide a governor complete with switch located in the hoistway overhead.
- .8 Properly synchronize dual and multi-stage pistons for smooth car ride regardless of passenger loading within cab. Ensure dual pistons maintain accuracy of 3 mm to each other.
- .9 Provide PVC or other waterproof protection for any portion of jack within 50 mm of pit floor.

2.6 Pumping Unit

- .1 Design pumping unit as an integral unit, combining motor, pump, valves, and reservoir in one enclosure.
- .2 Prevent lateral displacement of pumping unit.
- .3 Reduce airborne noise with sound deadening material on the inside of the enclosure or submerge pump and motor in oil reservoir.
- .4 Provide swing panels or panels equipped with quick release fasteners for convenient access to parts of equipment requiring adjustment.
- .5 Use positive displacement screw-type pump, with direct connection to drive motor, and pump through flexible coupling, specially designed for quiet service.

- .6 Where necessary, install oil tight drip pan beneath unit to retain leakage of hydraulic fluid.
- .7 Install thermostatically controlled heaters or other means to maintain fluid viscosity within limits necessary to provide consistent, reliable operation at all times.
- .8 Install thermostatic protection of oil temperature in reservoir where pump or motor is submerged in reservoir.
- .9 Provide oil storage tank with capacity equal to volume of oil required to lift elevator to top terminal plus reserve of not less than 45 litres.
- .10 Provide an oil level indicator to show minimum permissible oil level.

2.7 Control Valve

- .1 Provide unit body control valve with high efficiency solenoids manufactured for the elevator industry. Valve to provide smooth elevator operation and reliable speed control and leveling under the full range of expected oil viscosity conditions. Include:
 - .1 Externally adjustable relief.
 - .2 Externally adjustable up start.
 - .3 Check valve rated to support full load.
 - .4 Externally adjustable up-level.
 - .5 Externally adjustable down.
 - .6 Manual lowering.
- .2 Include appropriate strainers to avoid valve damage in case of oil contaminants or particulate.

2.8 Motor

- .1 Design motor for minimum 80 starts per hour.
- .2 Do not exceed EEMAC Design B locked rotor current.
- .3 Design for minimum locked rotor torque of 150% and minimum breakdown torque 200% at normal voltage.
- .4 Provide data plate on motor showing motor connections.
- .5 Limit starting current of elevator motor to not more than four (4) times full load running current.

- .6 Include class B motor insulation.
- .7 Include manually reset integral overheating protection to CSA C22.2 No. 77.

2.9 Motor Controller

- .1 Provide a CSA approved modular microcomputer controller to provide solid state soft start starting.
- .2 Provide the following protection during the starting and running modes.
 - .1 Start fault.
 - .2 Line fault.
 - .3 Temperature fault.
 - .4 Stall motor.
- .3 Provide LED indicators for advisory status and fault annunciation.
- .4 Design controller to be capable of delivering its rated current and ambient temperatures ranging from 5°C to 34°C.

2.10 Oil Storage Tank

- .1 Provide oil storage tank capacity equal to volume of oil required to lift elevator to top terminal plus reserve of not less than 10% or 40 litres, whichever is greater. Provide all new elevator hydraulic fluid as approved by manufacturer of power unit: biodegradable synthetic and not vegetable based. Provide Viscosity Index of 190 with Flash point of 200 degrees C or better. Include permanent signage on reservoir indicating the type of oil required and viscosity index.
- .2 Clearly and permanently indicate minimum permissible oil level.
- .3 Include gauge glasses to indicate oil level if top of tank is more than 1.5 metres above floor level.
- .4 Provide filtering screen mounted over the suction inlet.
- .5 Provide a drain connection.

2.11 Low Oil Control

- .1 Provide low oil control feature to automatically cause up-travelling car to descend to main landing if reservoir oil level is insufficient.

- .2 Arrange control so that oil reservoir must be refilled before elevator can be returned to service.
- .3 Open car and hoistway doors automatically at lower landing. Deactivate control buttons in car operating panel except door open button. Close hoistway doors automatically.

2.12 Sound Isolation

- .1 Include resilient pads to effectively isolate power unit from machine room flooring. Design for transmissivity of less than 10%. Use a minimum of 37 mm thick pads. Do not use built-up pads.
- .2 Provide sound isolation between plunger platen and car frame.
- .3 Provide sound isolation between pumping unit and controller, motor, and pump, and building supports.
- .4 Provide sound isolation coupling in pipeline between pump and cylinder.
- .5 Hang or support oil-line so that it is sound-isolated, by use of non-rigid material, from all elements of building structure.
- .6 Provide flexible connection in all EMT or other rigid conduit which leads to components mounted on the machine room walls, such as battery lowering units.

2.13 Silencer

- .1 Provide new MEI heavy-duty muffler/silencer for power unit pulsation and noise suppression.
- .2 Provide threaded or grouped connection to suit new oil line.
- .3 Utilize system of baffles and bladder charged with air to approximately 42% of hydraulic working pressure.
- .4 Provide all related connections, adaptations, and interfaces.

2.14 Piping

- .1 Use threaded couplings or mechanical couplings which mechanically prevent separation of adjoining members.
- .2 Welding is permitted providing interior of pipe is thoroughly cleaned after welding or where welding method prohibits introduction of foreign material into interior of pipe.

- .3 Provide two (2) shut-off valves in the line to facilitate maintenance and adjustment of the elevator, one in the machine and one in the pit. Provide full-bore ball valve.
- .4 Locate piping where it can be serviced. Buried piping is not acceptable.
- .5 Provide overspeed valve within 300 mm (12") of the hydraulic jack. Activate on pressure drop - not electrical connection. Provide adjustable flow initially set to activate at 125% of contract speed.

2.15 Governor and Safeties

- .1 Provide a new self-resetting overspeed governor and switch.
- .2 Provide a new governor rope tension sheave.
- .3 Provide car safety device.
- .4 Design car safety to release when car moves in "UP" direction.

2.16 Car Guides

- .1 Equip car with heavy duty roller guides, individually spring loaded, mounted on top and bottom of car frame. Provide minimum diameter 102 mm (4").
- .2 Provide each guide with durable, oil resistant and resilient tired ball bearing rollers to run on the finished rail surfaces.
- .3 Do not lubricate guide rails. Maintain each roller on its respective guide in uniform contact with rail surface at all times by means of substantial adjustable springs or by resilient mountings.
- .4 Provide guide operation, which is inaudible to passengers in car or outside hoistway with car operating at rated speed and car fan turned off.
- .5 Use roller tire material which will not develop flat spots after standing idle for 72 hours under average environmental conditions.
- .6 Design guides and related lateral support so that passenger movement within cab does not cause noticeable cab sway.

2.17 Guide Rails and Brackets

- .1 Provide car guide rails of 15 lb/ft minimum.

- .2 Align and file all joints.
- .3 Erect guide rails plumb and parallel within maximum deviation of 1 mm per any 6,000 mm section and 0 mm per any 25 mm section.
- .4 Use metal shims only and provide lock washers under nuts and tapped bolts.
- .5 Compensate for expansion and contraction of guide rails.
- .6 Use splice plates and guide rails with contact surfaces accurately machined to form smooth joints.
- .7 Provide planed steel tees, erected plumb and fasten to hoistway by heavy steel brackets.
- .8 Use "T" shape tongue and groove rails connected with steel splice plates.
- .9 Bolt or weld brackets directly to steel. Do not use clips.
- .10 In concrete structures, provide inserts in concrete formwork or self-drilling expansion shell bolt anchors for support of brackets. Where Engineer considers any concrete fastener improperly installed either replace fastener or demonstrate stability of fastener by performing on site test under which fastener is subjected to four times manufacturer's safe pull out or working load.
- .11 Do not burn out fastening holes.
- .12 Where pits are waterproofed, anchor guide rails in pit so as not to reduce effectiveness of waterproofing.
- .13 Include steel reinforcement for car guide rails where necessary.
- .14 Provide a minimum 150 mm (6") clearance below the guide rails in the pit to ensure that the rails do not bottom.
- .15 Provide additional trimmer beams as required above the level of the last landing served, and between the levels of the floor slabs of each landing served to accommodate structural design. Include any rail stiffening and/or bracket extensions as required.

2.18 Car Buffers

- .1 Provide buffers, stands and associated pit steel.
- .2 Use reduced stroke buffers and emergency terminal stopping devices where pit depth or overhead height does not permit installation of normal stroke buffers.

- .3 Include buffer extensions and working platform complete with ladder where necessary to suit pit depth.
- .4 Provide a switch on each floor mounted car buffer to prevent operation of the elevator towards buffer if buffer does not return to normal position.
- .5 Mount any conduit approximately 300 mm (12") above pit floor. Suitably support this conduit.

2.19 Controller and Cabinet

- .1 Provide a solid-state controller equipped with programmable logic microprocessor controls and self-diagnostic features. Provide fully non-proprietary version of all control equipment including:
 - .1 All required diagnostics are "on board".
 - .2 All programming, tools and diagrams required for long-term maintenance are provided with the controller as the Building Owner's property.
 - .3 The controller will not shut down or alter its functionality in any way after a pre-determined increment of time or use.
 - .4 Any elevator contractor shall be allowed to purchase parts, supplies, diagrams, support, or training directly from the factory at the same cost level as the original installer. A published price list shall be supplied with the controller.
 - .5 Parts, including circuit boards, shall be available for direct purchase from the factory in numbers and not on a one-for-one "exchange only" basis.
 - .6 Manufacturer will provide factory training to the Owner and their Representative in regularly scheduled events, at no fee to attend.
 - .7 Manufacturer offers engineering support and technician training directly to the Owner, their Representative and any service contractor at no costs during the installation period and during the warranty period. Manufacturer offers engineering support and technician training directly to the Owner, their Representative and any service contractor at fair cost subsequently.
- .2 Enclose the controller in enamelled, ventilated, sheet steel cabinet, with swing-type doors at front.
- .3 Provide robust equipment capable of reliable operation with ambient temperature between 5°C and 34°C.
- .4 Provide relays and contactors particularly designed for elevator duty.
- .5 Provide a suitable communication system junction box on the outside of the controller and identify it accordingly. Provide a separate identified box for the fire alarm connection, emergency power signal and security cabling.

- .6 Cord all field wiring and insulate from metal contact.
- .7 Permanently identify all switches, relays, and fuses.
- .8 Mechanically fasten all conductors in controller. Do not employ plastic adhesive clips or brackets.
- .9 Provide protection against reverse and open phasing of main feeders.
- .10 Provide separate plexiglass cover over high voltage section, including 600 V elements, to allow working on the controller with the main doors open.
- .11 Include properly sized primary and secondary fuses for each transformer used in the controller.
- .12 Mount all controller components, including resistors, inside the cabinets. Do not mount components on controller doors or removable panels.
- .13 Govern motion of cars by means analysing real position of car in hoistway. Position device shall be positively connected to the car by mechanical or electrical means. Travelling to a terminal landing for recycling is not acceptable. Stepper relays are not acceptable.
- .14 Do not employ components or controller logic which will disable or otherwise alter the operation of the elevator after a pre-determined number of starts, door cycles, etc.
- .15 Use microprocessors for all logic related functions such as dispatcher, car controller and motion control. Provide crystal regulated frequencies. Provide a dispatching program in ROM, with at least 40% spare capacity. Power each processor from a separate power supply. Isolate the inputs and outputs by optical devices or relays.
- .16 Use easily removable printed circuit boards for all solid-state devices other than high power SCR's and rectifiers. Use gold plated edge connectors. Protect circuits from oxidation. Make all wiring connections through properly dimensioned pads.
- .17 Design solid state circuits to operate in the anticipated environment. Provide means to restart the elevator system efficiently in the event of power interruption. Incorporate noise suppression devices in power supplies, inputs and outputs.
- .18 To facilitate testing and troubleshooting, arrange control circuits to ground one side of the control power supply used for external circuits. (External circuits are those outside of microprocessors or solid-state devices, such as relays, lights, limits, locks and buttons.) Arrange the design so that safety circuits are not compromised by accidental grounding of control circuits.

- .19 Install wiring runs neatly. Terminate wiring at studs or terminal strips, using connections that assure substantial electrical and mechanical integrity. Identify all major components exactly as they are indicated on wiring diagrams. Use engraved Lamicoid or metal tag mounted immediately adjacent to the component.
- .20 Provide battery back-up for all circuits containing volatile memory to retain all information for at least 48 hours without regular power.

2.20 Control and Operation

- .1 Provide microprocessor-based simplex selective collective automatic control optimized to minimize passenger waiting times. Submit a full description of proposed control systems including their features, the conditions which bring these into operation and response time.
- .2 Provide dispatching programs in ready-only-memory, with a minimum of 40% spare capacity.
- .3 In the event of failure of the automatic dispatch system, provide alternate dispatching means to ensure service to all landings and for both travel directions.
- .4 In the controller, include absolute floor encoding which, upon power up, shall move the car to the closest floor to identify the position of the elevator.
- .5 Arrange elevator so that momentary pressure of one or more of its car buttons causes car to start.
- .6 Provide a time delay to hold the car for an adjustable interval at landings at which stops are made to enable passengers to enter or leave the car.
- .7 Do not start car unless the car door is in the closed position and all hoistway doors are locked in the closed position.
- .8 If down landing buttons are pressed while the car is travelling up, the car shall not stop at these landings, but shall allow these calls to remain registered.
- .9 After the highest car and landing calls have been answered and the door interlock circuit is established, the car shall automatically reverse and respond to down car and landing calls.
- .10 Cause the car to start before this time upon registration of a car button for another landing.
- .11 Permit car to be registered to establish direction of travel when car has answered the furthest call, even if other landing calls are registered.

- .12 When the car has been started, either in response to its own car button calls or to landing calls, respond to its own car button calls and to landing calls registered for direction in which car is travelling in order in which landings are reached, irrespective of sequence in which calls were registered. When travelling down the car will not respond to up calls, but these will remain registered and be answered on the next up trip.
- .13 If no car buttons are pressed and a car starts up in response to several down calls, it shall proceed first to the highest down call and reverse to collect other down calls. Similarly, up calls shall be collected when the car starts down in response to such calls.
- .14 If the car stops for a landing call and a car button is pressed within a pre-determined interval thereafter corresponding to the direction in which the car is travelling, the car shall proceed in the same direction regardless of other landing calls registered.
- .15 Provide the elevator with a self-levelling feature that will automatically bring the car to the floor landings. Self-levelling shall, within its zone, be entirely automatic and independent of the operating device, shall correct for over travel or under travel and shall maintain the car within 10 mm of the landing irrespective of load and direction of travel.
- .16 The main floor as described in this section is the first floor.

2.21 Automatic Battery Lowering

- .1 Provide battery-based inverter system to automatically sense building power outage and release passengers in the elevator cabs through lowering to an available floor and opening doors.
- .2 Utilize maintenance-free, sealed batteries, appropriately rated for the duty encompassing controller, door operator, and pumping unit.
- .3 Provide fully rated means of disconnecting from main power source during battery operation.
- .4 Provide onboard LED diagnostic signals.
- .5 Provide an auxiliary contact in the mainline disconnect switch to accommodate this feature.

2.22 FEO - Phase I Emergency Recall Operation

- .1 Provide emergency recall service which will be initiated automatically or manually by any recall switch. When recall has been initiated:

- .1 The elevator controlled by the recall switch and on automatic operation, including independent service operation, shall return directly to the recall level where the doors shall open and remain open. The elevator shall not respond to the landing or car call buttons. Travelling to a terminal landing first and then reversing to travel to the recall level is not acceptable.
- .2 The elevator that is stopped with the doors closed, or is travelling towards the recall level, shall proceed non-stop to the recall level.
- .3 The elevator travelling away from the recall level shall reverse at or before the next available landing without opening its doors.
- .4 A car stopped at a landing shall have its emergency stop switch rendered inoperative as soon as the doors are closed, and the car starts to move. A moving car shall have its emergency stop switch rendered inoperative.
- .5 All call registered lights and directional lanterns shall be extinguished and remain inoperative. Position indicators, in the car and at the recall level, should remain in service.
- .6 The car shall be provided with a visual and audible signal system which shall be activated to alert passengers that the car is on the emergency recall operation and at least the visual signal shall remain operative until the car reaches the recall level.
- .7 An elevator stopped at a floor other than the recall level with doors open shall close its doors and proceed non-stop to the recall level.
- .8 Door re-opening devices that may be affected by smoke or hot gases shall be rendered inoperative.
- .9 If the elevator is on inspection operation, a signal shall warn the inspector to return the car to the recall level. The elevator shall remain under the control of the inspector.
- .10 The recall operation shall be terminated when both switches at the main control panel and lobby panel are in the "RESET" or "OFF" position, as is appropriate.
- .11 Include for connecting the fire alarm signal through the recall switch.

2.23 FEO - Phase II Emergency In-Car Operation

- .1 Provide in-car emergency service initiated by a key switch located in the car station. The switch shall be marked "OFF - HOLD - ON" and the key shall be removable in the OFF and HOLD positions. The switch shall become effective in initiating in-car emergency operation when in the "ON" position, provided the emergency recall operation is in effect and the car has returned to the recall level. During emergency in-car operation, the elevator shall operate as follows:
 - .1 The elevator shall be operable only by a person in the elevator.
 - .2 The elevator shall not respond to elevator landing calls.
 - .3 The opening of power-operated doors shall be controlled only by continuous pressure on the "DOOR OPEN" button. If the "DOOR OPEN" button is released during the "OPEN" motion, the door shall reclose immediately. When doors are fully open, they shall remain open until closed as in point 5.
 - .4 Door re-opening devices for power-operated doors shall be rendered inoperative.

- .5 The doors shall be closed, and the car started by registering a car call and constant pressure on the "DOOR CLOSE" button or on any car call button.
- .6 Momentary operation of the in-car emergency service switch to the "HOLD" position shall cancel registered car calls.
- .7 When the car is at a landing and the key switch in the car is turned to the "HOLD" position, the doors shall remain open and car calls cannot be registered.
- .8 When the car is at a landing and the key switch in the car is turned to the "OFF" position, the car shall automatically return to the recall level as on emergency recall operation regardless of the position of the emergency recall switch.
- .9 The elevator shall be returned from In-car operation only when the car is at the recall level and the in-car switch is in the "OFF" position.

2.24 Independent Service

- .1 Include independent service by means of key-operated switch in car service panel to allow removal from passenger service and to operate independently in response to car calls only and as follows:
 - .1 Render the hall lanterns and/or car riding lanterns inoperative. Car position indicator to remain operational.
 - .2 Cause the car to park with the doors open. Arrange the controls so that the car responds to any car calls registered if a button is held until the doors are closed and the interlocks made-up.
 - .3 Cause the doors to reopen if the button is released at any time up to the point at which the elevator starts to move. Render inoperative the normal door protective devices.
 - .4 Render the door detector inoperative.

2.25 Access to Pit, Hoistway and Top of Car Inspection

- .1 At the top landing for all elevators, provide keyed access to car top.
 - .1 Provide between car crosshead and hoistway door, a single operating fixture containing the following: an emergency stop switch, continuous pressure buttons for operating the car and a switch for making the buttons on top of the car operable. Operation from top of the car shall be obtained by simultaneous, continuous pressure of the appropriate direction button and a safety operating button after these buttons have been made effective.
 - .2 Operation from top of the car shall not be possible unless all electric door contacts are closed.
 - .3 Means shall also be provided so that when the car is to be operated from the top of the car, automatic levelling, power door operation and the normal operating devices car and landing are made ineffective.
 - .4 Arrange circuits to prevent car moving away, when on top of car operation, by any other means.
 - .5 The speed of the elevator shall be not more than 150 fpm and not less than 50 fpm while on inspection mode.

- .6 Provide appropriate circuitry so that top of car operation accomplishes smooth start and stop when operated by any sequence of car top buttons.
- .2 At all landings, provide a hoistway door unlocking device. Provide a collar for holes in door.
- .3 Provide car top guard rail and toe-board on all non-access sides of the elevator car top where the distance to a wall exceeds 300 mm. Comply with TSSA Director's Order 245/10.
 - .1 Include for an intermediate rail and toe board.
 - .2 Include weight of railings in engineered design.
 - .3 Where overhead does not allow standard railings, provide collapsible railings including all safety switches outlined in section 4.2 of Director's Order 245/10.
 - .4 Paint the railing and toe board yellow.
 - .5 Provide an outline of the top of car refuge area.

2.26 Work Lights and Receptacles

- .1 Provide suitable protected light fixtures on top of car.
- .2 Provide two (2) protected and permanently wired light fixtures on car top. One light to be a moveable unit to be used as a hand-held light.
- .3 Provide 120 V 15 amp duplex GFCI receptacle on car top.

2.27 Emergency Lighting

- .1 Include emergency lighting in the cars, with a minimum of two (2) lamps.
- .2 Use battery operated emergency lighting equipment to CSA C22 No. 141-1985, to provide general illumination and 10 Lx minimum illumination at car operating panel.
- .3 Include means for convenient manual operation and testing of the unit from within car. Testing means to be spring loaded or self-centring key switch.

2.28 Car Platform

- .1 Provide a structural steel platform and install a sub floor made of one layer of 19 mm plywood or more rugged as required for class of loading.
- .2 Provide a structural steel isolation frame all around platform.

- .3 Provide 38 mm thick rubber isolation pads. Vulcanize steel plates to top and bottom of pads. Arrange for fastening top plate to platform and bottom plate to isolation frame.
- .4 Provide rubber isolation of car enclosure to sides of uprights.
- .5 Provide aluminum threshold, with suitable grooves for car door lower guides. Set threshold to accept flooring chosen by Owner.

2.29 Car Frame

- .1 Provide a structural steel car frame. Bolt sections together.
- .2 Provide reinforcement to relieve car enclosure of undue stress.
- .3 Design and install car frame and shell to be free of squeaks and rattling noises when car is in motion.

2.30 Car Interior

- .1 Provide suspended ceiling system finished in #4 stainless steel. Totally enclose and conceal all wiring from view within the car.
- .2 Provide a six (6) MR16 fixtures with LED lamps (5W/60 deg/warm white) c/w satin aluminum trim ring and directional gimbal. Design for light intensity measured at car sill of 100 lux minimum.
- .3 Provide pad hooks around entire perimeter of cab including return panels. Provide one set of protective pads to cover all walls including the front return panel (provide cut-out to accommodate car operating station).
- .4 Provide 2438 mm clear height in cab under suspended ceiling for elevators.
- .5 Fabricate entrance return panels, header, entrance columns/door jambs, and car doors of matching, integral brushed stainless steel, 20 gauge. Run grain vertically. Provide clear car entrance height of 2135 mm.
- .6 Install new appropriately fire rated, raised, plastic laminate panels on all non-accessible sides of car cab. Install plastic laminate using two (2) coats of solvent-based contact cement and "J" trim fastening. Provide separate panels above and below the handrail. Provide panels of equal width on each wall and provide stainless steel reveals between panels. Provide stainless steel trim to protect edges of panels on all sides. Provide choice of the laminate colour and finish to standard range of Formica or Wilsonart 1.6 mm (1/16") thick. Consult Architect at time of shop drawings with samples.

- .7 Provide bar type handrail, 6.35 mm x 102 mm solid aluminum on all non-access sides of cab with space of 40 mm between rail and cab wall. Mount at 900 mm above floor. Return ends to wall.
- .8 Provide single-sheet LVT flooring to match corridor, to the Owner's choice of pattern and colour of Marmoleum by Forbo, 3.2 mm. Provide a minimal and even seam at perimeter.
- .9 Provide new stainless steel licence holders in cabs sized to fit standard Provincial licenses as issued at time of project completion.
- .10 Provide emergency exit on top of the car of suitable size, equipped with an electrical device which will prevent operation of the elevator if the exit cover is open more than 50 mm and designed to comply with elevator code.
- .11 Ventilate by an exhaust air handling unit through roof and through concealed perforations at base. Limit total fan noise to 55 dBA, measured on an 'S' response scale, measured 0.9 m above floor with fan on high speed. Include two speed operation of ventilation system. Fan air movement to be approximately 350 CFM on high speed and 200 CFM on low speed.
- .12 Provide any required assistance with mounting cab signage, advertisement boards or TV screens.
- .13 Provide rigid structure to cab walls capable of resisting 20 lb force horizontally at any point without noticeable (temporarily) deflecting and 100 lb force without permanently deforming.
- .14 Use bolts fitted with washers and lock washers and fabric separators, if necessary, to assemble and guarantee entire structure to operate entirely free from squeaks and metallic sounds.
- .15 Provide an aesthetically pleasing finished product including square joints, flush surfaces, even finishes and firm bonding/fastening throughout.
- .16 At shop drawing review provide CAD-generated cab approval drawing, one-file drawing covering all surfaces, to scale and in colour. Provide all necessary samples at this time.
- .17 Fabricate cab shell ceiling with sheet steel, minimum of 12 gauge, smooth and free from defects. Emergency exit to be of same fabrication and finish.

2.31 Car Doors

- .1 Provide flush steel horizontal-slide doors faced with 16-gauge, matching stainless steel. Wrap stainless steel around doors. Do not use binder angles.

- .2 Provide two (2) steel pins, one at each end of each door panel extending from the door into the centre of the threshold grooves to prevent the door swinging into the hoistway, should the lower guides become dislodged.
- .3 Install main guides, one at each end of each door panel.
- .4 Provide smooth and quiet door operation. Do not employ felt-covered gibs.

2.32 Hoistway Door Hangers, Locks, Tracks, and Closing Devices

- .1 Use self-lubricating ball or roller bearings sealed to retain grease lubrication and wipers to maintain rollers and track in clean condition.
- .2 Include two-point suspension door hangers for each door panel using rollers with resilient sound absorbing wearing surfaces and replaceable hanger tracks.
- .3 Absorb upthrust with adjustable eccentric rollers equipped with ball or roller bearings.
- .4 Design for replacement of gibs without removing door from hanger tracks.
- .5 Provide spring-type, sill-mounted closing devices or alternatively heavy-duty spirator devices.
- .6 Provide positive electric interlocks and door closing devices. Provide wiring to door locks including a separate green ground wire back to controller.
- .7 Provide door safety retainers to prevent door panel displacement should the replaceable primary guiding means fail.
- .8 Dowel all hoistway door pick-up roller assemblies after final adjustments have been made.
- .9 Provide auxiliary closing devices on multi-section doors.

2.33 Car and Hoistway Door Operator

- .1 Provide a heavy-duty door operator to open and close the car and hoistway doors quietly and smoothly. Provide high speed, electric door operator, with solid-state feedback (closed loop) control.
- .2 Operate the car door and hoistway doors simultaneously.
- .3 Provide a minimum motor power of 1/4 HP.
- .4 Provide electrical cushioning at each end of travel.

- .5 Provide one (1) gate switch per door panel, operated by a roller attached to the door panel. Provide wiring including a separate green ground wire back to controller.
- .6 Provide a heavy-duty mechanical door restrictor, as recommended by the manufacturer of the door operator for the application, to resist opening of the car door unless the car is in the unlocking zone as described by applicable Code.

2.34 Car Door Protective Devices

- .1 Provide a three-dimensional, solid state, electronically operated door reversal device on the leading edge(s) of car door panel(s). The device shall contain systems specifically designed for the application and enclosed in an insulated chassis. Arrange the device to:
 - .1 Provide long term reliable operation, include no moving parts.
 - .2 Upon failure of the device, shut the car down at the next available floor, with doors in the fully open position.
 - .3 Provide totally silent operation.
 - .4 Include visible diagnostics on the device to permit verification that the unit is functioning.
 - .5 Have all components installed behind the door jamb, so as to provide a clear opening and present a clean architectural appearance.
- .2 Design the device to provide a zone of detection a minimum of 75 mm in advance of the leading edge of each car door and arrange the operation as follows:
 - .1 Trigger the protection system when any object is located in the entrance and cause the door to reopen without engaging the object.
 - .2 Permit the protection system to be active over the full travel of the doors.
 - .3 After elapse of the normal door open dwell time, provide a limited door reversal operation. Arrange the operation so that the door retracts sufficiently to permit only the immediate entering passenger to pass. Continue closing of the door after the passenger leaves detection zone.

2.35 Fire Rated Elevator Entrances

- .1 Provide complete elevator entrances at all floors.
- .2 Construct doors and frames to ULC 1 ½ hours fire rating. Test to CAN 4-S104 sandwich panel construction 25 mm thick minimum.
- .3 Finish entrances in brushed stainless steel at all floors.
- .4 Provide 1067mm (42") wide, 2134 mm (84") high one speed side opening doors.

- .5 Cushion opening doors and closing doors with rubber bumpers.
- .6 Assume complete and undivided responsibility for entire installation including doors, frames, structural supporting angles, headers, fascias or toeguards, hangers, sills, and sill support angles. Frames to suit wall thickness dimensions, as shown in drawings.
- .7 Include struts, fastened to supports with 12 mm bolts.
- .8 Install 50 mm high stainless steel Arabic numerals on both sides of entrance frames. Include a "star" at the main egress level.

2.36 Flush Type Hoistway Doors

- .1 Construct hoistway doors of two-panel sheet steel, hollow center with internal reinforcement.
- .2 Reinforce doors to withstand strains due to power operation.
- .3 Include sight guard finished to match entrances at all floors.
- .4 Provide smooth and quiet door operation. Do not employ felt-covered gibs.
- .5 Equip landing door with safety retainers as required in the jurisdiction. Design retainers to secure the closed door panel in position should the primary guiding means fail, including resisting detaching or permanently deforming under upwards force or force into the hoistway, as described by applicable Code.

2.37 Hall Sills

- .1 Include extruded aluminum sills with anti-slip wearing surfaces to ASTM B221-74 alloy 6351-T6.
- .2 Grout sills in position providing up to 50 mm thickness as required.
- .3 Include channel or angle supports at each sill, fasten to building supports with 12 mm bolts, angles to span full width of entrance.

2.38 Fascias and Toeguards

- .1 Provide fascia and toeguards not less than 17-gauge sheet steel from the pit floor to underside of overhead floor, extended a minimum of 75 mm beyond clear opening.

- .2 Reinforce to walls where necessary to prevent deflection and securely fasten to entrance arrangement.
- .3 Provide final coat of paint for non-galvanized steel fascias and toeguards.

2.39 Identification

- .1 Provide 100 mm (4") numerals corresponding to floor level on hoistway side to fascia plates and locate numerals as required by Code.
- .2 Provide all bilingual engraving on faceplates in Helvetica medium, upper and lower case.
- .3 Provide 50 mm (2") numerals on all elevator equipment.
- .4 Identify all elevators at recall level. For this and any other identification of cars and floors at entrances that is visible to passengers, use formed metal or aluminum-coloured plastic numerals 75 mm in height and 10 mm thick. Final location and form to be confirmed at time of shop drawing review.
- .5 Provide six (6) keys of each type used with key rings and engraved Gravoply discs, identifying use of key.

2.40 Lanterns

- .1 Provide translucent, high-impact plastic, flush mounted car riding lanterns in each door jamb. Illuminate lantern suitably to indicate direction of car travel to waiting passengers.
- .2 Provide illuminated fixture of diameter not less than 70 mm (2.75") with stainless steel faceplates.
- .3 Sound gong or chime with the illumination of direction arrows, one gong for up and two for down. Chime to be adjustable in volume. Provide clear tone at 30 dBA approximately 8 feet from fixture. Time gong so as to be heard by passengers waiting in the hall.

2.41 Hall Button Fixtures

- .1 Provide one (1) riser of LED illuminated, stainless steel push buttons (blue illumination). LEDs to be rated for 100,000 hours illumination.
- .2 Install at 1066 mm to top of button above floor level.

- .3 Provide flush mounted illuminated type push button on a stainless steel, No. 4 finish faceplate. Illuminate buttons when pressed to indicate a call has been registered and retain illumination until the call has been answered.
- .4 Provide an Out of Service indicator in each fixture. Whenever service is denied to the elevator for any reason, the "OUT OF SERVICE" sign shall illuminate automatically. This includes top of car inspection operation and an opening in the safety circuit.
- .5 Provide a two position, spring return keyed switch (removable in OFF position) in each station to allow registration of hall calls in ON position. Properly identify function of keyed switch and positions.

2.42 Special Operation Fixture

- .1 Provide in the ground floor lobby hall station:
 - .1 A three (3) position fire recall switch, OFF - ON – RESET with pilot light.
 - .2 Engrave faceplate "FIREFIGHTERS' EMERGENCY OPERATION" in red lettering 5 mm in height.
 - .3 Provide engraved instructions adjacent to the switch for the operation of the recall switch.
 - .4 Provide an audible and illuminated visual signal adjacent to the main lobby "Fire Recall" switch labelled "ELEVATOR COMMUNICATIONS FAILURE" in red letters a minimum of 5 mm in height. Include a key switch to reset the alarm.
- .2 Provide at recall level near elevator hoistway a box conspicuously located and identified containing the emergency recall service keys.

2.43 Position Indicators and Voice Annunciation

- .1 Provide flush mounted position indicator over top of each hall entrance and include one (1) additional indicator in the car station. Provide LED-illuminated, segmented, digital-display position indicators with stainless steel faceplate.
- .2 Use characters at least 38 mm high.
- .3 Provide voice annunciation indication of each floor, when served and of car direction. Provide volume control adjustable from behind car station. Provide high-power speakers, minimum of two (2) per car so no distortion is readily noticeable to passengers. Provide sample of annunciations with shop drawings.
- .4 Provide in each hall position indicator an "OUT OF SERVICE" sign/indicator.

- .1 Whenever service is denied to the particular elevator for any reason, the "OUT OF SERVICE" sign shall illuminate automatically. This includes independent service and inspection operation and an opening in the safety circuit.
- .2 Provide an identified toggle switch on the side of the controller that shall illuminate the OUT OF SERVICE sign.

2.44 Car Operating Station

- .1 Provide one (1) car operating station in the cab. Provide a new stainless steel faceplate.
- .2 Provide a separate lockable "Firefighter's Operation" cabinet located at the top of the car operating panel (no higher than 1800 mm from finished cab floor).
 - .1 "FIRE OPERATION" key switch
 - .2 "CALL CANCEL" button
 - .3 "STOP" switch
 - .4 "DOOR OPEN" and "DOOR CLOSE" buttons
 - .5 Additional indicator light
 - .6 Operating instructions
 - .7 Buzzer for emergency recall.
- .3 Incorporate a lockable service cabinet into the car operating station. Service panel shall be located at bottom of the car operating panel. Provide the following key operated switches in the service cabinet:
 - .1 Car lighting
 - .2 2-speed fan
 - .3 Emergency light test
 - .4 Independent service
 - .5 Hoistway access enable
 - .6 Run/Stop switch
 - .7 Spare key switch with temporary label.
- .4 Engrave the following on the service cabinet faceplate:
 - .1 Elevator number/designation in Arabic numerals (e.g., "2"), number to be 25 mm high.
 - .2 Provincial Installation number.
 - .3 Building Address.
 - .4 Capacity, include the wording "MAXIMUM CAPACITY".
- .5 Provide DUPAR US91 blue LED-illuminated stainless steel floor buttons, one for each floor served. Provide flush-mounted tactile identification at side of button. Stainless steel finish and button type to match hall stations. Include the following additional buttons:
 - .1 Door Open
 - .2 Door Close
 - .3 Alarm
 - .4 Phone activation

- .6 Provide Video and Messaging system:
 - .1 Provide non proprietary system with no annual fees or software license fees.
 - .2 Include a flush mounted and durable fixture in the cab for video and messaging to CSA B44 2019 2.27.1 including camera and display. Include and all wiring required to be connected to the internet source in the control room.
 - .3 Provide live video of elevator interior and real time two way messaging.
 - .4 Allow non verbal passengers to message "yes" and "no" through door open and door close buttons.
 - .5 Activate two-way communication through assistance button located on the car operating station faceplate.
 - .6 Provide end-to-end encryption.
- .7 Locate all buttons between 890mm and 1220mm or as permitted by Appendix E of ASME 17.1/CSA B44.
- .8 Engrave all characters on plate and fill with enamel. Make all identification engraved in upper or lower case, Helvetica medium, minimum 10 mm filled with red or black enamel, as required.
- .9 Use international symbols wherever possible.

2.45 Terminal Stopping Devices

- .1 Provide an automatic stopping device, arranged to bring car to a stop at the terminal landings independent of the regular operating device in the car.
- .2 Dowel final limits to main rails.

2.46 Barrier-Free Design

- .1 Arrange all controls and fixtures to be easily reached and operated by disabled persons.
- .2 Unless otherwise specified within, arrange any new controls and fixtures to meet all requirements of Appendix "E" of the ASME A17/CSA-B44-19 Safety Code for Elevators and Escalators.

2.47 Signal Illumination

- .1 Illuminate signal fixtures with intensity which produces distinct and well-defined indications in daylight or dim conditions. All signals to be LED-illuminated.

2.48 Fixture Fastening

- .1 Fasten all fixture faceplates, including car-operating station, with tamper-proof screws.

2.49 Markings

- .1 Engrave identification and instructions at least 0.8 mm deep on operating panels and on all signal equipment in both official languages except where design is such that inference is obvious and readily understood. Submit markings and designs for approval.

2.50 Non-standard Pit and Overhead

- .1 Include for working platforms and buffer extensions if required.

2.51 Seismic Design

- .1 Meet the safety design requirements for seismic (refer to Project Structural drawings) as outlined in Section 8.4 of the ASME A17.1-2019/CSA-B44-19 Safety Code.

PART 3 – EXECUTION

3.1 Inspection

- .1 Periodically during construction of hoistway and machine room structure, verify that hoistway, pit and machine room are proceeding correctly for equipment installation.
- .2 Verify shaft and openings are of correct size and within tolerances.
- .3 Confirm electrical power is available and of correct characteristics.
- .4 Report defects in writing to Consultant.

3.2 Welding

- .1 Where welding is used for cylinder and pressure piping, prepare joints and weld in approved manner using welders fully qualified to the requirements of CSA Standard W47-92.
- .2 Identify field welds with welder's identification stamp.

3.3 Installation

- .1 Install piping between hoistway plunger and pump unit.
- .2 Mount motor and pump unit. Place on structural supports and bearing plates. Securely fasten to building supports to prevent lateral displacement.
- .3 Locate piping where it can be readily accessed for service.
- .4 Arrange equipment in machine room so functioning equipment and other equipment can be removed for repairs or replacement without dismantling or removing other equipment components. Arrange for clear passage to access door. Accommodate equipment in space indicated on Architectural drawings.
- .5 Erect guide rails using metal shims with lock washers under nuts and threaded bolts. Compensate for expansion and contraction of guide rails.
- .6 Use splice plates and guide rails with contact surfaces accurately machined to form smooth joints.
- .7 Provide inserts for placement in concrete form work or self-drilling expansion shell bolt anchors that will perform to four times rated pull-out load.

- .8 Install hoistway door sills, frames, and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.
- .9 Mount copy of master schematic wiring diagrams in framed glass or plastic enclosure on machine room wall. If number of wiring drawings exceeds five (5), then mount drawings protected with clear plastic on rack permanently attached to machine room wall.
- .10 Provide delivery of pistons and other large components in advance of closing up of building structure. Alternatively, provide cylinders or other large components in sections easily passed through standard doorways.
- .11 Electrically isolate dissimilar metals throughout installation.

3.4 Storage

- .1 Coordinate delivery and storage of materials with General Contractor.

3.5 Coordination

- .1 Coordinate work with the work of the other trades on the job site. Plan the work so as not to hinder other work not included in this contract, but which must be carried out at the same time and location. In instances of conflict with other trades, make substantial attempt to co-operate before notifying Owner's representative of conflict.
- .2 Expect to have work interrupted or suspended from time to time because of work which must be performed at the same time by another Sub-contractor. Mutually coordinate with the other Sub-contractor.

3.6 Field Quality Control

- .1 Perform and meet tests required by CAN/CSA-B44 Safety Code for Elevators. Supply instruments and carry out these and other tests specified herein.
- .2 Provide 2 days written notice to Consultant of date and time of tests.
- .3 Have a copy of the Specifications on site and available to the installation mechanic.
- .4 Provide Consultant with copy of all speeds and current readings taken at the time of the Provincial regulatory agency inspection.

3.7 Cleaning

- .1 Completely remove protective coverings from finished surfaces and components.
- .2 Maintain clean work areas and running equipment through the duration of the project.
- .3 Provide cleaning throughout construction per General Contractor requirements. Including regular cleaning of hoistways and machine spaces.
- .4 Provide one (1) final cleaning of all equipment, elevator related spaces, and work areas prior to final completion of project. Coordinate final cleaning with the General Contractor.

3.8 Painting

- .1 Paint the following equipment in the hoistway:
 - .1 Car tops and crossheads.
 - .2 Rails and strut angles and fascia plates.
 - .3 Outline of refuge space on the car top.
 - .4 Pit equipment, including pit floor and 3 feet high on the pit wall.
- .2 At the end of the project, touch-up any equipment to provide finished look free of scratches and other blemishes.
- .3 Use paint materials listed on the CGSB qualified products list only.
- .4 Utilize only low volatile organic compound paint. Content of lead in the paint is not to exceed 500 mg per kg.
- .5 Paint materials for each coating formulae to be products of a single manufacturer.
- .6 Prepare masonry, stucco, and concrete surfaces to CGSB 85-GP-31M.
- .7 Prepare concrete floors to CGSB 85-GP-32M.
- .8 For concrete floors apply:
 - .1 One coat enamel CGSB 1-GP-66M reduced by addition of one (1) part CGSB 1-GP-70M thinner to eight (8) parts enamel.
 - .2 One coat enamel CGSB 1-GP-66M.

3.9 Hoistway Projections and Fascia

- .1 Provide bevelling for projections or recesses shown on architectural drawings in hoistway.

- .2 Provide fascia required in hoistway by arrangement shown on Architectural drawings.

3.10 Burning Torches

- .1 Do not employ burning torches in the work. Work with burnt-out holes will be rejected.

3.11 Technical Presentation

- .1 Provide the services of a mechanic or adjuster who has worked on the project and is thoroughly familiar with the elevator control system and its operation to provide technical training to designated building authorities.
- .2 Allow at least 1 day for this training. Training session to cover but not be limited to the following features:
 - .1 Emergency power operation and emergency recall operation Phase I and Phase II including duplicate switches.
 - .2 Independent service operation.
 - .3 Remote video monitoring system.
 - .4 Voice communication system operation.
 - .5 Any special features provided on the elevators.
- .3 Provide when requested by the Engineer a hard copy of a condensed version of the elevator operational features.
- .4 The Elevator Contractor is to provide all information to the Engineer that is required for the safe and efficient maintenance of the elevator equipment, including any solid state equipment or devices supplied under these specifications. The supplier is not to refuse any information, or the supply of parts, at fair market value, that is required by the Building Maintenance Contractor.

3.12 Field Testing and Commissioning

- .1 Furnish competent personnel to assist the Engineer during the inspection and testing of the systems should they be required.
- .2 The inspections shall be carried out to ensure document compliance.
- .3 Prior to Engineer's testing, the Elevator Contractor shall test all systems to ensure proper operation.
- .4 Upon completion of each elevator provide all personnel and necessary testing equipment to perform the following:

- .1 Test operating times to verify performance requirements.
 - .2 Test door operating equipment to verify performance requirements.
 - .3 Test the ride to verify performance requirements.
 - .4 Test the equipment under full load and no load to verify speed variation performance requirements.
 - .5 Perform all electrical readings and complete technical data forms required by the specifications.
- .5 Upon completion of the group of elevators, furnish technicians, adjusters or engineers fully trained in the equipment installed to test all operating systems included but not limited to, emergency power operation, special emergency service and operation of the group control system to verify the specification requirements.
- .6 Attend at job site meetings pertaining to the Work.
- .7 After Provincial inspection of each elevator and before turn-over for customer use, test each elevator in simulated automatic operation without passenger access.
- .1 Test for three (3) consecutive hours with no load operating from floor to floor, with or without door operation.
 - .2 Test for three (3) consecutive hours with 100% load operating from floor to floor, with or without door operation.
 - .3 Test for three (3) consecutive hours operating from floor to floor with door operation. Provide barricades and signage to indicate that an elevator test is in progress.
- .8 Before turn-over for customer use, test elevators as following:
- .1 Working pressure in up direction with 100% carload.
 - .2 Operating speed, full load, up.
 - .3 Operating speed, empty car, down.
 - .4 Door timings and dwell settings.
 - .5 Door close force.
 - .6 Door detector interrupt setting.
- .9 During warranty maintenance period closely monitor equipment for malfunctions and track reliability. Achieve a reliability rate of less than 0.6 malfunctions per elevator per month. Not achieving a reliability rate of 1.0 malfunction per elevator per month during the three-month period preceding the expiration of the warranty maintenance period will extend the warranty maintenance, including full parts and labour, on the malfunctioning elevator(s) only until the (moving window) 90-day reliability target has been achieved.
- .10 Upon completion of the project, arrange with the Engineer to provide a Technical Seminar and demonstration for the Building Operation's staff. The seminar, in both official languages, shall include a review of all documentation, operation of equipment

and demonstration of special features. Allow a minimum of four (4) hours for the technical seminar.

APPENDICES

Table 1- Commissioning Data

TO BE SUBMITTED BY CONTRACTOR UPON COMPLETION OF EACH CAR

PARAMETER	Elevator 1
Car speed UP 125% load (fpm)	
Car speed DOWN empty (fpm)	
Start to stop UP (sec)	
Start to stop DOWN (sec)	
Operating pressure UP (psi)	
Relief Pressure (psi)	
Door open (sec)	
Door close (sec)	
Car call dwell (sec)	
Hall call dwell (sec)	
Door stall force (lb)	
Door timeout (sec)	

Table 2 – Fire Signal Verification

TO BE SUBMITTED BY ELEVATOR CONTRACTOR

Recall Test Date:		
Elevator Contractor:		
Fire Alarm Testing Contractor:		
Test Performed By:		
Signature:		
DEVICES ACTIVATED:	B44 CODE REQUIREMENT	B44 CODE COMPLIANT
Hoistway Detector	All cars in the hoistway returned to the designated level with fire hats flashing inside the car.	YES / NO
Machine/Control Room Detector	All cars returned to the designated level with fire hats flashing inside the car.	YES / NO
General Fire Alarm Activation Devices from Hall Lobbies	All cars returned to the designated level - fire hats in cars stay illuminated but did not flash.	YES / NO
Dedicated Detector at Designated Level	All cars returned to the alternate floor - fire hats in cars stay illuminated but did not flash.	YES / NO
Recall Switch at the Main Floor and Remote Switch (if applicable)	Indicator light Illuminated on automatic or manual recall.	YES / NO

– END OF DOCUMENT –

Part 1 General

1.1 References

- .1 Division 00 and Division 01, apply to and are a part of this Section.

1.2 Application

- .1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Unless otherwise noted, where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.
- .2 Be responsible for advising product vendors of requirements of this Section.
- .3 Review Drawings and Specifications in conjunction with documents of other Divisions.

1.3 Documents

- .1 The intent of these drawings and specifications is to provide a complete and operational system to the owner.
- .2 The drawings and specifications are not mutually exclusive, that is they form a complete package. Items defined or implied in one but omitted in the other shall be interpreted as specified and must be provided.
- .3 The following sections shall comprise this Mechanical specification. It is the Contractor's responsibility to read the specification in its entirety and understand the interrelationship between the following sections:
 - 20 05 05 - Mechanical Work General Instructions
 - 20 05 10 - Basic Mechanical Materials and Methods
 - 21 13 00 - Fire-suppression Sprinkler Systems
 - 22 10 00 - Plumbing Piping and Specialties
 - 22 47 00 - Plumbing Equipment
 - 23 05 23 - Electric Motors and Mechanical Wiring
 - 23 05 24 - Variable Frequency Drives
 - 23 05 29 - Hangers and Supports
 - 23 05 48 - Seismic Control and Restraint
 - 23 05 93 - Testing Adjusting and Balancing
 - 23 07 14 - Mechanical Insulation
 - 23 11 23 - Natural Gas Service and Piping
 - 23 21 00 - Hydronic Piping and Specialties
 - 23 21 23 - HVAC Pumps
 - 23 23 00 - Refrigerant Piping
 - 23 25 00 - HVAC Water Treatment
 - 23 31 00 - Ductwork and Accessories
 - 23 34 00 - HVAC Fans
 - 23 36 00 - Air Terminal Units
 - 23 37 00 - Air Outlets and Inlets
 - 23 52 17 - Condensing Boilers - Firetube
 - 23 64 10 - Water Chillers - Air Cooled
 - 23 73 23 - Indoor Modular Air Handling Units
 - 23 82 00 - Terminal Heat Transfer Units
 - 23 82 05 - Unit Ventilators
 - 25 50 00 - Building Management System
 - 25 90 00 - Sequence of Operation
- .4 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

- .5 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .6 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .7 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .8 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions, work of other trades and other architectural and/or structural details but not shown on Drawings.
- .9 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of the building, all at no additional cost to Contract.
- .10 Specification does not generally indicate specific quantity of items, or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to Schedules, Drawings and Specification to provide correct quantities.
- .11 Motor starter, motor control centre (MCC) and variable frequency drive (VFD) schedule drawings are common to both mechanical and electrical, and apply to the work of the Mechanical and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD and motor specification requirements prior to Bid Submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

1.4 Definitions

- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with Consultant.
- .8 "barrier-free" – means when applied to a building and its facilities, that building and its facilities can be approached, entered and used by persons with physical or sensory disabilities in accordance with requirements of local governing building code.

- .9 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
- .10 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .11 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .12 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .13 "Consultant" - means person, firm or corporation identified as such in Agreement or Documents and is licensed to practice in the Place of Work, and has been appointed by the Owner to act for the Owner in a professional capacity in relation to the Work.

1.5 Cash Allowances

- .1 Refer to General Contractor for general and mechanical Cash Allowances included in bid amount by Prime Contractor
- .2 Mechanical contractor costs, including coordination, management, supervision, installation, mark-up and overhead and other burdens are to be included in Bid amount.

1.6 Metric and Imperial Measurements

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Confirm exact measurements based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.7 Examination of Documents and Site

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.
- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.8 Work Standards

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction (AHJ).
- .2 Changes and alterations required by AHJ shall be carried out without delay to the progress of the work.
- .3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:
 - .1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
 - .2 Air-Conditioning, Heating and Refrigeration Institute (AHRI);
 - .3 Air Movement and Control Association (AMCA);

- .4 American National Standards Institute (ANSI);
 - .5 American Society of Mechanical Engineers (ASME);
 - .6 American Society of Testing and Materials (ASTM);
 - .7 American Water Works Association (AWWA);
 - .8 Associated Air Balance Council (AABC);
 - .9 Building Industry Consulting Services, International (BICSI);
 - .10 Canadian Gas Association (CGA);
 - .11 Canadian Standards Association (CSA);
 - .12 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
 - .13 Electrical Safety Authority (ESA);
 - .14 Electronic Industries Association (EIA);
 - .15 Factory Mutual Systems (FM);
 - .16 Institute of Electrical and Electronic Engineers (IEEE);
 - .17 International Standards Organization (ISO);
 - .18 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
 - .19 National Electrical Manufacturers Association (NEMA);
 - .20 National Fire Protection Association (NFPA);
 - .21 National Standards of Canada;
 - .22 Occupational Health and Safety Act (OHSA);
 - .23 Ontario Building Code (OBC);
 - .24 Ontario Electrical Safety Code (OESC);
 - .25 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
 - .26 Technical Standards and Safety Authority (TSSA);
 - .27 Thermal Insulation Association of Canada (TIAC);
 - .28 Underwriters' Laboratories of Canada (ULC);
 - .29 Workplace Hazardous Materials Information System (WHMIS);
 - .30 Material Safety Data Sheets by product manufacturers;
 - .31 local utility inspection permits;
 - .32 Codes, standards, and regulations of local governing authorities having jurisdiction;
 - .33 additional codes and standards listed in Trade Sections;
 - .34 Owner's standards.
-
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
 - .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
 - .6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.
 - .7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
 - .8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review with Consultant at any time.
 - .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

- .10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .11 Maintain mechanical equipment and materials on site in an orderly manner. Protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Owner and reviewed with Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.
- .12 Controls devices, new or existing to be reused, shall be protected from dust and dirt throughout all phases of work from demolition through to completion. Protection shall be to satisfaction of Owner and reviewed with Consultant. Where devices are not protected the Contractor may be directed to perform cleaning to the Consultant's satisfaction, and perform subsequent testing to ensure proper operation after cleaning.
- .13 Protect pipe ends, duct ends, valves, and other parts of the system from damage and from intrusion of foreign matter by means of caps, plugs, blind flanges etc. Do not allow pipe to be stored with open ends.
- .14 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.
- .15 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.
- .16 Submit 3 copies of inspection and test reports promptly to the Consultant. Provide copies of reports to Subcontractor of the Work being inspected/tested or manufactured/fabricated.

1.9 Storage and Site Operating Facilities

- .1 The Owner's property shall be kept in a neat and tidy condition.
- .2 The Mechanical Contractor shall be responsible for storage and security of their materials, tools and equipment on the job site.
- .3 The Mechanical Contractor shall provide a trailer at the site to store all materials, tools and to serve as a workshop. Trailer power (120/240 VAC) will be made available by the Owner or General Contractor. Contractor shall be responsible for making connection.
- .4 Materials and equipment shall be stored in original, undamaged condition with manufacturer's labels and seals intact, or properly crated where applicable. Prevent damage to materials during handling and storage. Storage areas shall be dry and secure from pilfering. The Owner will not assume any liability for lost or mislaid material and/or equipment.
- .5 Upon completion of the contract the Mechanical Contractor shall remove from the site all waste materials, clean all equipment, and leave all items in perfect operating condition.

1.10 Permits, Certificates, Approvals and Fees

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

- .2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.
- .3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

1.11 Requirements for Contractor Retained Engineers

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be members in good standing with local Professional Engineers Ontario, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:
 - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
 - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
 - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
 - .4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;
 - .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of Engineer's services.

1.12 Workplace Safety

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.

- .3 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with Consultant.

1.13 Planning and Layout of Work

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions.
- .3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or 1/4"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. If necessary, obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .7 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

1.14 Phasing

- .1 Include for scheduling, coordination, and construction phasing to suit project as specified in Division 01 and on drawings. Review exact phasing requirements with Consultant prior to start of Work.
- .2 Phasing and scheduling of Work is required in order to maintain existing building operations. Include costs (including costs for "off hours" work) for scheduling, coordination, and construction phasing to suit this project. Review phasing requirements with Consultant prior to start of Work.
- .3 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained in operation through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.
- .4 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used continuously by Owner or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium timework to meet these requirements.
- .5 Project partial occupancy permits to be required throughout project. Provide for each partial permit, required local governing authority certificate and any other testing/verification certificates for systems.

1.15 Coordination of Work

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:
 - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
 - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
 - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
 - .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.
 - .5 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless otherwise directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.
- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.

- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.16 Products

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable.
- .3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available.
- .4 Products scheduled and/or specified and/or on the drawings have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number.
- .5 Where multiple manufacturers are listed in individual product Specification sections, the first name listed is base specified company used as the basis of design. Unless otherwise indicated in individual product Specification sections, the specified basis of design manufacturer shall be used to form the Mechanical Contractor's base Bid amount. This Article shall take precedence over any contradicting requirements of Divisions 00 or 01.
- .6 Where other manufacturers are listed as Acceptable Alternates to the basis of design in the individual product Specification sections, the contractor may, at his choice, obtain pricing from the listed alternate manufacturers, providing that the performance, quality and design are equal. Contractor shall indicate make, model numbers and the amount of credit obtained from using acceptable alternate materials/ equipment on the Bid Form. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included in the credit amount shown on the Bid Form. This Article shall take precedence over any contradicting requirements of Divisions 00 or 01.
- .7 Where multiple manufacturers are listed as Acceptable Manufacturers in the individual product Specification sections, the contractor may, at his choice, select to use one of these manufacturers to formulate the base bid price instead of the base specified manufacturer, providing that the performance, quality and design are equal. Contractor shall indicate make and model numbers of acceptable materials/ equipment that are not the specified basis of design on the Bid Form. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included in the amount shown on the tender form. This Article shall take precedence over any contradicting requirements of Divisions 00 or 01.
- .8 Listing of a product as "Acceptable Manufacturer", or "Acceptable Alternate" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

- .9 Contractors proposing use of alternate manufacturers are responsible for all costs for all trades and all costs for engineering design time as required by the consulting engineer associated with use of alternate manufacturers. The dimensions, configurations, weights of equipment from alternative manufacturers must be as shown on the plans. The components included with equipment from alternative manufacturers must be as specified herein and as shown on the plans. The performance of equipment from alternative manufacturers, including sound data, must meet all of the requirements as indicated on the performance schedules as shown on the plans and/or in the specification.
- .10 Where model numbers are given with performance data for specified equipment, the performance data shall take precedence in the case of any discrepancy. Model numbers designate the manufacturer's series of equipment and shall only be used as a reference to the performance data during the selection process.
- .11 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .12 In addition to manufacturer's products base specified or named as acceptable, or acceptable alternates, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price amount shall be based on products base specified or named as acceptable as described above. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.
- .13 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.
- .14 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with Consultant, and costs for review, to be borne by Contractor.
- .15 Whenever use of product other than based specified products, products named as acceptable, or named as acceptable alternates is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.

1.17 Openings

- .1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

- .2 No openings are permitted through completed structure without written approval from Owner and reviewed with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.

1.18 Submittals for Review (Shop Drawings)

- .1 Contractor shall submit shop drawings in accordance with the requirements of CCDC2-2008, Part 3, Article GC 3.10.
- .2 At start-up meeting, review with Consultant products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review, complete with anticipated dates of submission aligning with the work schedule. This list may be expanded by the Engineer.
- .3 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Coordinate exact requirements with Consultant.
- .4 Submit for review, drawings showing detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
 - .1 product literature cuts;
 - .2 equipment weights and structural loads;
 - .3 equipment data sheets;
 - .4 equipment dimension drawings;
 - .5 system block diagrams;
 - .6 sequence of operation;
 - .7 connection wiring schematic diagrams;
 - .8 functionality with integrated systems.
- .5 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .6 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
- .7 Contractor shall review all shop drawings in advance of submitting them to the Consultant. Shop drawings provided by the Contractor to the Consultant shall indicate by stamp, date and signature of the person responsible for review that the Contractor has reviewed each one of them. The Contractor represents by this review that the Contractor has determined and verified all applicable field measurements, field construction conditions, product requirements catalogue numbers and similar data and that the Contractor has checked and coordinated each shop drawing with the requirements of the work and the contract documents.
- .8 Consultant to review drawings and indicate review status by stamping shop drawings copies as follows:
 - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If the Consultant's review of the shop drawing is final.
 - .2 "REVISE AND RESUBMIT" – If the Consultants review of the shop drawing is not final. Consultant to stamp drawing as stated above, mark submission with comments, and return submission. Contractor shall revise shop drawing per Consultant's notations and resubmit.
- .9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.
- .10 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.

- .11 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

1.19 Progress Payment Breakdown

- .1 Progress payments shall be in accordance with CCDC2-2008, Section 5 and;
 - .1 Prior to submittal of the first progress draw, submit a list of products for which shop drawings will be submitted to the Consultant for review, complete with anticipated dates of submission aligning with the work schedule.
 - .2 Prior to the submittal of the first progress draw, submit a detailed work breakdown of work cost to assist Consultant in reviewing and approving progress claims.
 - .3 Payment breakdown is subject to Owner's approval and Consultant's review.
 - .4 Progress payments will not be processed until an approved breakdown is in place and shop drawing submittal list is in place.

1.20 Changes in the Work

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for review, a quotation being proposed cost for executing change or revision.
- .2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 Make requests for changes or revisions to work in writing to Consultant and if accepted by Owner, Notice of Change will be issued.
- .4 Do not execute any change or revision until written authorization for the change or revision has been obtained from the Consultant.

1.21 Provisions for Systems/Equipment Used During Construction

- .1 Contractor shall base Bid amount on the basis that permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.
- .2 Nearing the completion of construction it may be necessary to operate the equipment. Consideration may be given to the permanent mechanical systems in building may be used for temporary heating or cooling during construction subject to following conditions:
 - .1 the owner agrees;
 - .2 each entire system is complete, pressure tested, cleaned, and flushed out;
 - .3 specified water treatment system has been commissioned, and treatment is being continuously monitored;
 - .4 building has been closed in and areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes;
 - .5 there is no possibility of damage from any cause;
 - .6 supply ventilation systems are protected by 60% filters, which are to be inspected daily, and changed every 2 weeks, or more frequently as required;
 - .7 return air systems have approved construction filters over openings, inlets, and outlets;
 - .8 systems are operated as per manufacturer's recommendations or instructions, and are monitored on a regular and frequent basis;
 - .9 warranties are not affected in any way;
 - .10 regular preventive and other manufacturer's recommended maintenance routines are performed;

- .11 before application for Substantial Performance, each entire system is to be refurbished, cleaned internally and externally, restored to "as-new" condition, and filters in air systems replaced;
- .12 energy costs are to be paid by Contractor.
- .3 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.
- .4 During this period of construction, such systems/equipment to not become property of Owner or be Owner's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Owner.
- .5 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, paint finishes "touched-up", filters cleaned or replaced, etc.

1.22 Temporary Services

- .1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.
- .2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.23 Maintaining Equipment Prior To Acceptance

- .1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.
- .2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.
- .3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.
- .4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

1.24 Record As-Built Drawings

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$50.00 CDN plus HST, per drawing, up to first 10 drawings, and \$25.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawing.
- .2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:

- .1 dimensioned location of inaccessible concealed work;
- .2 locations of control devices with identification for each;
- .3 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
- .4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;
 - .1 location of piping system air vents;
 - .2 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
- .3 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.
- .4 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.
- .5 For projects with phased turnover of project (refer to Division 01), review with Consultant completeness of as-built drawings prior to turn over of an area. Copies of hand drawn interim as-built drawings to be made available to Owner's maintenance personnel.
- .6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

1.25 Operating and Maintenance Manuals

- .1 For each product for which a shop drawing is required supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Review exact quantity of manuals with Consultant. Consolidate each copy of data in an identified document. Each document to include:
 - .1 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;
 - .2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 equipment manufacturer's authorized contact person name, telephone number and company website;
 - .4 Table of Contents sheet, and corresponding index tab sheets;
- .2 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
 - .1 Operating data is to include:
 - .1 pressure test reports, and certificates issued by governing authorities;
 - .2 description of each system and its controls;
 - .3 control schematics for equipment/systems including building environmental controls;
 - .4 wiring and connection diagrams;
 - .5 if applicable, BAS architecture and all required operating data;

- .6 description of operation of each system at various loads together with reset schedules and seasonal variances;
- .7 operation instruction for each system and each component;
- .8 description of actions to be taken in event of emergencies and/or equipment failure;
- .9 valve tag schedule, and flow diagrams to indicate valve locations.
- .2 Maintenance data is to include:
 - .1 operation and trouble-shooting instructions for each item of equipment and each system;
 - .2 schedules of tasks, frequency, tools required, and estimated task time;
 - .3 recommended maintenance practices and precautions;
 - .4 complete parts lists with numbers;
 - .5 Instructions for lubrication, motor and drive replacement.
- .3 Performance data is to include:
 - .1 equipment and system start-up data sheets;
 - .2 equipment performance verification test results, and final commissioning report;
 - .3 final testing, adjusting and balancing reports.
 - .4 copies of warranties;
 - .5 items requested specifically in Section Articles.
- .3 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.
- .4 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.
- .5 Provide digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as reviewed with Consultant and enhanced with bookmarks and internal document links.

1.26 Commissioning

- .1 After successful start-up and prior to application for Substantial Performance of the Work, commission the mechanical work. Commissioning work is the process of Contractor demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, as further described below.
 - .1 Retain services of a testing, adjusting, and balancing agency to perform testing and balancing of mechanical system air/fluid flows and capacities, prior to operational performance testing. Refer to Section entitled Testing, Adjusting and Balancing.
 - .2 Test, adjust and operate equipment and systems after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents. Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions. Complete commissioning data sheets to document successful operational performance testing.
 - .3 Repeat successful operational performance testing with completed commissioning data sheet documentation in the presence of Consultant and Owner to validate and verify equipment and systems are complete in all respects, function correctly, and are ready for acceptance.

- .4 Submit final commissioning data sheets, TAB reports as specified in Section entitled Testing, Adjusting and Balancing, project closeout documents, and other required submittals.
- .2 An independent Commissioning Agent is to be retained by Owner to perform equipment and system commissioning work as specified in Division 01, and in Section entitled Mechanical Work Commissioning. Interface, cooperate and coordinate with Owner's Commissioning Agent. Submit copies of submittals such as shop drawings/product data sheets, schedules, O&M manuals, and test reports to Commissioning Agent as required.

1.27 Warranty

- .1 Warranty shall be as per CCDC-2008 Stipulated Price Contract, Part 12, Article GC 12.3.
- .2 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.
- .3 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:
 - .1 once during 1st month of building operation;
 - .2 once during 3rd month of building operation;
 - .3 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

1.28 Project Closeout Submittals

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
 - .1 Operating and Maintenance Manuals;
 - .2 As-built record drawings and associated data;
 - .3 extended warranties for equipment as specified;
 - .4 operating test certificates, i.e. Sprinkler Test Certificate;
 - .5 final commissioning report and TAB report;
 - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
 - .7 other data or products specified.
 - .8 Schedule of warranty visits.
 - .9 Schedule of specified contractor seasonal start-ups and/or shut downs of equipment.

1.29 Spare Parts

- .1 Supply replacement parts, as specified in individual product specification sections, inclusive of, but not limited to, the following:
 - .1 Spare belt set for each belt drive.
 - .2 One set replacement filters for each air handling unit or filter housing. Filters not to be used for final filter change upon Completion.
 - .3 Provide one (1) box of thirty (30) 20 micron cartridge filters per water chemical treatment system.
 - .4 Provide sufficient water treatment chemicals for treatment and testing during warranty period.
- .2 Identify each set of spare parts by the equipment it serves.

1.30 Instructions to Owner

- .1 Refer to any additional requirements in Divisions 00 and 01 for equipment and system operational and maintenance training.
- .2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site, of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
 - .1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting – diagnostic instructions, test and inspection procedures;
 - .3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
 - .4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
 - .5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
- .6 Obtain in writing from Consultant list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
 - .1 date instructions were given to Owner's staff;
 - .2 duration of instruction;
 - .3 names of persons instructed;
 - .4 other parties present (manufacturer's representative, consultants, etc.).
- .7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

1.31 Final Inspection

- .1 Submit to Consultant, written Declaration of Completion with request for final inspection of systems. Include written certification signed by an accountable officer of the Company indicating that the following procedures and tests have been performed in accordance with the drawings and specifications:
 - .1 Approvals and permits have been obtained for the Work.
 - .2 Deficiencies noted during job inspections have been completed.
 - .3 Field quality control procedures have been completed.
 - .4 Systems have been tested and verified, balanced and adjusted under load, and are ready for operation.
 - .5 Chemical treatment report certificate has been obtained.

- .6 TSSA refrigeration registration has been completed.
- .7 Sprinkler material and test sheets have been submitted.
- .8 Maintenance and operating data have been completed and submitted to, reviewed with Consultant and accepted by Owner.
- .9 Tags and nameplates are in place and equipment identifications have been completed.
- .10 Clean-up is complete such that debris and construction materials have been removed from the site.
- .11 Commissioning procedures have been completed, BMS commissioning check sheets and equipment start-up sheets have been submitted.
- .12 BAS controls have been tested and adjusted under load.
- .13 Spare parts and replacement parts specified have been provided and acknowledged by Consultant.
- .14 As-built and record drawings have been completed and submitted to and reviewed with Consultant and accepted by Owner.
- .15 Owner's staff has been instructed in operation and maintenance of systems.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.
- .3 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

1.2 Submittals

- .1 Submit shop drawings/product data sheets for products listed in specification including but not limited to:
 - .1 Access doors
 - .2 Pressure gauges and snubbers and isolation valves
 - .3 Thermometers
 - .4 Flexible connectors - Pipe
- .2 Submit copy of architectural reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations.
- .3 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.
- .4 Sleeves: Submit drawings indicating size and location of required sleeves recesses and formed openings in poured concrete or precast concrete work.

Part 2 Products

2.1 Pipe Sleeves

- .1 In poured concrete or precast concrete construction:
 - .1 Galvanized sheet steel, minimum 16 gauge with integral flange and one end secured to formwork construction.
 - .2 Polyethylene factory fabricated, flanged high density polyethylene sleeve with reinforced nail bosses.
- .2 In water proof slabs of poured concrete or precast concrete or foundation walls:
 - .1 Galvanized Steel pipe – schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate.
 - .2 Polyethylene factory fabricated, flanged high density polyethylene sleeve with reinforced nail bosses, anchor and water stop plate.
- .3 In masonry or drywall construction:
 - .1 Steel Pipe – Schedule 40 mild galvanized steel.
 - .2 HDPE – with suitable fire and smoke ratings for plenums

2.2 Fire stopping and Smoke Materials

- .1 Fire stopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Architectural Section and in Section entitled Fire stopping and Smoke Seal Systems and work is to be included as part of mechanical work.
- .2 Acceptable manufacturers:
 - .1 Specified Technologies Inc.
 - .2 3M Canada Inc.
 - .3 Tremco
 - .4 A/D Fire Protection Systems
 - .5 Nelson
 - .6 Hilti Canada
- .3 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN 4-S115-M85, and CAN/ULC-S101-M for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.
- .4 Fire stopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and number for each specific installation.
- .5 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.
- .6 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- .7 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.
- .8 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame-retardant poly bag.
- .9 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.
- .10 Supply products of a single manufacturer for use on work of this Division.
- .11 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.
- .12 Include for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer's authorized representative and manufacturer's representative.
- .13 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".

2.3 Pipe Escutcheon Plates

- .1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

2.4 Access Doors

- .1 Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.
- .2 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. Other doors to be prime painted steel.
- .3 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .4 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with Consultant. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.
- .5 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.
- .6 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Consultant for review, details of non-standard door construction details.
- .7 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .8 Where access doors are in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.
- .9 Acceptable manufacturers include: Acudor.

2.5 Pressure Gauges

- .1 Acceptable Manufacturers
 - .1 Trelco Co.
 - .2 Weiss Instruments,
 - .3 Winters
 - .4 Ashcroft
- .2 Pressure gauges based on Winters Model PFP as follows:
 - .1 Liquid filled stainless steel case
 - .2 Stainless steel bayonet ring
 - .3 Stainless steel wetted parts
 - .4 100 mm or 115 mm (4" or 4-1/2") diameter
 - .5 Accuracy to +/- 1% of scale range;
 - .6 poly carbonate lens.
 - .7 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;
 - .8 Ventable plug
 - .9 Black pointer.
- .3 Pressure gauge accessories and additional requirements as follows:
 - .1 a bronze ball shut-off valve is to be provided in the piping to each pressure gauge;
 - .2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber.
 - .3 pressure gauges in fire protection piping must be ULC listed and labelled.
 - .4 CRN registered.
 - .5 5 year warranty

2.6 Thermometers

- .1 Acceptable Manufacturers
 - .1 Trerice Co.
 - .2 Weiss Instruments,
 - .3 Winters
 - .4 Ashcroft
- .2 Thermometers based on Winters Model TIM as follows:
 - .1 9" Valox case
 - .2 Organic filled tube
 - .3 Dual scale (C and F), aluminum painted white with black markings
 - .4 Adjustable angle connection and 360 degree case rotation
 - .5 Graphite filled bulb chamber
 - .6 ASME B40.200 and ASTM #2511 compliant
 - .7 CAN/CGS-M88 compliant
 - .8 Lead free, separable thermowell.
 - .1 Accuracy to +/- 1%
 - .2 5 year warranty

2.7 Flexible Connectors - Pipe

- .1 Acceptable Manufacturers:
 - .1 Senior Flexonics Ltd.
 - .2 The Metraflex Co.
- .2 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application.

Part 3 Execution

3.1 General Piping and Ductwork Installation Requirements

- .1 Unless otherwise specified, locate and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant's approval.
- .2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.
- .3 Install pipes and ducts parallel to building lines and to each other.
- .4 Neatly group and arrange exposed work.
- .5 Install pipes and ducts to avoid undue stress and distortion due to expansion and contraction.
- .6 Provide for expansion and contraction by the use of expansion loops or offsets. Expansion loops shall be installed in the line in a cold sprung position with anchors and guides. The use of expansion joints is to be reviewed with the Engineer for the service and location and type of material.
- .7 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.

- .8 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.
- .9 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.
- .10 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.
- .11 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, in which case insulation will be terminated at each side of the duct fire damper.
- .12 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.
- .13 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.
- .14 Provide continuous galvanized sheet metal drip pan under drain, water and water solution piping extending through rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping is to be extended to closest drain.
- .15 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.
- .16 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.2 Pipe Joint Requirements

- .1 Do not make pipe joints in walls or slabs.
- .2 Ream piping ends prior to making joints.
- .3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.
- .4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.
- .5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder's identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.
- .6 A random check of bolted flanged connections may be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints

- are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.
- .7 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.
- .8 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.
- .9 Pressure crimped piping is not permitted.
- .10 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer's recommendations, ASTM D2855, and CSA requirements.
- .11 Install PVC piping with gasketed joints in accordance with manufacturer's current published specifications, instructions and recommendations, and CSA requirements.

3.3 Installation and Pipe Sleeves

- .1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:
 - .1 in poured concrete slabs – unless otherwise specified, minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves;
 - .2 in concrete or masonry walls – Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.
 - .3 in waterproof walls.
- .2 Size sleeves, unless otherwise specified, to leave 12 mm (½") clearance around pipes, or where pipe is insulated, a 12 mm (½") clearance around pipe insulation.
- .3 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:
 - .1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;
 - .2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;
 - .3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified.
- .4 Where sleeves are required in masonry work, accurately locate and mark sleeve location, and hand sleeves to mason for installation.
- .5 Terminate piping for sleeves that will be exposed so sleeve is flush at both ends with building surface concerned so sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above finished floor.
- .6 "Gang" type sleeving will not be permitted.
- .7 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of sleeved opening.

3.4 Installation of Pipe and Duct Escutcheon Plates

- .1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.
- .2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

3.5 Supply of Access Doors

- .1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.
- .2 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.
- .3 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.
- .4 Group piping and ductwork to ensure minimum number of access doors is required.
- .5 Submit a sample of each proposed access door for review prior to ordering.

3.6 Installation of Valves

- .1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:
 - .1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;
 - .2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;
 - .3 unless otherwise specified, provide a check valve in discharge piping of each pump;
 - .4 valve sizes are to be same as connecting pipe size;
 - .5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;
 - .6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.7 Installation of Pressure Gauges and Thermometers

- .1 Provide pressure gauges wherever shown and/or specified.
 - .1 Provide ball valve
 - .2 Provide snubber
- .2 Provide thermometers wherever else shown and/or specified.
- .3 Locate, mount and adjust instruments so they are easily readable.
- .4 Conform to following installation requirements:
 - .1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;
 - .2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;
 - .3 locate, mount and adjust instruments so they are easily readable;
 - .4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.

3.8 Mechanical Work Identification

- .1 Identify and label new and existing piping and ductwork to indicate content and direction of flow.
- .2 All markings/identification shall be painted on with stencil.

- .3 Locate identification where it may be easily seen from floor or service platforms. Locate as follows:
 - .1 at every end of every piping or duct run;
 - .2 adjacent to each valve, strainer, damper and similar accessory;
 - .3 at each piece of connecting equipment;
 - .4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;
 - .5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;
 - .6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.
- .4 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:
 - .1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;
 - .2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;
 - .3 at each access door location;
 - .4 at each piece of connected equipment, automatic valve, etc..
- .5 Where outside diameter of pipe (or insulation) exceeds 3" provide labels with a minimum width of 2.5" and 2" high letters. Where outside diameter of pipe (or insulation) is 3" or less, provide labels of 1" minimum width and 1" high lettering.
- .6 Conform to ASHRAE and ANSI/ASME Standards for primary label colour and with legend and direction arrows in black. Print legend in full wherever feasible, or a recognized abbreviation of the service involved.
- .7 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.
- .8 Paint new natural and/or propane gas piping with primer and 2 coats of yellow paint in accordance with Code requirements and requirements of Painting Section in Division 09. Identify piping at intervals as specified above.
- .9 Tag valves and prepare a valve tag chart in accordance with following requirements:
 - .1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;
 - .2 prepare a computer printed valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);
 - .3 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals;
 - .4 hand an identified CD of valve tag chart to Owner at same time O & M Manuals are submitted.
- .10 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:
 - .1 HVAC piping valves and equipment: yellow
 - .2 fire protection valves and equipment: red
 - .3 plumbing valves and equipment: green
 - .4 HVAC ductwork dampers and equipment: blue
 - .5 control system hardware and equipment: orange

3.9 Finish Painting of Mechanical Work

- .1 Touch-up paint damaged factory applied finishes on mechanical work products.
- .2 Finished painting shall be done by the Painting Contractor with the exception of that work specifically called for to be done by the Mechanical Contractor.
- .3 Iron work shall be carefully brushed and cleaned after installation, in order that it may be in proper condition for paint.
- .4 Metal shall, unless shop primed, receive one coat of metal priming paint. Any equipment defaced during construction shall be cleaned and repainted as required to original finish.
- .5 Prime and touch up marred finished paintwork to match original.
- .6 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

3.10 Pipe Leakage Testing

- .1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connect, test piping for leakage.
- .2 Tests are to be witnessed by Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.
- .3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.
- .4 Gravity Drainage and Vent Piping
 - .1 Test piping in accordance with local governing building code.
 - .2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.
- .5 Pumped Drainage Piping:
 - .1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.
- .6 Domestic Water Piping:
 - .1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.
- .7 Heat Transfer (HVAC) System Piping:
 - .1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.
- .8 Natural Gas Piping:
 - .1 Test piping in accordance with requirements of CAN/CSA B149.1 and any additional requirements of local governing authorities.
 - .2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.
 - .3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.
- .9 Refrigerant Piping:
 - .1 Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of ASHRAE Handbook - Fundamentals.
- .10 Following requirements apply to all testing:
 - .1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;
 - .2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;

- .3 when testing is carried out below highest level of the particular system, increase test pressure by the hydrostatic head of 7 kPa (1 psi) for every 600 mm (24 inches) below the high point;
- .4 include for temporary piping connections required to properly complete tests;
- .5 piping under test pressure is to have zero pressure drop for length of test period;
- .6 make tight leaks found during tests while piping is under pressure, and if this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;
- .7 tests are to be done in reasonably sized sections to minimize number of tests required.
- .8 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections, and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.11 Cutting, Patching and Core Drilling

- .1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant's approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by Consultant.
- .2 Criteria for cutting holes for additional services:
 - .1 cut holes through slabs only; no holes to be cut through beams;
 - .2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;
 - .3 keep at least 100 mm (4") clear from beam faces;
 - .4 space at least 3 hole diameters on centre;
 - .5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;
 - .6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;
 - .7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.
- .3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.
- .4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around pipes or pipe insulation. Refer also to Sleeving requirements.
- .5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.
- .6 Firestop and seal openings in fire rated construction in accordance with requirements of article entitled Firestopping and Smoke Seal Materials in this Section. Do not leave openings open overnight unless approved by Owner and Consultant.

3.12 Flashing for Mechanical Work Penetrating Roof

- .1 Perform required flashing work, including counter-flashing, for mechanical work penetrating and/or set in roof.
- .2 Perform flashing work in accordance with requirements of drawing details, and requirements specified in Architectural Sections.

3.13 Cleaning Mechanical Work

- .1 Refer to cleaning requirements specified in Division 01.
- .2 Clean mechanical work prior to application for Substantial Performance of the Work.
- .3 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.14 Connections to Other Equipment

- .1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.15 Seismic Restraint Anchor Points for Equipment

- .1 Mechanical equipment requiring seismic restraint is to be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by equipment manufacturers, so equipment may be bolted down or restrained in the field.
- .2 Equipment to be restrained must be designed such that the strength and anchorage of the internal components of equipment exceeds force level used to restrain and anchor equipment itself to the supporting structure.

3.16 Installation of Flexible Connectors

- .1 Provide flexible connectors in piping connections to seismically restrained equipment, and wherever else shown.
- .2 Provide flexible connectors in piping connections to vibration isolated equipment.

3.17 Equipment and System Manufacturer's Certification

- .1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer's authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to Consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer's instructions.

3.18 Equipment and System Start-Up

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:
 - .1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments made by Consultant;
 - .2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.

END OF SECTION

PART 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.
- .3 The work to be done includes the furnishing of all labour, materials, tools and equipment required to complete the design and installation.
- .4 Equipment and accessories shall be ULC and FM listed for fire protection service.

1.2 Design Requirements

- .1 Fire-suppression sprinkler work is to be designed in accordance with NFPA 13 and Provincial Standards, and, where required, local building and fire department requirements and standards of Owner's Insurer and as specified herein.
- .2 If water supply flow and pressure test data is not available, conduct Municipal main water flow and pressure tests at nearest fire hydrant to obtain criteria to be used in system design. Include hydrant location and flow and pressure test data with system design calculations.
- .3 Include for design by a qualified Professional Engineer licensed in the Province of Ontario. Refer to Section entitled Mechanical Work General Instructions for requirements regarding Contractor retained engineers. Hydraulically design sprinkler piping where dimensions are not indicated on drawings. Submit shop drawings sealed by the design Engineer. Design safety factor to be 5psig. Incorporate piping that has been pre-sized into design drawings as a minimum size for the installation.
- .4 Sprinkler /System Occupancy – Hazard Design requirements: In accordance with NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

1.3 References and Quality Assurance

- .1 NFPA 13 - Standard for the Installation of Sprinkler Systems.
- .2 NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
- .3 NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- .4 UL 405-2011 - Standard for Fire Department Connection Devices.
- .5 Conform to ULC, FM, CSA, NFPA 13, NFPA 14.
- .6 Products and Materials shall: Bear FM and ULC label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.4 Submittals for Review

- .1 Shop Drawings: Provide manufacturers catalogue information. Indicate valve data and ratings. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

- .2 Provide data on sprinklers, valves, and specialties, including manufacturer's catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- .3 Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
- .4 Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
- .5 Submit shop drawings, product data, and hydraulic calculations to the authority having jurisdiction for approval. Submit AHJ approval to Engineer and Owner
- .6 Include the following paragraph for submission of physical samples for selection of finish, colour, texture, etc.
- .7 Submit two (2) samples of each style of sprinkler specified.
- .8 Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
- .9 Submit Seismic bracing calculations for system bracing sealed by Professional Engineer licensed in the Province of Ontario.
- .10 Submit Sprinkler Shop Drawings sealed by the Professional Engineer licensed in the Province of Ontario.

1.5 Submittals for Closeout

- .1 Record Documentation: Record actual locations of components and tag numbering.
- .2 Operation and Maintenance Data: Include installation instructions and spare parts lists.
- .3 Test certificates
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.
- .5 Provide Contractor's Material and Test Certificate.
- .6 System flow, tamper, switches tested with the fire alarm company.
- .7 System flow test.
- .8 Valve tags, label, ID and flow markings have been installed as per specification.
- .9 As-built drawings.
- .10 Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location.
- .11 Warranty certificate.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience and approved by the manufacturer.
- .3 Sprinkler work is to be performed by a sprinkler company who is a member in good standing of the Canadian Automatic Sprinkler Association

PART 2 Products

2.1 Pipe, Fittings, Joints – Above Ground

- .1 Pipe and fittings shall be black steel Schedule 40 ASTM A53 steel pipe suitable for either welding or threading. Grooved Pipe and fittings may be black steel Schedule 10 ASTM A53 steel pipe or thicker wall suitable for grooved ends.
- .2 For 2" diameter and smaller: pipe and fittings shall be screwed standard, standard black iron fittings.

- .1 Schedule 40 mild black carbon steel, ASTM A53. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4.
- .3 For 2½" diameter and larger pipe: pipe and fittings shall be welded, flanged or grooved.
 - .1 Grooved: Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints. Strap type outlet fittings such as Victaulic "Snap-Let" are not acceptable. Grooved products including couplings, fittings, and valves shall be by one manufacturer.
 - .2 Schedule 40 mild black carbon steel, ASTM A53. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.
- .4 Flexible Pipe – Equal to Victaulic "VicFlex"
 - .1 Drop system is to consist of a braided type 304 stainless steel flexible tube, zinc plated steel 25 mm (1") NPT male threaded nipple for connection to branch-line piping, and a zinc plated steel reducer with a 20 mm (¾") NPT female thread for connection to sprinkler head.
 - .2 Drop is to include a cULus/FM approved Series AH2 braided hose with a bend radius to 50 mm (2") to allow for proper installation in confined spaces.
 - .3 Union joints are to be provided for ease of installation, prevention of hose torque stresses and on site changing of factory 146 mm (5.75") straight reducing nipple in reduced spaces under obstructions.
 - .4 On T-bar ceiling grid with drop in tile application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB1 bracket. Bracket is to allow installation before ceiling tile is in place.
 - .5 On T-bar ceiling grid designed for hard lid drywall application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB2 bracket. Bracket is to allow for vertical adjustment of reducer/head from below drywall, post-drywall installation.
 - .6 On hat furring channel grid with hard lid drywall application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB4 bracket. Bracket is to allow for vertical adjustment of reducer/head from below drywall, post-drywall installation.
 - .7 Braided drop system is to be cULus listed for sprinkler services to 1206 kPa (175 psi).
 - .8 Maximum flexible pipe length to be 1200 mm (48") if required.

2.2 Service Main Double Check Valve Assembly

- .1 Minimum 1205 kPa (175 psi) rated dual check valve backflow preventer assembly to CAN/CSA B64, complete with tight-closing resilient seated shut-off valves, test cocks and strainer.
- .2 Acceptable manufacturers are: Watts Industries Canada; Zurn/Wilkins; Apollo Valves (Conbraco Industries).

2.3 Isolation Valves

- .1 Minimum 2070 kPa (300 psi) rated full port brass or bronze body screwed ball valves and lug body or grooved end type butterfly valves.
- .2 Butterfly valves are to include a pressure responsive seat, and stem is to be offset from disc centerline to provide complete 360° circumferential seating. Standard of Acceptance: Victaulic Style 705.
- .3 Supervised closed applications standard of acceptance Victaulic Series 707C supervised closed butterfly valve.
- .4 OS&Y Gate Valves: 1725 kPa (250 psi), grooved ends with ductile iron body, yoke, and handwheel conforming to ASTM A-536, EPDM coated ASTM A-126-B cast iron disc,

ASTM B16 brass rising stem, flanged and epoxy coated ductile iron bonnet, EPDM O-ring stem seals and body gasket. Equal to Victaulic Series 771H (Grooved ends) and Series 771F (Grooved x Flanged).

- .5 Tamper-proof supervisory switches, each arranged to activate a fire alarm system trouble alarm condition if the valve is closed or tampered with, each suitable in all respects for the application, and each complete with required mounting and connection hardware. Actuator housings are to be weatherproof.

2.4 Fire Department Connection

- .1 Wall mounting polished brass clapper type dual inlet Fire Department connection with 2, 65 mm (2-1/2") diameter inlets threaded to Fire Department hose requirements and equipped with caps and chains.
- .2 Wall plate to be embossed indicating what system supplied.

2.5 Sprinkler Heads

- .1 Sprinkler heads are to be fully concealed with white cover unless otherwise indicated.
- .2 Heads in storage rooms to be complete with protective guard.
- .3 Heads and escutcheon plates to be either chrome plated or white as approved by Architect.
- .4 Sprinklers located close to heat producing equipment or other similar sources of heat, heads shall be high temperature type.
- .5 Refer also to drawings for type.
- .6 Spare Sprinkler Head Cabinet is to be sized to accommodate a minimum of 4 spare heads for each type of head used on the project, however, each cabinet is to be full of spare heads. Surface wall mounting, red enamelled steel, identified cabinet with hinged door, shelves with holes for mounting sprinkler heads, a wrench or wrenches suitable for each type of sprinkler head, and a full complement of spare sprinkler heads.

PART 3 Execution

3.1 Installation

- .1 Install piping to NFPA 13 for sprinkler systems NFPA 14 for standpipe and hose systems NFPA 24 for service mains and Reviewed Shop Drawings.
- .2 Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient. Install piping to conserve building space, to not interfere with use of space and other work.
- .3 Piping, unless otherwise specified, is as follows:
 - .1 for underground piping inside or outside building – Class 200, DR14 rigid PVC, braced and secured at bends and tees with concrete blocks in accordance with Municipal standards and details;
 - .2 for piping inside building and above ground except as noted below – Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints, or, for piping to and including 50 mm (2") diameter, screwed fittings and joints, or, for piping 65 mm (2-1/2") diameter and larger, welding fittings and welded joints;
 - .3 for branch pipe drops to sprinkler heads in suspended ceilings; rigid pipe drops or, flexible piping installed in accordance with manufacturer's instructions;
 - .4 dry pipe zone steel piping, fittings, unions, couplings and flanges are to be galvanized;
 - .5 wet zone steel piping, fittings, unions, couplings and flanges for sprinkler work exposed to weather either inside or outside building (including parking garages), are to be galvanized;
 - .6 PVC piping is not to be used above grade;

- .4 Group piping whenever practical at common elevations.
- .5 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .6 Pipe sizes, pipe routing, sprinkler head quantities and locations, and layout of work shown on drawings are to assist during tendering period. Ensure adequate head coverage, head quantities and pipe sizing as specified in Part 1 of this Section. Do not reduce size of sprinkler main or re-route main unless reviewed with and approved by Consultant.
- .7 Install grooved joints in accordance with manufacturer's latest installation instructions. Grooved ends are to be clean and free from indentations, projections and roll marks. Gaskets are to be moulded and produced by coupling manufacturer, and verified as suitable for intended service. Have factory-trained representative from mechanical joint manufacturer provide on-site training in proper use of grooving tools and installation of grooved piping products. Have factory-trained representative periodically review product installation and ensure best practices are being followed. Remove and replace any improperly installed products.
- .8 Clean pipe, fittings, couplings, flanges and similar components after erection is complete. Wire brush clean any ferrous pipe, fitting, coupling, flange, hanger, support and similar component which exhibit rust and carefully coat with suitably coloured primer.
- .9 When sprinkler work is complete, test system components and overall system(s) and submit completed test certificate and other documentation in accordance with Chapter 8 of NFPA 13.
- .10 Slope piping and arrange systems to drain at low points.
- .11 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .12 Do not penetrate building structural members unless indicated.
- .13 Provide sleeves when penetrating floors walls footings. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- .14 Install valves with stems upright or horizontal, not inverted.
- .15 Provide butterfly, gate or ball valves for shut-off or isolating service.
- .16 Provide drain valves at main shut-off valves, low points of piping and apparatus.
- .17 Provide drain piping as required, from sectional valves, zone valves and system risers. It is the intent to drain the majority of the water via common drains to the outside. In addition, auxiliary drains shall be provided and piped and drained to suitable locations. Piping must be provided with proper drain connections in compliance with NFPA standards.
- .18 Drains located above ceilings or where their location is not evident, a red vinyl sign of adequate size with white letters and arrow indicating location will be provided.
- .19 Place and coordinate pipe runs with other trades to minimize obstruction to other work.
- .20 Place piping in concealed spaces above finished ceilings and in walls. Areas with no suspended ceilings, the piping shall be installed to be coordinated architecturally with the beams, ducts, lights and walls to the Owner's approval.
- .21 Coordinate sprinkler layout with reflected ceiling plan.
- .22 Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting.
- .23 Flush entire piping system of foreign matter.
- .24 Install guards on sprinklers in storage rooms, gymnasiums and where susceptible to damage.
- .25 Hydrostatically test entire system.
- .26 Require test be witnessed by authority having jurisdiction and Engineer.
- .27 Electrical wiring will be completed by the electrical contractor. This contractor is responsible to provide information, schematics and data supplied to him by the manufacturer to insure a complete and proper installation. Co-ordinate with the Electrical

- Contractor to ensure that all flow, pressure, low pressure and tamper switches are compatible with the building fire alarm systems prior to installation.
- .28 Ensure required devices are installed and connected as required to fire alarm system.

3.2 Drains

- .1 Supply and install drain piping as required, from sectional valves, zone valves and system risers. It is the intent to drain the majority of the water via common drains to the outside. In addition, auxiliary drains shall be provided and piped and drained to suitable locations. Piping must be provided with proper drain connections in compliance with NFPA standards.
- .2 Drains located above ceilings or where their location is not evident, a red vinyl sign of adequate size with white letters and arrow indicating location will be provided.

3.3 Installation of Double Check Valve Assembly

- .1 Provide a double check valve assembly in sprinkler main inside the building.
- .2 Equip assembly with inlet and outlet shut-off valves with supervisory switches as specified below.
- .3 Support each end of assembly from floor by means of flanged pipe supports with saddles.

3.4 Installation of Isolation Valves and Check Valves

- .1 Provide shut-off valves and check valves in piping where shown and wherever else required.
- .2 Locate valves for easy operation and maintenance.
- .3 Confirm exact locations prior to roughing-in.

3.5 Installation of Fire Department Connection

- .1 Provide an exterior Fire Department connection. Confirm exact location prior to roughing-in. Confirm finish prior to ordering.
- .2 Equip connection with a check valve. Equip check valve with a ball drip to drain piping between Fire Department connection and check valve. Extend drainage piping from outlet of ball drip to nearest suitable floor drain or through exterior wall.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.
- .3 This contractor is responsible for excavating and backfilling required to complete the work.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Solder joints used on domestic water, sanitary and venting systems shall be lead free.
- .3 DCW (potable water) isolation valves, check valves and backflow preventers shall be lead free, not more than 0.25% lead by weight.
- .4 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
 - .2 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - .3 ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV
 - .4 ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes
 - .5 ASME B16.29 - Wrought Copper And Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
 - .6 ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
 - .7 ASME B31.2 - Fuel Gas Piping
 - .8 ASME B31.9 - Building Services Piping
 - .9 ASME Boiler and Pressure Vessels Code (BPVC) - Section 1 - Rules for Construction of Power Boilers
 - .10 ASME Boiler and Pressure Vessels Code (BPVC) - Section IV - Rules for Construction of Heating Boilers
 - .11 ASME Boiler and Pressure Vessel Code (BPVC) - Section IX - Welding and Brazing Qualifications
 - .12 ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - .13 ASTM A74-09 - Standard Specification for Cast Iron Soil Pipe and Fittings
 - .14 ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - .15 ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
 - .16 ASTM B32 - Standard Specification for Solder Metal
 - .17 ASTM B75/B75M - Standard Specification for Seamless Copper Tube
 - .18 ASTM B88-09 - Standard Specification for Seamless Copper Water Tube
 - .19 ASTM B88M - Standard Specification for Seamless Copper Water Tube

- .20 ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- .21 ASTM B306 - Standard Specification for Copper Drainage Tube (DWV)
- .22 ASTM B837- Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems
- .23 ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
- .24 ASTM C443- Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- .25 ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- .26 ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
- .27 ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
- .28 ASTM D2241- Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- .29 ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
- .30 ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
- .31 ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- .32 ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems
- .33 ASTM F708 -Standard Practice for Design and Installation of Rigid Pipe Hangers
- .34 ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX AL PEX) Pressure Pipe
- .35 AWS A5.8/A5.8M- Specification for Filler Metals for Brazing and Braze Welding
- .36 AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems
- .37 AWWA C651 - Disinfecting Water Mains
- .38 CAN/CSA-B70 - Cast Iron Soil Pipe, Fittings, and Means of Joining
- .39 CAN/CSA-B1800 - Thermoplastic Nonpressure Piping Compendium
- .40 CAN/ULC-S102.2 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies
- .41 CSA ANSI Z21.22/CSA 4.4 - Relief Valves for Hot Water Supply Systems
- .42 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- .43 MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation
- .44 MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends
- .45 MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends
- .46 MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends
- .47 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves
- .48 MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
- .49 NFPA 54/ANSI Z223.1 - National Fuel Gas Code
- .50 NFPA 58 - Liquefied Petroleum Gas Code
- .51 AWWA C510 - Double Check Valve Backflow Prevention Assembly
- .52 AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly
- .53 ASSE (Plumbing) 1011 - Performance Requirements for Hose Connection Vacuum Breakers
- .54 ASSE (Plumbing) 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent

- .55 ASSE (Plumbing) 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
- .56 ASSE (Plumbing) 1019 - Performance Requirements for Wall Hydrants with Backflow Protection and Freeze Resistance
- .57 PDI-G 101- Testing and Rating Procedure for Hydro Mechanical Grease Interceptors with Appendix of Installation and Maintenance
- .58 PDI-WH 201- Water Hammer Arrestors.
- .59 CAN/CSA B125.1, Plumbing Supply Fittings.
- .60 CAN/CSA B125.3, Plumbing Fittings.

1.3 Submittals for Review

- .1 Provide data on valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- .2 Provide component sizes, rough-in requirements, service sizes, and finishes.
- .3 Provide catalogue illustrations of fixtures, sizes, rough-in dimensions utility sizes, trim, and finishes and colour chip samples.

1.4 Closeout Submittals

- .1 Record Documentation: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, etc.
- .2 Backflow preventer test certificates and tickets.
- .3 Potable water quality test report.
- .4 Operation Data: Indicate frequency of treatment required for interceptors.
- .5 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views. Include fixture trim exploded view and replacement parts lists.
- .6 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 Delivery, Storage, And Protection

- .1 Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- .2 Provide temporary protective coating on cast iron and steel valves.
- .3 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .4 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 Environmental Requirements

- .1 Ambient Conditions: Do not install underground piping when bedding is wet or frozen.

Part 2 Products

2.1 Domestic Hot/Cold Water Piping, Above Ground

- .1 Copper Tubing:
 - .1 Copper: manufactured to ASTM B88M (ASTM B88), Type L, hard drawn. Fittings: ASME B16.18 cast copper alloy ASME B16.26 cast copper alloy ASME B16.22 wrought copper and bronze ASME B16.50 wrought copper. Joints: ASTM B32, soldered AWS A5.8/A5.8M brazed. ASTM-B32 95% tin/5% antimony soldered joints.
 - .2 Not Permitted: grooved or press fit systems

2.2 Sanitary Sewer, Storm Sewer, and Vent Piping, Above Ground

- .1 Cast Iron Pipe: CAN/CSA-B70.
 - .1 Manufactured to CAN/CSA-B70.
 - .2 Fittings: Hubless Cast Iron Pipe Fittings: FSWW-P-401.
 - .3 Joints: ASTM C564, rubber or compression gaskets with stainless steel clamps.
- .2 Copper Tube: .
 - .1 Manufactured to ASTM B306 type DWV.
 - .2 Fittings: ASME B16.23 cast bronze ASME B16.29 wrought copper.
 - .3 Joints: ASTM B32, soldered AWS A5.8/A5.8M brazed. ASTM-B32 95% tin/5% antimony soldered joints.
- .3 PVC/DWV Pipe:
 - .1 Manufactured to CSA-B181.2 and CAN/ULC-S102.2, Schedule 40, with flame spread rating less than 25 and smoke spread rating less than 50.
 - .2 Fittings: CSA-B181.2, socket type and CAN/ULC-S102.2, flame spread rating less than 25 and a smoke spread rating of less than 50.
 - .3 Joints: ASTM D2564 solvent cement and primer.
 - .4 Equal to IpeX System 15 (XFR) rigid PVC drain, waste and vent pipe and fittings
 - .5 Plenum rated as required.

2.3 Sanitary Sewer, Storm Sewer Drain and Vent Piping, Below Ground

- .1 PVC Sewer – 6" and larger.
 - .1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.
- .2 PVC Sewer – 4" and smaller
 - .1 DR35 rigid, PVC sewer pipe and fittings, with solvent weld joints, all certified to CSA B182.1 and colour-coded as per local governing codes, regulations and standards.

2.4 Drain Trap Seal Primer Piping, Below Grade

- .1 Semi-Rigid Polyethylene Tubing:
 - .1 Versa Fittings and Mfg. Inc. 13 mm (½") dia., high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

2.5 Drain Pumped Discharge Sanitary, Grey Water and Storm Water Piping

- .1 From pump discharge, up to and including shut-off and valve connections.
 - .1 PVC/DWV Pipe:
 - .1 Manufactured to CSA-B181.2 and CAN/ULC-S102.2, Schedule 40, with flame spread rating less than 25 and smoke spread rating less than 50.
 - .2 Fittings: CSA-B181.2, socket type and CAN/ULC-S102.2, flame spread rating less than 25 and a smoke spread rating of less than 50.
 - .3 Joints: ASTM D2564 solvent cement and primer.

2.6 Valves

- .1 Isolating Valves 3" (75mm) and smaller
 - .1 Ball Valves
 - .1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port, solid ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, and a removable lever handle.
 - .2 Valves in insulated piping are to be complete with stem extensions.

- .3 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 5049A-LF;
 - .2 Milwaukee Valve Co. #UPBA485B;
 - .3 Kitz Corporation Code 859;
 - .4 Apollo Valves #77LF-200;
 - .5 Watts Industries (Canada) Inc. #LFFBVS-3C.
- .2 Isolating Valves 4" (100mm) and larger
 - .1 Ball Valves - Flanged Connection
 - .1 Application: Shut-off,
 - .1 Size: 65 mm (2.5 in) diameter and larger
 - .2 Body & Shell Working Pressure Rating:
 - .1 Class 150/300WOG
 - .2 NSF/ANSI 372
 - .2 Materials of Construction:
 - .1 Body: A351-CF8M Stainless Steel, full port
 - .2 Ball: Teflon fused stainless steel solid ball
 - .3 Seats: PTFE
 - .4 Seals: PTFE
 - .5 Stem: 316 Stainless steel, Blow-out proof
 - .6 Stem Seal: PTFE adjustable packing
 - .7 Operator: : Lever handle or gear operated
 - .8 Connections: Flanged
 - .3 Manufacturers:
 - .1 American Valve 4001
 - .3 Swing Check Valves
 - .1 Swing Check Valves Up To and Including 75 mm (3 inches): MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat.
 - .2 Swing Check Valves 50 mm (2 inches) and Larger: MSS SP-71, Class 125, iron body, bronze swing disc.
 - .3 Acceptable product Kitz Corporation Code 823, lead-free
 - .4 Vertical Spring Loaded Check Valves
 - .1 Equal to Kitz Corp. Code 826, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends, bronze trim, stainless steel springs, Buna N seals.
 - .2 Acceptable product Kitz Corp. Code 826, lead-free.
 - .5 Drain Valves
 - .1 Applications: Install at bases of risers, at main shut-off valves, in drain connections to equipment, low points of horizontal piping, and other locations as required to permit drainage of the respective hydronic system.
 - .1 Size: 20 mm (3/4 in)
 - .2 Body & Shell Working Pressure Rating:
 - .1 2070 kPa (300 psig)
 - .3 Materials of Construction:
 - .1 Body: Standard port, bronze or brass
 - .2 Ball: Bronze, chrome-plated brass

- .3 Seat: PTFE
- .4 Outlet: 20 mm (3/4 in) threaded hose end with cap and chain
- .5 Operator: Lever handle
- .6 Connections: NPT
- .4 Manufacturers:
 - .1 Toyo Valve Co. Fig. 5046;
 - .2 Dahl Brothers Canada Ltd. Fig. No. 50. 430;
 - .3 Kitz Corporation Code 58CC;
 - .4 Apollo Valves #78-104-01;
 - .5 Watts Industries (Canada) Inc. #B6000.
- .6 DHWR Balancing Valves – Globe Type, Threaded/Screwed Connection
 - .1 Applications: : Balancing (calibrated) and flow measurement. Valves shall be capable of positive shut off against system pressure.
 - .1 Size: Up to 50 mm (2 in) diameter
 - .2 Maximum Service Pressure:
 - .1 2065 kPa (300 psi)
 - .3 Maximum Service Temperature:
 - .1 120 deg C (248 deg F)
 - .4 System Operating temperature/Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .5 Materials of Construction:
 - .1 Body: Y- Pattern, Brass or copper
 - .2 Disc: Bronze, brass, or metal copper alloy
 - .3 Seats: Brass, or metal copper alloy
 - .4 Stem: Brass, copper alloy
 - .5 Stem Seal: EPDM O-ring
 - .6 Memory Lock: Brass
 - .7 Operator: Vernier type handwheel
 - .8 Meter Ports: NPT brass body with EPDM check
 - .9 Drain Tappings: Built-in drain connection complete with shut-off valve and protective caps, and integral valve insulation.
 - .10 Connections: NPT threaded or soldered
 - .6 Manufacturers:
 - .1 S.A. Armstrong Ltd., Series CBV.
 - .2 Victaulic (Tour & Andersen) Series, 786 soldered, 787 screwed,
 - .3 Red White Valve # 9517, 9519

2.7 Backflow Preventers

- .1 Provide lead free backflow preventer assembly complete that conforms to the applicable CAN/CSA B64 Standard with locations and types determined by the Ontario Building Code and the Local Authority having jurisdiction, except where specified otherwise.
- .2 The backflow assemblies shall consist of shut-off valves before and after the assembly with test cocks where applicable.
- .3 Internal iron surfaces subject to rusting shall be covered with an approved potable water epoxy finish.
- .4 A protective “Y” strainer with standard mesh screen shall be supplied adjacent to the first shut-off valve on all reduced pressure (R.P.) and double check (DCVA) assemblies.

- .5 Backflow Preventer - Acceptable Materials/Pressure/Temperature
- .6 Up to 2" (50 mm): Bronze, 175 psi (1.2 mPa), 33° F (1° C) to 180° F (82° C)
- .7 Larger than 2" (50 mm), F.D.A. epoxy coated cast iron, 175 psi (1.2 mPa), 33° F (1° C) to 140° F (60° C)
- .8 Acceptable Manufacturers: Zurn/Wilkins, Watts, Zurn/Wilkins, Apollo Valves (Conbraco).

2.8 Roof Drains

- .1 Refer to Specification on Drawings.
- .2 Supplied by Mechanical Contractor and turned over to roofer for installation and connected to piping by mechanical contractor.
- .3 Manufacturers: Thaler RDA-30
- .4 Galvanized cast iron drain with sump, removable cast aluminum domed strainer with vandal proof screws and including the following accessories.
 - .1 Membrane flange and membrane clamp with integral gravel stop.
 - .2 Adjustable under deck clamp.
 - .3 Roof sump receiver.
 - .4 Waterproofing flange.
 - .5 Levelling frame.
 - .6 Adjustable extension sleeve for roof insulation.
 - .7 Perforated or slotted ballast guard extension for inverted roof.
 - .8 Perforated stainless steel ballast guard extension.

2.9 Plumbing Vent Flashings

- .1 Thaler model SJ-26, 18" high (457mm), aluminum construction, to CSA B272 with removable cap, premolded urethane insulation liner, and roof flashing. Roofer to seal into roof. Thaler Stack Jack flashing or equal.
- .2 Refer to Specification on Drawings also.

2.10 Trap Seal Primer

- .1 Cast bronze
 - .1 removable gasketed cover, replaceable valve seat. Mifab, Watts, Zurn Z-1022A, Ancon-MS-810.

2.11 Plumbing Fixtures

- .1 Refer to Drawing Schedule for Basis of Specification. Manufacturers listed in Drawing Schedule are to be the base of bid. Alternate manufacturers may be considered with products and performance of equal or better characteristics of those listed on the drawings and in the specifications.
- .2 Best of their respective kind, free from all defects.

2.12 Access Doors

- .1 Refer to General Requirements section

Part 3 Execution

3.1 Examination

- .1 Verify excavations are to required grade, dry, and not over-excavated.
- .2 Verify existing conditions before starting work.
- .3 Verify wall and floor finishes are prepared and ready for installation of fixtures.

- .4 Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.
- .5 Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.2 Installation

- .1 This contractor is responsible for excavating, bedrock removal and backfilling required to complete the work.
- .2 Solder joints used on domestic water, sanitary and venting systems shall be lead free.
- .3 DCW (potable water) isolation valves, check valves and backflow preventers shall be lead free, not more than 0.25% lead by weight.
- .4 Install to manufacturer's written instructions.
- .5 Ream pipe and tube ends. Remove burrs.
- .6 Remove scale and dirt, on inside and outside, before assembly.
- .7 Install piping to maintain headroom, conserve space, and not interfere with use of space.
- .8 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .9 Install hot and cold water pipes at least 6" (150 mm) apart in pipe spaces and elsewhere to permit insulation to be installed.
- .10 Provide access panels where valves and fittings are not exposed.
- .11 Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- .12 Provide support for utility meters to requirements of utility companies.
- .13 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- .14 Install valves with stems upright or horizontal, not inverted.
- .15 Sleeve pipes passing through partitions, walls and floors.
- .16 Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- .17 Install floor cleanouts at elevation to accommodate finished floor.
- .18 Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to sinks and lavatories and washing machine outlets.
- .19 Install each fixture with trap, easily removable for servicing and cleaning.
- .20 Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- .21 Install components level and plumb.
- .22 Install and secure fixtures in place with wall carriers and wall supports and bolt, washer, nut fasteners.
- .23 Seal fixtures to wall and floor surfaces with sealant, colour to match fixture.
- .24 Solidly attach water closets to floor with lag screws.
- .25 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- .26 Adjust thermostatic valves to design requirements and check and test operation. Set maximum temperature limit stops.
- .27 Clean plumbing fixtures and equipment.
- .28 Backflow Preventers
 - .1 Install in accordance with CSA B64.10, where indicated and elsewhere as required by code for proper functioning of equipment and/or systems.
 - .2 Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
 - .3 Pipe relief from backflow preventer to nearest drain.

- .4 Submit signed test results and inspection and test log cards for each backflow preventer
- .29 Domestic Water Piping
 - .1 Grade all horizontal lines of hot and cold water to ensure complete drainage of lines through risers, fixtures and drips. Install drains faucets in accessible locations to work as drain valves at low points and arrange for convenience connection to floor drains.
 - .2 for pipe inside building and aboveground in sizes up to 100 mm (4") dia. – Type "L" hard copper with solder joints.
 - .3 for underground piping outside building to fixtures/outlets at grade level – flexible polyethylene, snaked in the trench and in a continuous length.
- .30 Drainage Piping and Fittings.
 - .1 Lay drains to true and even falls as near as possible to minimum grades unless otherwise specified. Install and slope underground drainage piping to inverts or slopes if indicated on drawings. Verify available slopes before installing pipes.
 - .2 No pipe shall be laid or roughed-in unless and until all details and elevations of the storm, sanitary sewer and other underground services have been established and agreed upon. This Contractor shall be responsible for changes to work of this division because of failure to comply.
- .31 Trap Seal Primers
 - .1 Provide trap seal primer for drains and other plumbing fixtures requiring priming.
 - .2 for trap seal primer tubing located underground or in concrete or masonry construction – semi-rigid polyethylene;
 - .3 for trap seal primer tubing located above ground – semi-rigid polyethylene plenum rated or copper tubing.
- .32 Vent Piping
 - .1 Vent all fixture traps and install a vent pipe system.
 - .2 Increase the vent stacks in size below the underside of the roof so that the vent extension through and above the roof is not smaller than 3" (75mm).
 - .3 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions. Maintain a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building roof to satisfy local governing codes and authority. Coordinate vent routing with other building services and Architect.
 - .4 Supply a properly sized vent stack cover for each vent stack penetrating roof.
 - .5 Hand vent stack covers to roofing trade at site for installation and flashing into roof construction as part of roofing work. Coordinate installation to ensure proper locations. Provide waterproofing caps over vent stacks.
- .33 Rain Water Leaders and Fittings
 - .1 Install horizontal rainwater leaders as per drainage piping.
 - .2 At the base of all rainwater leaders provide a Barrett type clean out and suitable access door where required.
- .34 Cleanouts
 - .1 Provide cleanouts in drainage piping in locations as follows:
 - .1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed
 - .2 at or as close as practicable to the base of each drainage stack
 - .3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller
 - .4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.
 - .5 in the wall at each new urinal or bank of urinals in a washroom;
 - .6 wherever else shown on drawings.

- .2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.
- .3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor.
- .4 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.
- .5 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.
- .6 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.
- .7 Ensure cleanout termination covers in tiled floor are square in lieu of round.
- .35 Floor Drains (Drains)
 - .1 In equipment rooms and similar areas locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping.
 - .2 In washrooms, locate floor drains to avoid interference with toilet partitions.
 - .3 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.
- .36 Plumbing fixtures
 - .1 Supply, install and connect plumbing fixtures and equipment to the water supplies, wastes and vents, respecting plumbing requirements of each fixture.
 - .2 Set fixture level, square and centered with relation to floors, walls and partitions. Standard height from floor to rim, unless otherwise show on the Drawings, and/or as directed by the Architect/Engineer.
 - .3 Attach plumbing fixtures in an approved manner with bolts and wall plates.
 - .4 All exposed pipes, fittings and stop valves of the fixtures shall be chromium plated and tubing shall be iron pipe size chromium plated.
- .37 Hose Bibbs
 - .1 Indoor hose bibbs: unless otherwise shown, specified, or required, mount hose bibbs approximately 1 m (3') above floor. Confirm exact locations prior to roughing-in.
 - .2 Non freeze outdoor hose bibbs: install level and plumb such that hose outlets are approximately 600 mm (2') above grade level. Confirm exact locations prior to roughing-in. Provide a shut-off valve inside building to each exterior non-freeze wall hydrant.

3.3 Disinfection of Domestic Water Piping System

- .1 Upon completion of the testing, thoroughly flush and disinfect potable water systems.

END OF SECTION

1.01 GENERAL

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Solder joints used on domestic water, sanitary and venting systems shall be lead free.
- .3 DCW (potable water) isolation valves, check valves and backflow preventers shall be lead free, not more than 0.25% lead by weight.

1.3 Submittals for Review

- .1 Provide dimension drawings of equipment indicating components, rough-in requirements, connection sizes, finishes, weights, dimensions, placement of openings and holes
- .2 Indicate pump type, capacity, power requirements.
- .3 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- .4 Provide electrical characteristics and connection requirements.
- .5 Indicate heat exchanger dimensions, size of tapings, and performance data.
- .6 Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.

1.4 Submittals for Closeout

- .1 Record Documentation: Record actual locations of components and .
- .2 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers.
- .3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

Part 2 Products

2.1 Gas Fired Water Heaters - Commercial

- .1 Acceptable Manufacturers:
 - .1 Lochinvar "Shield"
 - .2 A.O. Smith
 - .3 Rheem-Ruud Canada Ltd.
 - .4 Bradford White Canada Inc.
- .2 General Description: ASME labelled, Sealed Combustion hot water heater complete with automatic, natural gas-fired heat exchanger with multiple flue passages and thermally insulated vertical storage tank.

- .3 Construction:
 - .1 Heat Exchanger: Direct fired stainless steel heat exchanger mounted on top of a glass lined storage tank. Water heater shall be capable of full modulation on firing down to 20% of rated input at a 5:1 turndown ratio. Water heater shall comply with energy efficiency requirements of ASHRAE 90.1 as determined in accordance with AHRI.
 - .2 Tank: Storage tank shall be constructed of heavy gauge steel with glass lining applied to all water-side surfaces. Storage tank have a maximum working pressure of 150 psig. The tank shall be completely encased in high density insulation of sufficient thickness to meet the energy efficiency requirements of ASHRAE 90.1.
 - .3 Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve, combustion venting and combustion air intake.
- .4 Controls:
 - .1 Water heater shall utilize 24 VAC control circuit and components. Control system shall include:
 - .1 Electronic LCD display for set-up, status and diagnostics.
 - .2 High limit temperature control.
 - .3 Inlet and outlet water temperature sensors.
 - .4 Flue temperature sensor.
 - .5 Runtime contacts.
 - .6 Alarm contacts.
 - .7 Low water flow protection.
 - .8 Contacts for louvers.
 - .9 Enable/Disable contacts.
 - .10 Adjustable pump time delay.
 - .11 Freeze protection.
 - .2 Provide 2400 mm (8 ft) 120V/ 60Hz power cord.

2.2 Domestics Hot Water ReCirculating Pump

- .1 Acceptable manufacturers:
 - .1 Ecocirc XL
 - .2 Grundfos Alpha 2
 - .3 Armstrong Compass 20-20SS
- .2 Programmable, Automatic Timer Kit to control circulating pump on and off at pre-set minimum 15 minute intervals, and equipped with ON (continuous run), OFF (at all times), and TIMER (run at programmed times) modes.
- .3 Control enables the ALPHA2 to be programmed in one of 3-constant speed,
- .4 3-constant pressure, or AUTOADAPT control modes. The current operating mode is always visible on the ALPHA2's LED display
- .5 The large LED display shows the current energy consumption in Watts and estimated flow in gallons per minute
- .6 ALPHA2 is complete with an integrated check-valve, foam insulation jacket, and nut captures for flanges.
- .7 Stainless steel.

2.3 Thermal Expansion Tanks

- .1 Acceptable Manufacturers:
 - .1 Amtrol "Therm-X-Trol"
- .2 General Description:
 - .1 Diaphragm type, factory pre-pressurized excess pressure tank with permanent separation of air and water and suitable for use in potable water systems. Tank

shall be constructed and stamped in accordance with the ASME Code for Unfired Pressure Vessels and complete with a system connection, drain connection and air charging valve.

- .3 Construction:
 - .1 Steel pressure tank suitable for working pressures up to 10.3 bars (150 psig) and maximum working temperature of 93 deg c (200 deg F) and shall be supplied complete with stainless steel system connection.
 - .2 Diaphragm shall be heavy duty butyl complete with polypropylene liner.

Part 3 Execution

3.1 Installation

- .1 Install water heaters to manufacturer's instructions.
- .2 Install venting to manufacturer's instructions.
- .3 Coordinate with plumbing piping and related gas venting fuel piping electrical work to achieve operating system.
 - .1 Pumps:
 - .1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
 - .2 Testing
 - .1 Test all plumbing systems in accordance with plumbing codes and local authorities.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 IEEE – Institute of Electrical and Electronics Engineers Standards
 - .2 OHSA – Occupational Health & Safety Act Standards
 - .3 CAN/CSA C747- Energy Efficiency Test Methods for Small Motors
 - .4 CAN/CSA C390 - Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors
 - .5 CAN/CSA C22.2 – General Requirements- Canadian Electrical Code, Part II
 - .6 NEMA MG1 – Motors and Generators

1.3 Submittals

- .1 Submit shop drawings/product data sheets for:
 - .1 electric motors; submit with equipment they are associated with.
- .2 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

Part 2 Products

2.1 Equipment Drive Guards and Accessories

- .1 For flexible couplings – removable "U" shaped galvanized steel guards to OHSA Standards with a 2.3 mm (3/32 in) thick frame and expanded mesh face.
- .2 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (3/4 in) galvanized steel wire mesh with galvanized steel frames, to OHSA Standards.

2.2 Electric Motors

- .1 Unless otherwise specified, motors are to conform to NEMA Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.
- .2 Motors shall be selected for quiet continuous operation to suit loads imposed by equipment.
- .3 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.

- .4 Efficiency of single-phase motors up to 0.746 KW (1 HP) and three-phase motors greater than or equal to 0.186 KW (1/4 HP) and less than 0.746 KW (1 HP) shall be in accordance with CAN/CSA C747.
- .5 Efficiency of three-phase motors equal to 0.743 KW (1 HP) or greater shall be in accordance with CAN/CSA C390.
- .6 Provide 60 cycle, 1800 RPM motors except where otherwise indicated in project plans and equipment schedules.
- .7 Motor nameplates shall list the full load motor efficiency.
- .8 Motors shall have a +/- 10% voltage distortion range to protect against voltage variation.
- .9 Unless otherwise specified, single-phase motors smaller than 0.373 KW (1/2 HP) shall be 120 volt, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, NEMA Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature. Single-Phase motors shall be complete with grease lubricated open ball bearings with grease fittings to permit re-lubrication of the bearings without dismantling motor.
- .10 Unless otherwise specified, motors 0.073 KW (1/2 HP) and larger are to be 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated in project plans and equipment schedules. Motors shall be NEMA Design "B" for normal starting torque, or Design "C" for high starting torque as required by the application. Provide NEMA Class "F" insulation and a 1.15 service factor at 40°C (105°F) ambient temperature. Three-Phase motors shall be complete with grease lubricated open ball bearings with grease fittings to permit re-lubrication of the bearings without dismantling motor, a cast iron frame with cast iron feet (where required), cast iron end bracket, precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminum, or copper rotor windings. Provide bearings with L10 design life of at least 100,000 hours.
- .11 Provide motor enclosures as follows:
 - .1 Open drip-proof – shall be provided for motors in areas that are protected from the weather and moisture entrainment. For motors located within air streams, open drip-proof motors are permitted when air conditions are satisfactory for motor operation at maximum temperature and humidity levels.
 - .2 TEFC (Totally Enclosed Fan Cooled) – shall be provided for motors in all other locations.
- .12 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG-1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified. Provide motors that are:
 - .1 constructed with cast iron frames and NEMA Class "F" insulation.
 - .2 equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.
 - .3 operable from a PWM (pulse width modulated) waveform and shall not saturate while operating at up to 110% of the nameplate voltage.
 - .4 capable of running at 10% of full rated speed with the variable speed drive output provided by the drives.
 - .5 capable of withstanding voltage spikes of 1,800 V in a rise time of 0.1 microseconds.
 - .6 provided with thermal sensors embedded in the windings with connections extending to the motor terminal box. For motors up to and including 18.6 KW (25 HP), the sensors may be thermistors. For larger motors in excess of 18.6 KW (25 HP) provide resistive temperature sensing device. Embed sensors in the part of the windings that is in contact with iron for response to both copper and iron temperature. Provide two (2) marked leads brought out to the motor conduit box. Provide manual reset motor protection tripping relays compatible with motor starter to shut down equipment in the event of overheating.

- .13 Unless otherwise indicated, motors 22.4 KW (30 HP) and larger shall be supplied complete with a heat sensing PTC (positive temperature coefficient) resistive thermistor in the end turn stator winding for each phase and connected in series inside the motor with two (2) marked leads brought out to the motor conduit box. Provide manual reset motor protection tripping relays compatible with motor starter to shut down equipment in the event of overheating.
- .14 Manufacturers:
 - .1 TECO-Westinghouse Motors Canada Inc.
 - .2 Canadian General Electric.
 - .3 Baldor Electric Co.
 - .4 U.S. Electrical Motors.
 - .5 Weg Electric Corp.
 - .6 Marathon Electric.
 - .7 Toshiba Corp.
 - .8 Leeson Canada

2.3 Motor Starters and Accessories

- .1 Refer to Mechanical Division and Division 26 Specifications for requirements of motor starters and accessories.
- .2 Mechanical Contractor shall review starter requirements for mechanical motors and coordinate requirements with Division 26 and other divisions.

2.4 Wiring

- .1 Electrical work shall confirm to Division 26 Specifications unless otherwise specified.

Part 3 Execution

3.1 Supply of Motor Starters and Accessories

- .1 Motor starters for mechanical equipment, except for starters integral with packaged equipment, starters factory installed in equipment power and control panels, and starters specified to be shipped loose with equipment, will be provided by the electrical work.

3.2 Electrical Wiring Work For Mechanical Work

- .1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment shall be done as part of the electrical work:
 - .1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment;
 - .2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment;
 - .3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment;
 - .4 provision of receptacles for plug-in equipment;
 - .5 provision of disconnect switches for motors more than 10 m (30') from starter location, or cannot be seen from starter location, and associated power wiring;
 - .6 wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts; thermistor tripping relays shall be provided by Mechanical Contractor;
 - .7 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;

- .8 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;
- .9 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.
- .2 Mechanical Contractor to review requirements for disconnects, starters, interlocking relays, tripping relays, and other wiring associated with mechanical equipment and shall coordinate these requirements with Division 26 and other divisions.
- .3 Low voltage mechanical wiring (120V nominal and under), including Building Automation System (BAS) wiring and mechanical equipment safety and interlock wiring shall be supplied and installed by the Mechanical Contractor.
- .4 Mechanical wiring work not listed above or specified herein or on the drawings shall be done as part of the electrical work is to be installed in conduit and is to be done as part of the mechanical work in accordance with the wiring requirements specified for electrical work.

END OF SECTION

PART 1 - GENERAL

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 Submittals

- .1 Submit shop drawings with product data sheets for variable frequency drives (VFDs). Include:
 - .1 construction and performance details;
 - .2 wiring and control schematics;
 - .3 dimensions of units;
 - .4 calculations specific to installation showing total harmonic voltage distortion is less than 5%;
 - .5 certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.
- .2 Submit a start-up and installation certification letter from supplier of VFDs as specified in Part 3 of this Section;
- .3 Prepare list of parameters for uploading for Owner's future use as specified in Part 3 of this Section. Load on USB type flash drive and submit to Consultant.
- .4 Where extended warranty is specified to be included, include a copy of VFD extended warranty in each Operating and Maintenance Manual. Prior to Substantial Performance of Work, submit a copy of warranty to Owner.
- .5 Coordinate with Prime Contractor and Electrical Contractor to ensure shop drawings clearly identify proposed VFDs and connected motors are 100% compatible and Mechanical Contractor to sign off on selected VFDs.

1.3 Coordination With Electrical Divisions

- .1 This Section specifies Variable Frequency Drives (VFD) requirements for motors. VFDs packaged with various system equipment are to comply with specifications of this Section.
- .2 Each VFD to be approved by respective manufacturer of VFD and connected motors, as suitable for installation on scheduled motors. VFD output current rating to match or exceed connected motor nameplate full load current rating.
- .3 Coordinate and review with Electrical Divisions, responsibility requirements for supply of VFDs, harmonic filters and requirements for control and power conductors and connections.
- .4 Check motors are equipped with AEGIS or approved equal, shaft grounding ring system to protect bearings from damage in motors by diverting harmful shaft voltages and bearing currents to ground.

PART 2 - PRODUCTS

2.1 VFD Basic Requirements

- .6 VFDs supplied on project to be products of same manufacturer and be CSA approved, ULC listed and labelled. Base specified is a unit that include compliance with following standards:
 - .1 CSA C22.2 No.14 Industrial Control Equipment;
 - .2 UL 508 - Industrial Control Equipment;
 - .3 UL 508C – Power Conversion Equipment;
 - .4 NEMA ICS 7 - Adjustable-Speed Drives.
- .7 VFDs to include following basic requirements:
 - .1 regardless of HP rating are to be of same VFD model; I/O and control circuit boards as well as keypads are to be identical and interchangeable regardless of HP rating;
 - .2 to be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start);
 - .3 6-pulse width modulated (PWM) AC to AC converter utilizing latest isolated gate bipolar transistor (IGBT) technology; PWM switching pattern to include a motor flux optimization circuit that automatically reduces applied motor voltage to the motor to optimize energy consumption and audible motor noise;
 - .4 carrier frequency control circuit that reduces carrier frequency based on actual VFD temperature allowing higher carrier frequency without derating VFD or operating at high carrier frequency only at low speeds;
 - .5 provisions that determines motor torque and flux every 25 microseconds (40,000 times per second);
 - .6 completely assembled and tested by manufacturer in their facility;
 - .7 designed to provide at least 250,000 hours mean time before failure (MTBF) when specified preventative maintenance is performed.
 - .8 bypass system completely factory wired and tested;
 - .9 door interlocked padlockable disconnect switch to disconnect all input power from drive and all internally mounted options;
 - .10 control panel keyboard and display with password protection against parameter changes.

2.2 Harmonic Filters And Reactors

- .1 VFDs to include internal 5% impedance AC line reactor (or equivalent 5% impedance dual positive and negative DC bus reactors) provided as a standard to reduce input current harmonic content and provide isolation from power line transients and to reduce RFI emissions.

2.3 Controls And Adjustment Functions

- .1 Include for following:
 - .1 programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed;

- .2 proportional integral derivative (PID) speed loop regulators with an auto tune function as well as manual adjustments; PID set point controllers to allow pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control; includes 250 mA of 24 VDC auxiliary power and capability of loop powering a transmitter supplied by others; two parameter sets for first PID allowing sets to be switched via a digital input, serial communications or from keypad for night setback, summer/winter set points, etc; independent, second PID loop to utilize second analogue input and modulate analogue outputs to maintain set point of an independent process (ie. valves, dampers, etc.); set points, process variables, etc. to be accessible from serial communication network;
- .3 programmable analogue inputs that accept current or voltage signals;
- .4 programmable analogue outputs (0-20 mA or 4-20 mA), that may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data;
- .5 programmable digital inputs;
- .6 programmable digital Form-C relay contact outputs for programmable on and off delay times and adjustable hysteresis; rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS;
- .7 run permissive circuit - for damper or valve control; dry contact closure to signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;
- .8 two independently adjustable accel and decel ramps with 1 to 1800 seconds adjustable time ramps;
- .8 Operator Control Panel:
 - .1 front mounted plug-in operator control panel consisting of keypad, multi-line backlit LCD display for programming and fault diagnostics;
 - .2 keys (switches) for H-O-A, and manual speed control INCREASE/DECREASE;
 - .3 menu navigation and parameter selection keys for custom programming;
 - .4 HELP key for assistance with programming and troubleshooting;
 - .5 date and time clock - clock to have a battery backup with 10 years minimum life span; clock to be used to date and time stamp faults and record operating parameters at time of fault; if battery fails VFD automatically reverts to hours of operation since initial power up; clock also to be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays; VFD to have digital input that allows an override to time clock (when in off mode) for a programmable time frame; four (4) separate, independent timer functions that have both weekday and weekend settings;
 - .6 parameter names, fault messages, warnings and other information to be displayed in complete words or standard abbreviations to allow user to understand what is being displayed without use of a manual or cross reference table, as follows:
 - .1 "HAND" position to start drive and modify reference frequency by use of INCREASE/DECREASE keys;
 - .2 "OFF" position stops drive;
 - .3 "AUTO" position allows drive to be started or stopped using whichever remote start/stop command configured; drive speed controlled by external speed reference input or by PID controller.
 - .4 applicable operating values to be capable of being displayed in engineering (user) units; operating displayed include:
 - .1 Output Frequency;
 - .2 Motor Speed (RPM, %, or Engineering units);
 - .3 Motor Current;

- .4 Drive Temperature;
- .5 DC Bus Voltage;
- .6 Output Voltage.

2.4 Protective Functions

- .1 For each programmed warning and fault protection function, keypad displays a message in complete words or standard abbreviations. Three most recent fault messages and times are stored in drive's fault history.
- .2 VFDs include metal oxide varistors (MOV's) for phase to phase and phase to ground line voltage transient protection.
- .9 Short circuit current rating of 100,000 amps to be provided per UL 508C without relying on line fuses.
- .10 Ground fault protection, motor phase loss protection and phase unbalance protection to be provided. Single phase protection to be provided on input and output.
- .11 VFDs to provide electronic motor overload protection qualified per UL 508C.
- .12 Protection to be provided for AC line or DC bus overvoltage at 130% of maximum rated or undervoltage at 65% of minimum rated.
- .13 Stall protection to be programmable to provide a warning or stop VFD after motor has operated above a programmable torque level for a programmed time limit.
- .14 Underload protection to be programmable to provide a warning or stop VFD after motor has operated below a selected underload curve for a programmed time limit.
- .15 Overtemperature protection to provide a warning if power module temperature is less than 5C° (9F°) below overtemperature trip level.
- .16 Input terminal to be provided for connecting a motor thermistor (PTC type) to drive's protective monitoring circuitry. An input to also be programmable to monitor an external relay or switch contact.
- .17 VFDs through 56 kW (75HP) to be protected from damage from input and output power miss-wiring. VFD to sense this condition and display an alarm on control panel.
- .18 EMI / RFI filters to be provided as per standard EN 61800-3.
- .19 dv/dt long lead filter (LRC) to protect power system network.
- .20 Automatic reset feature to automatically reset selected faults and attempt to restart drive based on control parameters such as adjustable time delays, number of restart attempts and duration of restart attempts. Faults include following:
 - .1 Overcurrent;
 - .2 Overvoltage;
 - .3 Undervoltage;
 - .4 Analogue input signal reference loss;
 - .5 External fault.
- .21 Additional built-in protection circuits include:
 - .1 Overcurrent trip limit;
 - .2 Undervoltage trip limit;
 - .3 Microprocessor fault;
 - .4 Keypad control panel loss;
 - .5 Serial communication loss;
 - .6 External fault interlock inputs;
 - .7 Adjustable output frequency and motor speed limits;
 - .8 Pass code parameter change protection;
 - .9 Keypad operator control lockout.

2.5 Communications

- .1 VFD to be complete with communications connections of integrated RS-485 port suitable to allow for VFD to be controlled, supervised, monitored and programmed from one remote control panel or PC with VFD system Windows based application software.
- .2 Communications protocol to be industry standard compatible to BAS of building. Coordinate exact requirements with Mechanical Divisions controls contractor and BAS vendor to ensure appropriate interface module is supplied for drive system to communicate with BAS being used in building with interface capability to include serial communication standard protocols as follows:
 - .1 Johnson Controls Metasys N2;
 - .2 Siemens Building Technologies FLN;
 - .3 BACnet.
- .3 Serial communication to be used for drive setup, diagnostic analysis, monitoring and control with capabilities to include, but not be limited to:
 - .1 run-stop control;
 - .2 speed set adjustment;
 - .3 proportional/integral/derivative PID control adjustments;
 - .4 current limit;
 - .5 accel/decel time adjustments;
 - .6 ability to lock and unlock control panel keypad;
 - .7 capability of allowing BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature;
 - .8 monitoring relays output status, and digital input status and analogue output values;
 - .9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;
 - .10 remote fault reset.

2.6 Warranty

- .1 VFDs to be warranted free from defective labour and materials for period of 36 months from date of Substantial Performance of the Work. Include for initial one year Contract warranty and an additional 2 year extended warranty direct to Owner. Extended warranty terms and conditions are to be identical to one year Contract warranty, and extended warranty period is to commence day Contract warranty expires.

2.7 Site Services, Training And Maintenance Manuals

- .1 Provide onsite inspection, testing, start up and verification work of VFDs and filters by manufacturer's authorized technician. Allow a minimum of 1/2 day per system. Also include for a second visit to site of one (1) day duration to train operating personnel in operation and maintenance of drives. Provide verification reports and supply soft copy of system programming parameters.
- .2 Upon completion of installation, supplier of VFDs to supply minimum one hard copy of complete sets of service and maintenance manuals including wiring and connection diagrams. Include for digital copy loaded onto a USB type flash drive.
- .3 Provide system training and instructions on operating and maintenance procedures. Refer to additional requirements in General Instructions section and Division 01.

2.8 Acceptable Manufacturers

- .1 Acceptable VFD manufacturers are:
 - .1 Danfoss
 - .2 ABB;

- .3 Schneider Electric (Square D);
- .4 Eaton;
- .5 Siemens Electric.

PART 3 - EXECUTION

3.1 Installation Of Variable Frequency Drives

- .1 Provide variable frequency drives for motorized equipment in accordance with drawing requirements. Coordinate requirements for conductors and connections with Electrical Divisions Contractor.
- .2 VFDs supplied to be products of same manufacturer.
- .3 Wire length between VFD and motor to be less than 15 m (50') with properly sized conductors.
- .4 Install VFDs in accordance with manufacturer's instructions. VFDs installation to include upstream protection, either fuses or circuit breakers in accordance with VFD manufacturer's recommendations and local electrical code requirements. Advise Electrical Divisions Contractor of these requirements in addition to required conductors and connections. Provide required control wiring and connections.
- .5 Review VFD and related connected motor installation. Provide local disconnect to VFD in accordance with local governing code requirements.
- .6 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.
- .7 Properly support VFDs. Coordinate exact locations on site with Consultant.
- .8 Where VFDs are required for pumps, mount each VFD generally where shown but with exact location to ensure VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

3.2 Testing, Start-Up And Verification

- .1 When installation of VFDs and filters are complete, arrange for respective equipment manufacturer/supplier to:
 - .1 supply factory authorized technician at site for minimum of 4 hours per system to examine installation and connection of equipment, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures;
 - .2 supply factory authorized technician at site for minimum of one 8 hour day to train Owner's personnel on equipment operating and maintenance procedures;
 - .3 prepare and submit letter certifying equipment have been properly installed, tested and adjusted, and are in proper operating condition;
 - .4 submit list of start-up and testing parameters for uploading for future use by Owner and start-up data entries to include motor nameplate power, speed, voltage, frequency and current.
- .2 Perform following:
 - .1 Inspect equipment and accessories for verification of proper operation and installation.
 - .2 Inspect interface wiring to BAS for verification of proper operation and installation.
 - .3 Verify wire terminations to VFDs and bypass and to operational circuitry.
 - .4 Verify installation of VFD, bypass and motor being driven for proper operation and reliability.

- .5 Verify connections and communications to BAS or other monitoring/remote control system are of proper operation and installation and of full communications compatibility.
- .6 Measurement for verification of proper operation on each of following items:
 - .1 Motor voltage and frequency;
 - .2 Verification of proper motor operation;
 - .3 Control input for proper building automation system interface and control calibration.
- .7 Calibration check for following set points (and adjustment as necessary):
 - .1 minimum speed;
 - .2 maximum speed;
 - .3 acceleration and deceleration rates.
- .8 Verify harmonic compliance with onsite field measurements of both voltage and current harmonic distortion at point of common coupling-input terminals of harmonic mitigating equipment with and without equipment operating. Utilize recording type Fluke 41 or equivalent harmonics analyser displaying individual and total harmonic currents and voltages.
- .3 Document testing and results in a report signed by a Professional Engineer licensed in the Place of Work and authorized by equipment manufacturer. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.
- .3 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .3 ASHRAE – American Society of Heating, Refrigeration and Air-Conditioning Engineers Standards
 - .4 ANSI/ASME B31.9 – Building Services Piping
 - .5 ANSI/ASME
 - .6 NFPA – National Fire Protection Association
 - .7 SMACNA – Sheet Metal and Air Conditioning Contractors' National Association Standards
 - .8 TSSA – Technical Standards and Safety Authority Standards
 - .9 CAN/CSA B149.1- Natural Gas and Propane Installation Code
 - .10 CAN/CSA
 - .11 UL/ULC

1.3 Submittals for Review

- .1 Shop Drawings: Provide manufacturers catalogue data including load capacity.
- .2 Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- .3 Submit shop drawings/product data sheets for products listed in specification including but not limited to:
 - .1 Hangers
 - .2 Structural attachment methods
 - .3 Equipment bases and supports

Part 2 Products

2.1 Pipe Sleeves

- .1 In poured concrete water proof slabs or foundation walls: Waterproof Galvanized Steel pipe – schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate

2.2 Pipe Hangers and Supports

- .1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:
 - .1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;
 - .2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.
- .2 Hangers and supports for horizontal suspended piping as follows:
 - .1 adjustable steel clevis hanger – MSS Type 1;
 - .2 adjustable swivel ring band hanger – MSS Type 10;
- .3 Supports for horizontal pipe on vertical surfaces as follows:
 - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
 - .2 heavy-duty steel pipe clip – MSS Type 26;
 - .3 epoxy coated steel pipe stays are not permitted.
- .4 Floor supports for vertical risers as follows:
 - .1 copper tubing riser clamp – MSS Type 8;
 - .2 heavy-duty steel riser clamp – MSS Type 8.
- .5 Supports for vertical piping on vertical surfaces as follows:
 - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
 - .2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;
 - .3 extension split pipe clamp – MSS Type 12;
 - .4 epoxy coated steel pipe stays are not permitted.
- .6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.
- .7 Hangers and supports for various applications as follows:
 - .1 for piping on existing roof – Portable Pipe Hangers (Canada) Inc. "PP" Series or C-Port prefabricated portable pipe support system components to suit pipe, complete with required accessories including bases, galvanized structural steel frames, and galvanized steel pipe hangers and supports conforming to MSS SP-58;
 - .2 for piping on new roofs Thaler Roofing Specialties Products Inc. "MERS" Series insulated aluminum support risers with diameter, height, securement method and flashing to suit the application, channel type aluminum cross members, and galvanized steel pipe hangers and supports conforming to MSS SP 58, complete with all required accessories;
 - .3 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;
 - .4 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;
 - .5 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;
 - .6 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;

2.3 Accessories

- .1 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, continuous threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading, minimum 9.5 mm (3/8") diameter.

2.4 Shields, Inserts and rigid insulation

- .1 Protection Saddle: Piping mounted on roller support, use protection saddle between pipe and hanger equal to thickness of insulation
- .2 Galvanized Steel Shield and High Density Non-Compressible Insulation: Use on all water piping.
- .3 Insulation protection shields – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.

Part 3 Execution

3.1 General Piping and Ductwork Installation Requirements

- .1 Provide required pipe hangers and supports.
- .2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting. Unless otherwise shown or specified, hang or support from structure only.
- .3 Auxiliary structural members shall be by mechanical contractor where system components must be suspended between joist or beams of the structure.
- .4 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.
- .5 Provide for expansion and contraction by the use of expansion loops or offsets. Expansion loops shall be installed in the line in a cold sprung position with anchors and guides. The use of expansion joints is to be reviewed with the Engineer for the service and location and type of material.
- .6 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.
- .7 Hangers shall be spaced in accordance with drawings schedules, specifications and manufacturer instructions. Locate hangers and supports to support fittings, valves and other components.
- .8 Hanger spacing for plumbing and drainage shall be in accordance with the OBC.
- .9 Hanger spacing for fire protection shall be in accordance with N.F.P.A. standards.
- .10 Pipes supported from below shall be mounted on pipe rollers.
- .11 Suspending one hanger from another shall not be permitted.
- .12 Attachment to building structure shall be as per manufacturer instructions and shall be approved by the Structural Engineer.
- .13 Support requirements for underground piping are as follows:
 - .1 support underground pipe located in accordance with drawing detail;
 - .2 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;
- .14 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 32 mm (1-1/4") dia. are to be adjustable clevis type.
- .15 Space hangers and supports in accordance with following:
 - .1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing.
 - .2 plastic pipe – conform to pipe manufacturer's recommended support spacing.
 - .3 copper and steel pipe – hang or support at spacing in accordance with following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

- .16 Support piping on roof in accordance with manufacturer and drawing detail.
- .17 Support piping on the roof as follows:
 - .1 on existing roof – provide support members as specified in Part 2 of this Section spaced as per schedule above and of a type to suit the application, and, for each support, carefully scrape away roofing gravel, bed support in a heavy covering of roofing mastic, then scrape gravel back up around support and secure pipes to supports;
 - .2 on new roof – supply manufactured roof supports as per Part 2 of this Section to accommodate piping involved and support spacing specified above, and coordinate with roofing trade on roof for installation as with roofing work, then secure piping in place on supports.
- .18 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable.
- .19 For insulated horizontal piping provide High Density Non-Compressible Insulation and protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.
- .20 Do not support piping from steel deck (Q-deck) without written consent from Engineer. Ceiling flanges are not acceptable.
- .21 Do not support piping from wood deck without written consent from Engineer. Ceiling flanges are not acceptable.

3.2 Equipment Bases and Supports

- .1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads extending 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:
 - .1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;
 - .2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;
 - .3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.

- .2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:
 - .1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;
 - .2 flange bolt steel stands to concrete housekeeping pads;
 - .3 seismically restrained stands and supports in accordance with applicable requirements.

3.3 Concrete Work for Mechanical Equipment Bases/Pads

- .1 Concrete work required for mechanical equipment bases/pads will be provided as part of concrete work of Division 03.
- .2 Locate bases/pads at site and be present during concrete pour to ensure anchor bolts, inserts, plates and similar hardware are not damaged or dislodged.
- .3 Coordinate base/pad installations with concrete trade and ensure bases and pads are keyed into structure to meet seismic restraint requirements.
- .4 Provide poured concrete work, including reinforcing and formwork, required for mechanical equipment bases/pads. Perform concrete work in accordance with requirements specified in Division 03.
- .5 Concrete is to be minimum 20,700 kPa ready-mix concrete in accordance with CAN/CSA-A23.1 and the Building Code.

3.4 Flashing

- .1 Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- .2 Flash vent and soil pipes projecting 75 mm (3 inches) minimum above finished roof surface.
- .3 Provide curbs for mechanical roof installations 350 mm (14 inches) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
- .4 Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.
- .3 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.
- .4 The work to be done under this section shall include the furnishing of labour, materials, tools and equipment required to complete the installation of the Seismic Controls and Restraint as indicated on the drawings, and as specified and in accordance with the Ontario Building Code. This includes both static and dynamic components.

1.2 Design Requirements

- .1 It is the responsibility of the Mechanical Contractor to engage the services of an experienced Professional Engineer who is an active member of the Professional Engineers of Ontario, and the costs for these services shall be included in the Contract amount.
- .2 The Seismic Engineer shall design restraining systems, provide shop drawings for review, and provide inspection services during and after construction.
- .3 Seismic Engineer is to:
 - .1 Determine proper seismic hazard level, design, recommend, and review proposed mechanical work seismic restraint shop, placement and securing drawings, and sign and stamp drawings prior to submittal for review.
 - .2 Review installation of mechanical work seismic restraint.
 - .3 Provide, when work is complete, signed and sealed letter field review of seismic restraint work.
- .4 Seismic Restraint to be fully integrated into, and compatible with the noise and vibration controls specified elsewhere in this project specification.

1.3 Reference and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Seismic restraints are to be designed by a registered professional engineer as specified above, and are to be installed by qualified tradesmen under supervision of and to the approval of the design engineer.
- .3 Unless otherwise specified, seismic control and restraints are to be designed in accordance with OBC requirements, ANSI/SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, SMACNA/ASHRAE Service Restraint Applications Manual.
- .4 Seismic control and restraints for fire protection piping and equipment are to be in accordance with NFPA requirements.

1.4 Submittals for Review

- .1 Submit shop drawings and product data.
- .2 Obtain required equipment information and submit manufacturer's shop drawings/product data sheets for restraining devices and steel bases. Include placement data, and details of attachment to both equipment and structure meeting requirements of forces involved. Product data sheets and drawings are to be signed and stamped by Seismic Engineer.
- .3 Submittals to include:
 - .1 Details of design criteria.
 - .2 Working drawings (prepared to same standard of quality and size as documents forming these tender documents), materials lists, and schematics full specifications for all components of each system.
 - .3 Design calculations (including restraint loads resulting from seismic forces in accordance with Ontario Building Code (OBC), detailed work sheets, tables).
 - .4 Separate shop drawings for each devices for each system, equipment.
 - .5 Identification of location of each device.
 - .6 Schedules of types of equipment and devices.
 - .7 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
 - .8 Installation procedures and instructions.
 - .9 Design calculations including restraint loads to be to OBC and Supplement.

Part 2 Products

2.1 General

- .1 Isolation, anchors, bolts, bases, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in Code for the seismic zone in which building is located.
- .2 For both isolated and non-isolated floor mounted equipment, i.e. tanks, heat exchangers, boilers, etc., design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in Code, of the greater of 0.3 g or as required by Code, applied horizontally through the centre of gravity.
- .3 Seismic restraining devices factory supplied with equipment are to meet requirements of this Section.

Part 3 Execution

3.1 General Piping and Ductwork Installation Requirements

- .1 Provide seismic restraint for mechanical equipment, piping, and ductwork as per requirements of current edition of Building Code and this Section of the Specification.
- .2 Provide attachment points and fasteners to withstand the maximum load that the seismic restraint is to resist in all directions.
- .3 Provide structural steel bases for equipment unless equipment manufacturer certifies direct attachment capabilities.
- .4 Floor mounted isolated equipment is to be installed on 100 mm (4") high concrete housekeeping pads with at least 200 mm (8") clearance between drilled inserts and edges of pads. Ensure housekeeping pads are keyed to structure to resist seismic displacement.
- .5 Seismic control measures are not to impact noise and vibration isolation systems.
- .6 Inspection and Certification
 - .1 Systems to be inspected and certified by Seismic Engineer upon completion of installation.

- .2 Provide written report from manufacturer and Seismic Engineer that products and systems have been installed in accordance with design documents.
- .7 Commissioning Documentation
 - .1 Upon completion and acceptance of certification, hand one (1) complete set of construction documents to Engineer revised to show "as-built" conditions.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.
- .3 This Section includes the testing, adjusting and balancing to obtain the design conditions. Work shall be repeated until the required conditions have been met. Testing Adjusting and Balancing (TAB) includes all three functions and does not constitute only taking readings of existing or installed conditions.
- .4 The work in this section is to match the phasing of the project. Provide balancing reports at the completion of each phase. Measure and rebalance all systems in the entire facility at completion of project and before substantial completion of project.

1.2 References, Quality Control, and Services

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 AABC- National Standards for Total System Balance
 - .2 ASHRAE 111 - Testing, Adjusting, and Balancing of Building HVAC Systems
 - .3 NEBB – Procedural standards for testing, adjusting, and balancing of Environmental systems.
- .3 Perform total system balance to ASHRAE 111, NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
- .4 Maintain one (1) copy of documentation on site.
- .5 Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum five (5) years documented experience certified by AABC.
- .6 Perform Work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor or licensed Professional Engineer experienced in performance of this Work and licensed in the Province of Ontario.

1.3 Price and Payment Procedures

- .1 The balancing of systems is to be done by an independent balancing contractor specializing in this work and hired **by the Prime Contractor utilizing a Cash Allowance**.
- .2 The mechanical contractor and controls contractor shall include and make available staff, as required by the balancing contractor to assist in performing his work and to correct any deficiencies in the mechanical systems which prevent the balancing of the systems and include other in this section is part of the Contract Sum/Price.

1.4 Administrative Requirements

- .1 Pre-installation Meetings: Convene one (1) week weeks before starting work of this section.
- .2 Sequencing: Sequence work to commence after completion of each phase and after each system is complete and schedule completion of work before Substantial Completion of Project.

1.5 Submittals for Review

- .1 Schedule for testing and balancing.
- .2 Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- .3 Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- .4 Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Consultant and for inclusion in operating and maintenance manuals.
- .5 Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.
- .6 Include detailed procedures, agenda, sample report.

1.6 Submittals for Closeout

- .1 Test verification summary reports with pertinent information are to be filled out for tests. The reports shall be signed by the mechanical contractor and the balancing contractor to verify that the data recorded is correct. Three (3) typewritten reports shall be submitted to the Engineer for approval, noting the tests and adjustments made to each piece of equipment. The reports shall contain system flow rates, pressures, temperatures, motor data, motor operating data, voltages, current draw etc. Reports shall be complete with index pages and index tabs. The testing equipment shall be itemized in the test reports and shall be approved before any tests are undertaken.
- .2 Record Documentation: Record actual locations of flow measuring stations balancing valves and rough setting.
- .3 Test Reports: Indicate data on forms prepared following ASHRAE 111.
- .4 In the event the report is rejected, re-balance all systems, submit new certified reports and make a re-inspection, all at no additional cost to the Owner. A measured deviation of more than 5% between the verification reading and the reported data may be considered as failing the verification procedure. A failure of more than 5% of the selected verification readings may result in rejection of the report as unacceptable.

Part 2 Products

2.1 Agencies

- .1 Acceptable balancing companies are limited to;
 - .1 Troup Environmental,
 - .2 Dynamic Flow Balancing
 - .3

Part 3 Execution

3.1 Examination

- .1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - .1 Systems are started and operating in a safe and normal condition.
 - .2 Temperature control systems are installed complete and operable.
 - .3 Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - .4 Duct systems are clean of debris.
 - .5 Fans and pumps are rotating correctly.
 - .6 Air coil fins are cleaned and combed.
 - .7 Access doors are closed and duct end caps are in place.
 - .8 Air outlets are installed and connected.
 - .9 Duct system leakage is minimized.
 - .10 Hydronic systems are flushed, filled, and vented.
 - .11 Proper strainer baskets are clean and in place.
 - .12 Service and balance valves are open.
- .2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

3.2 Preparation

- .1 Provide instruments and labour required for testing, adjusting, and balancing operations. Make instruments and labour available to Consultant to facilitate spot checks during testing.
- .2 Provide additional balancing devices as required.
- .3 The balancing contractor shall not disconnect any building automation device after it has been calibrated. The controls contractor shall make all necessary adjustments through the control system as requested by the balancing contractor. If the balancing contractor fails to co-ordinate with the controls contractor and if failure to co-ordinate results in any cost, the cost of any change required shall be at no cost to the owner.
- .4 Provide final sheave change including belts for Air Handling Units, exhaust fans and existing equipment that forms part of the system (fixed sheave fans).

3.3 Installation Tolerances

- .1 Air Handling Systems: Adjust to within plus or minus 5% of design for supply systems and plus or minus 5% of design for return and exhaust systems.
- .2 Air Outlets and Inlets: Adjust total to within plus 10% and minus 5% of design to space. Adjust outlets and inlets in space to within plus or minus 10% of design.
- .3 Hydronic Systems: Adjust to within plus or minus 10% of design.
- .4 At the time of final inspection, recheck in the presence of the Engineer random selections of air quantities and fan data recorded in the certified report may be requested. Points or areas for recheck shall may be selected by the Engineer and may be approximately 10% of the report data.

3.4 Adjusting

- .1 Ensure recorded data represents actual measured or observed conditions.
- .2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- .3 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

- .4 Leave systems in proper working order.
- .5 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- .6 Check and adjust systems approximately six months after final acceptance and submit report.

3.5 Air System Procedure

- .1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- .2 Systems shall be adjusted so that fans operate at lowest static pressure possible.
- .3 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. Where no access ports have been provided new holes shall be made as required. These holes shall be resealed with pre-manufactured plugs after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable. Where insulation is damaged, it shall be repaired including the vapour barrier. Duct tape is not acceptable.
- .4 Measure air quantities at air inlets and outlets.
- .5 Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- .6 Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- .7 Provide system schematic with required and actual airflow recorded at each location.
- .8 Measure static air pressure on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.
- .9 Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- .10 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- .11 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- .12 Measure, make final adjustments and report upon the air volume at each fan, variable volume box, diffuser, register and grille. The static upstream and downstream of the fan, the fan speed and the motor current and be measured and recorded. Also to be reported upon are the air flows at outside, return and exhaust air dampers under conditions of minimum outside air, for maximum and minimum volumes and maximum outside air, exhaust air and return air.

3.6 Water System Procedure

- .1 Adjust water systems to provide required or design quantities.
- .2 Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- .3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- .4 Effect system balance with automatic control valves fully open to heat transfer elements.
- .5 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing
- .6 Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 Schedules

- .1 The following Systems and equipment shall be balanced:
 - .1 Plumbing Pumps.
 - .2 HVAC Pumps.
 - .3 Heating water systems.
 - .4 Chilled water systems.
 - .5 Make-up Air and Outdoor air systems
 - .6 Forced air systems
 - .7 Exhaust air systems
 - .8 Air distribution systems including supply, return and exhaust ducts systems, registers, grilles and diffusers

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 0 and 1 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
 - .2 NECB - National Energy Code of Canada for Buildings
 - .3 ASTM C335 - Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation
 - .4 ASTM C411 - Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 - .5 ASTM C449/C449M - Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement
 - .6 ASTM C518- Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .7 ASTM C547 - Specification for Mineral Fiber Pipe Insulation
 - .8 ASTM C553- Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - .9 ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded-Hot-Plate Apparatus
 - .10 ASTM C612- Standard Specification for Mineral Fiber Block and Board Insulation
 - .11 ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
 - .12 ASTM C1071- Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
 - .13 ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
 - .14 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .15 ASTM E96/E96M- Standard Test Methods for Water Vapor Transmission of Materials
 - .16 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
 - .17 CAN/ULC S101 – Standard Methods of Fire Endurance Tests of Building Construction and Materials
 - .18 CAN/ULC S102 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

- .19 CAN/ULC S114 – Standard Method of Test for Determination of Non-Combustibility in Building Materials
- .20 CAN/ULC S115 – Standard Method of Fire Tests of Firestop Systems
- .21 CAN/ULC S124 – Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic
- .22 CAN/ULC S702 – Standard for Mineral Fibre Thermal Insulation For Buildings
- .23 NAIMA - National Insulation Standards
- .24 NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilation Systems
- .25 NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
- .26 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
- .27 SMACNA 1966 - HVAC Duct Construction Standards - Metal and Flexible
- .28 UL 723- Tests for Surface Burning Characteristics of Building Materials
- .3 Thermal performance and Insulation thickness and conductivity shall meet or exceed minimum R-value requirements listed in ASHRAE/ANSI/IES Standard 90.1 version referenced in Ontario Building Code.
- .4 Insulation materials, adhesives, sealants and coatings shall be ULC listed, non-hygroscopic and mould proof.
- .5 Insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, NFPA 255, UL 723, ASTM E84.

1.3 Submittals for Review

- .1 Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- .2 Samples: Submit two (2) samples of any representative size illustrating each insulation type and proposed method of insulating specialties, valves, pumps, fittings, gauges etc.
- .3 Installation Data: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.4 Submittals For Closeout

- .1 Submit a letter from fire rated duct wrap supplier certifying duct wrap has been properly installed.

1.5 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.6 Delivery, Storage, And Protection

- .1 Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .2 Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 Environmental Requirements

- .1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .2 Maintain temperature during and after installation for minimum period of twenty-four (24) hours.

Part 2 Products

2.1 Duct and Equipment - Glass/Mineral Fibre, Flexible Blanket

- .1 Manufacturers:
 - .1 Johns Manville, Microlite Duct Wrap.
 - .2 Knauf, Atmosphere Duct Wrap.
 - .3 Manson, Alley Wrap.
 - .4 CertainTeed SoftTouch Duct Wrap
- .2 Insulation: ASTM C553; flexible, non-combustible blanket duct wrap.
 - .1 Blanket mineral fibre is to be blanket type roll form insulation, 24 kg/m³ (1½ lb/ft³) density, 40 mm (1-½") thick, with a factory applied FSK vapour barrier facing.
 - .2 Thermal Conductivity: ASTM C177, 0.036W/m.K at 24 °C (0.25Btu.in/h.sq ft at 75 °F.
 - .3 GreenGuard gold certified.
- .3 Vapour Barrier Jacket:
 - .1 Factory applied FSK vapour barrier facing.
- .4 Vapour Barrier Tape:
 - .1 Vapour barrier tape to match vapour barrier facing on insulation.
- .5 Tie Band: Stainless steel band, 0.5 in.

2.2 Duct and Equipment - Glass/Mineral Fibre, Rigid Board

- .1 Manufacturers:
 - .1 Johns Manville, 800 Series Spin-Glas
 - .2 Knauf, Atmosphere Duct Board.
 - .3 Manson, AK Board.
 - .4 CertainTeed CertaPro Commercial Board
- .2 Insulation: ASTM C612; rigid, noncombustible board.
 - .1 Rigid mineral fibre board is to be pre-formed board type insulation to, 48 kg/m³ (3 lb/ft³) density, with a factory applied reinforced FSK vapour barrier facing.
 - .2 Thermal Conductivity: ASTM C177, 0.036W/m.K at 24 °C (0.25Btu.in/h.sq ft at 75 °F.
 - .3 GreenGuard gold certified.
- .3 Vapour Barrier Jacket:
 - .1 Factory applied FSK vapour barrier facing.
- .4 Vapour Barrier Tape:
 - .1 Vapour barrier tape to match vapour barrier facing on insulation.

2.3 Equipment - Removable/Reusable Insulation Covers

- .1 For valves, back flow preventors and similar items installed in 'cold' services 12 mm (1/2 in) to 150 mm (6 in) valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.
- .2 For valves, back flow preventors and similar items installed in 'cold' services larger than 150 mm (6 in) and for equipment such as manifolds, pumps, heat exchangers etc. custom manufactured equipment covers conforming to shape of item to be insulated, designed to be easily removable and replaceable to suit use and maintenance procedures of particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m³ (6 lb/ft³) density ceramic fibre insulation sewn between minimum 542.5 g/m² (1.8 oz/ft²) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place.
 - .1 Manufacturers:
 - .1 Crossby Dewar Inc.;
 - .2 Insufab Systems Inc.;
 - .3 ADL Insulflex Inc.;
 - .4 Firwin Corp.;
 - .5 GlassCell Isofab Inc.

2.4 Duct - Glass Fibre Duct Liner, Rigid

- .1 Manufacturers:
 - .1 Johns Manville, Spin-Glas, 800 Series
 - .2 Knauf, Atmosphere Duct Board.
 - .3 Manson, AK Board.
- .2 Insulation: ASTM C612; rigid, noncombustible board with poly vinyl acetate polymer acrylic polymer meeting ASTM G21 impregnated surface and edge coat.
 - .1 Thermal Conductivity: 0.037W/m.K at 24 degrees C (0.27Btu.in/h.sq ft at 75 degrees F) maximum.
 - .2 Maximum service temperature: 121 degrees C (250 degrees F) 176 degrees C (350 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 25.4 m/s (5000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C1071 , 0.55 for 25 mm (1 inch) thickness, 0.75 for 40 mm (1-1/2 inch) thickness, 0.90 for 50 mm (2 inch) thickness.
 - .5 GreenGuard gold certified.
- .3 Adhesive:
 - .1 Johns Manville, Spin-Glas 800 Series
 - .2 Knauf, Atmosphere Duct Board.
 - .3 Manson, AK Board.
 - .4 Type: ASTM E162, fire-retardant Waterproof.
- .4 Liner Fasteners: Galvanized steel, self-adhesive pad welded impact applied with integral press-on head.

2.5 Duct - Glass Fibre Round Duct Liner

- .1 Manufacturers:
 - .1 Johns Manville, Spin-Glas Type 814.
 - .2 Knauf, Atmosphere Duct Board.
 - .3 Manson, AK Board.
- .2 Insulation: Round, preformed in cylindrical sections with acrylic polymer meeting ASTM G21 poly vinyl acetate polymer impregnated surface coat.

- .1 Thermal Conductivity: ASTM C1071 , 0.039W/m.K at 24 degrees C (0.27Btu.in/h.sq ft at 75 degrees F) 0.045W/m.K at 24 degrees C (0.31Btu.in/h.sq ft at 75 degrees F), maximum.
- .2 Maximum service temperature: 121 degrees C (250 degrees F) 176 degrees C (350 degrees F).
- .3 Maximum Velocity on Coated Air Side: 25.4 m/s (5000 fpm).
- .4 GreenGuard gold certified.

2.6 Pipe - Glass/Mineral Fibre Pre-Moulded for Pipe

- .1 Manufacturers:
 - .1 Johns Mansville; Micro-Lok HP
 - .2 Knauf; Earthwool 1000°F
 - .3 Manson; Product: Alley-K
- .2 Insulation: ASTM C547, rigid, pre- moulded mineral fibre, sectional, sleeve type, noncombustible.
 - .1 Thermal Conductivity (K-factor): ASTM C335/C335M, Max conductivity as per Insulation Thickness table in Part 3.
 - .2 GreenGuard Gold Certified.
- .3 Vapour Barrier Jacket:
 - .1 Factory applied ASJ vapour barrier facing.
- .4 Vapour Barrier Tape:
 - .1 Vapour barrier tape to match vapour barrier facing on insulation.

2.7 Pipe – Penetrating Fire-Rated Construction

- .1 Manufacturers:
 - .1 Roxul, Techton 1200
 - .2 IIG (Johns Mansville Inc.) MinWool-1200
 - .3 Poroc 1200
- .2 Insulation: ASTM C547, Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation.
 - .1 Thermal Conductivity: ASTM C335/C335M, Max conductivity as per Insulation Thickness table in Part 3.
- .3 Vapour Barrier Jacket:
 - .1 Factory applied vapour barrier jacket compatible with ULC-S115 and ULC-S101 firestopping.
- .4 Vapour Barrier Tape:
 - .1 Vapour barrier tape to match vapour barrier facing on insulation.

2.8 Pipe - Refrigerant line set insulation – Indoor Application

- .1 Manufacturers:
 - .1 Armacell AP Armaflex
 - .2 Armacell ArmaFlex Shield factory applied;
 - .3 IK Insulation Group K-Flex Self-Seal Pipe Insulation with color jacketing.
- .2 Insulation: Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories.

2.9 Pipe - Refrigerant line set insulation – Outdoor Application

- .1 Manufacturers:
 - .1 Armacell AP Armaflex with Armaflex WB field applied UV resistant finish
 - .2 Armacell ArmaFlex Shield factory applied UV resistant jacket;

- .3 IK Insulation Group K-Flex Self-Seal Pipe Insulation with UV resistant color jacketing.
- .2 Insulation: Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories.
- .3 Jacket/finish to be UV resistant.

2.10 Pipe – Phenolic Pipe Support Inserts

- .1 Manufacturers:
 - .1 Belform Insulation Ltd, "Koolphen K-Block"
- .2 Pipe Support Inserts: For all pipe services and sizes, horizontal pipe insulation at hangers and supports shall be pre-moulded, rigid, sectional phenolic foam insulation of the same thickness as the adjoining insulation. Inserts shall include a factory-applied reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.
- .3 Temperature Limits: -180 deg C to 120 deg C (-292 deg F to 248 deg F)
- .4 Density: 80 kg/m³ (5 lb/ft³)
- .5 Thermal Conductivity: 0.030 W/m*deg C (0.21 btu*in/h*sq-ft*deg F)
- .6 Compressive Strength: 620 kPa (90 psi) parallel to rise, 483 kPa (70 psi) perpendicular to rise.
- .7 Minimum requirements for supports shall be as per the following table:

Pipe Size mm (in)	Minimum Support Length mm (in)	Metal Saddle Gauge	Metal Saddle Width mm (in)
12 (1/2) to 32 (1-1/4)	150 (6)	22	100 (4)
40 (1-1/2) to 75 (3)	150 (6)	20	100 (4)
100 (4)	150 (6)	16	100 (4)
150 (6) to 200 (8)	225 (9)	14	175 (7)
250 (10)	300 (12)	14	250 (10)
300 (12)	400 (16)	14	350 (14)
350 (14) to 450 (18)	450 (18)	14	400 (16)
500 (20) to 600 (24)	600 (24)	14	550 2)

2.11 Insulation Fastenings

- .1 Aluminium Banding: Equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (1/2") wide, 0.6 mm (1/16") thick aluminum strapping.
- .2 Stainless Steel Banding: Equal to ITW Insulation Systems Canada "FABSTAPS" 0.6 mm (1/16") thick, minimum 12 mm (1/2") wide type 304 stainless steel strapping.
- .3 Duct Insulation Fasteners: Weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-1/2") square plastic or zinc plated steel self-locking washers.
- .4 Tape Sealant: Equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.
- .5 Mineral Fibre Insulation Adhesive: Clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.

2.12 Jackets – Duct and Equipment

- .1 Canvas Jacket:
 - .1 Fabric: 220 g/sq m (6 oz/sq yd) plain weave cotton treated with dilute fire retardant lagging adhesive. ULC listed and labelled 25/50 fire/smoke rated to ASTM E84, ULC S102, roll form.

- .2 Lagging Adhesive: white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated to ASTM E84, ULC S102 lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.

2.12 Jackets - Pipe

- .1 Canvas Jacket:
 - .1 Fabric: 220 g/sq m (6 oz/sq yd) plain weave cotton treated with dilute fire retardant lagging adhesive. ULC listed and labelled 25/50 fire/smoke rated to ASTM E84, ULC S102, roll form.
 - .2 Lagging Adhesive: white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated to ASTM E84, ULC S102 lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.
- .2 PVC Jacket:
 - .1 Manufacturers:
 - .1 Johns Manville; Product: Zeston 2000.
 - .2 Proto Corp PVC; Product: LoSMOKE.
 - .2 Roll Form Sheet and Fitting Covers – minimum 0.5mm (20 mil) thick white PVC, 25/50 fire/smoke rated tested in accordance with ULC S102, complete with installation and sealing accessories.

2.13 Exterior Vapour Barrier and Jacket- Pipe & Ductwork

- .1 Adhesive-backed flexible Aluminum Vapour Barrier (rubberized asphalt adhesive):
 - .1 Manufacturers:
 - .1 MFM Building Products Corp. "Flex-Clad 400"
 - .2 Polyguard "Alumaguard"
 - .2 Pre-fabricated self-adhering, sheet-type protective membrane. Adhesive backed flexible aluminum shall be roll form sheet material with an aggressive rubberized asphalt adhesive backing, high density polyethylene reinforcement, and an embossed aluminum facing.
- .2 Adhesive-backed flexible Aluminum Vapour Barrier (acrylic adhesive):
 - .1 Manufacturers:
 - .1 3M "VentureClad 1577CW"
 - .2 Ideal Tape "Ideal Seal 777"
 - .2 Pre-fabricated self-adhering, sheet-type protective membrane. Adhesive backed flexible aluminum shall be roll form sheet, multi-layered laminate material with an acrylic adhesive backing, and aluminum facing.
- .3 Adhesive-backed flexible Stainless Steel Vapour Barrier (rubberized asphalt adhesive):
 - .1 Manufacturers:
 - .1 MFM Building Products Corp. "Flex-Clad 400"
 - .2 Polyguard "Alumaguard"
 - .2 Pre-fabricated self-adhering, sheet-type protective membrane. Adhesive backed flexible stainless steel shall be roll form sheet material with an aggressive rubberized asphalt adhesive backing, high density polyethylene reinforcement, and an embossed stainless steel facing.
- .4 Adhesive-backed flexible Stainless Steel Vapour Barrier (acrylic adhesive):
 - .1 Manufacturers:
 - .1 3M "VentureClad 1577CW"
 - .2 Ideal Tape "Ideal Seal 777"

- .2 Pre-fabricated self-adhering, sheet-type protective membrane. Adhesive backed flexible stainless steel shall be roll form sheet, multi-layered laminate material with an acrylic adhesive backing, and stainless steel facing.
- .5 Rigid Aluminum Jacket- Pipe:
 - .1 Manufacturers:
 - .1 ITW Insulation "Strap-on"
 - .2 GTL Products "Z-Lock"
 - .2 Factory fabricated 0.406 mm (0.016 in) thick embossed aluminum jacket material to ASTM A240, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock longitudinal seam. Each section of jacketing shall be secured with stainless steel butt straps, weatherproofed end to end joints, At valves and fittings use aluminum die shaped components with factory attached liner.
- .6 Rigid Stainless Steel Jacket- Pipe:
 - .1 Manufacturers:
 - .1 ITW Insulation "Strap-on"
 - .2 GTL Products "Z-Lock"
 - .2 Factory fabricated 0.254 mm (0.010 in) thick embossed 304 stainless steel jacket material to ASTM A240, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock longitudinal seam. Each section of jacketing shall be secured with stainless steel butt straps, weatherproofed end to end joints, and 2-piece pressed stainless steel fittings with weather locking edges.
- .7 Rigid Aluminum Jacket- Ductwork:
 - .1 Shop or factory fabricated jacket of alloy 3003 temper H14 aluminum, ASTM B209. Insulation jacket shall be 22 ga, 0.63 mm (0.025 in) thick embossed aluminium, with sealed lap joints and secured in place over ductwork with stainless steel butt straps.
- .8 Rigid Stainless Steel Jacket- Ductwork:
 - .1 Shop or factory fabricated type 304 ASTM A480. Insulation jacket shall be 26 ga, 0.45 mm (0.018 in) thick embossed stainless steel, with sealed lap joints and secured in place over ductwork with stainless steel butt straps.

Part 3 Execution

3.1 Installation

- .1 Unless otherwise specified, do not insulate the following:
 - .1 Factory insulated equipment, piping and flexible branch ductwork.
 - .2 Heating piping within radiator unit enclosures, including blank filler sections of enclosures.
 - .3 Heating piping in soffits and/overhangs spaces that are connected to bare element radiation in these spaces.
 - .4 Branch potable water piping located under counters servicing counter mounted plumbing fixtures and fittings. (Except barrier-free lavatories.)
 - .5 Exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings. (Except barrier-free lavatories.)
 - .6 Heated fluid system pump casings, valves, strainers and similar accessories.
 - .7 Heating system expansion tanks.

- .8 Fire protection pump casings.
- .9 Acoustically lined ductwork and/or equipment.
- .10 Fire protection system water storage tanks.
- .11 Heating Piping unions
- .2 Verify that duct work has been sealed and tested before applying insulation materials.
- .3 Verify that piping has been tested before applying insulation materials.
- .4 Verify that surfaces are dry and clean of foreign material.
- .5 Install to manufacturer's written instructions and in a neat manner.
- .6 Install insulation or finishes at appropriate ambient temperature.
- .7 Install insulation directly over ducts and pipes, not over hangers and supports.
- .8 Install insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .9 Dampers, supports, anchors etc that are secured directly to cold surfaces shall be insulated and vapour sealed to prevent condensation.
- .10 Apply insulation to facilitate replacing and/or servicing equipment. Insulation shall be removable and reusable.
- .11 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from the action of condensation at its junction with metal.
- .12 When insulating "cold" piping and equipment, ensure installation is sealed vapour tight to prevent condensation.
- .13 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.
- .14 Rainwater Leaders:
 - .1 Horizontal sections of rain water leaders to be insulated with 25 mm (1in) thick insulation.
- .15 Refrigerant Piping:
 - .1 Refrigerant suction piping – 25 mm (1in) thick. Refrigerant hot gas inside building – 25 mm (1in) thick.
- .16 Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - .1 Insulate fittings, joints, and valves with moulded insulation.
 - .2 Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - .3 Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies and expansion joints.
- .17 For insulated pipes conveying fluids above ambient temperature:
 - .1 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - .2 For hot piping conveying fluids 60 deg C (140 deg F) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - .3 For hot piping conveying fluids over 60 deg C (140 deg F), insulate flanges and unions at equipment.
- .18 Finish insulation at supports, protrusions, and interruptions.
- .19 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.
- .20 Provide insulation type, insulation thickness, and canvas jacket as per the following tables:

Ducts - Rectangular Indoors

	Type	Thickness	Canvas Jacket
Outside air, exposed	Rigid Board	1-1/2"	Yes
Supply air, exposed	Rigid Board	1-1/2"	Yes

Return air, exposed	Rigid Board	1-1/2"	Yes
Exhaust air ^a , exposed	Rigid Board	1-1/2"	Yes
Outside air, concealed	Rigid Board	1-1/2"	Yes
Supply air, concealed	Flexible Blanket	1-1/2"	No
Return air ^a , concealed	Not Required	-	-
Exhaust air ^b , concealed	Flexible Blanket	1-1/2"	No

a: insulate within 3m (10ft) from opening to atmosphere including any exhaust air plenums within 3m (10ft) distance.

b: Concealed return air ducts located in unconditioned spaces to have 40 mm (1-1/2 in) flexible blanket insulation.

Ducts - Round Indoors

	Type	Thickness	Canvas Jacket
Outside air, exposed	Flexible Blanket	1-1/2"	Yes
Supply air, exposed	Flexible Blanket	1-1/2"	Yes
Return air, exposed	Flexible Blanket	1-1/2"	Yes
Exhaust air ^a , exposed	Flexible Blanket	1-1/2"	Yes
Outside air, concealed	Flexible Blanket	1-1/2"	No
Supply air, concealed	Flexible Blanket	1-1/2"	No
Return air ^a , concealed	Not Required	-	-
Exhaust air ^b , concealed	Flexible Blanket	1-1/2"	No

a: Insulate within 3m (10ft) from opening to atmosphere including any exhaust air plenums within 3m (10ft) distance.

b: Concealed return air ducts located in unconditioned spaces to have 40 mm (1-1/2 in) flexible blanket insulation.

c: Exposed ductwork in gymnasium does not require external insulation.

.21 Rigid board installation procedure:

- .1 Liberally apply adhesive to surfaces of ducts and/or casings. Neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12 in) centres on bottom and side surfaces. Secure and seal joints with 75 mm (3 in) wide tape sealant.
- .2 At trapeze hanger locations, install insulation between duct and hanger.
- .3 Provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.
- .4 At duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant.
- .5 Installation of fastener pins and washers is to be concurrent with duct insulation application.
- .6 Cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant.
- .7 Neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers.
- .8 Prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

.22 Flexible blanket installation procedure – Rectangular Duct:

- .1 Liberally apply adhesive to surfaces of ductwork, and wrap insulation around duct with a butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12 in) centres on bottom surfaces.

- Secure and seal joints with 75 mm (3 in) tape sealant. At each trapeze type duct hanger, provide a 100 mm (4 in) wide full length piece of rigid mineral fibre board insulation between duct and hanger.
- .2 Install 13 mm (½ in) aluminum bands spaced on 400 mm (16 in) centers. Provide minimum 2 bands per length of each insulation section. Double or group banding will not be accepted.
- .23 Flexible blanket installation procedure – Round Duct:
- .1 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4 in) wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.
- .2 Install 13 mm (½ in) aluminum bands spaced on 400 mm (16 in) centers. Provide minimum 2 bands per length of each insulation section. Double or group banding will not be accepted.
- .24 Canvas jacket installation procedure:
- .1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent un-insulated surfaces.
- .25 Exterior Ductwork:
- .1 Supply and return ductwork installed exterior to building and in unconditioned spaces shall be insulated using 2" rigid board fiberglass or glass wool insulation.
- .2 Rigid insulation shall be impaled over welded pins attached on 12" to 18" (330 to 457 mm) centres. A minimum of 2 rows of fasteners per side shall be used. Pins shall be capped with spring clip washers 1 sp. In. (25mm) minimum area and pin end shall be clipped off. Butt all joints tightly and seal all break and joints by adhering a 4" (200mm) wide tape to cover all breaks, joints and holding pins. Vapour barrier tape to match vapour barrier facing on product.
- .3 Exterior ductwork shall be installed complete with aluminum or stainless steel faced self-adhering, sheet-type protective air vapour barrier membrane installed over rigid board insulation. Install sheet vapour barrier membrane in accordance with manufacturer recommendations. Ensure continuous air vapour barrier.
- .4 Provide rigid aluminum or stainless steel jacket over air vapour barrier membrane layer and secure in place using stainless steel bands.
- .5 Where additional vapour barrier is required apply vapour barrier mastic sealant prior to application of rigid jacket.
- .6 All exterior ductwork shall be sealed water and vapour tight.
- .26 Plenum Liner, Duct Liner, Application:
- .1 Internally Insulate first 3 m (10 ft) of ductwork.
- .2 Adhere insulation with adhesive for 100% coverage.
- .3 Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
- .4 Seal and smooth joints. Seal and coat transverse joints.
- .5 Seal liner surface penetrations with adhesive.
- .6 Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

.7 Finish insulation at supports, protrusions, and interruptions.

.27 Pipe Systems – Mineral/Glass Fiber Insulation Thickness

.1 Provide insulation thicknesses as noted in the following table for the noted pipe systems.

Fluid Operating Temp. Range – deg C (deg F)	Maximum Insulation Conductivity - W/m* deg C (btu*in/h*sq-ft* deg F)	Mean Rating Temp.- deg C (deg F)	Nominal Pipe Diameter - mm (in)				
			Less Than 25 (1)	25 to 32 (1 to 1-1/4)	40 to 75 (1-1/2 to 3)	100 to 150 (4 to 6)	200 and Larger (8 and Larger)
Heating Systems (Steam, Condensate, Heating Water/Glycol)							
Above 177 (Above 350)	0.049 (0.34)	121 (250)	112.5 (4.5)	125 (5.0)	125 (5.0)	125 (5.0)	125 (5.0)
122-177 (251-350)	0.046 (0.32)	93 (200)	75 (3.0)	100 (4.0)	112.5 (4.5)	112.5 (4.5)	112.5 (4.5)
94-121 (201-250)	0.043 (0.30)	66 (150)	65 (2.5)	65 (2.5)	65 (2.5)	75 (3)	75 (3)
61-93 (141-200)	0.042 (0.29)	52 (125)	40 (1.5)	40 (1.5)	50 (2.0)	50 (2.0)	50 (2.0)
41-60 (105-140)	0.040 (0.28)	38 (100)	25 (1.0)	25 (1.0)	40 (1.5)	40 (1.5)	40 (1.5)
Domestic, Recirculation and Service Hot Water Systems							
41-60 (104-140)	0.040 (0.28)	38 (100)	25 (1.0)	25 (1.0)	40 (1.5)	40 (1.5)	40 (1.5)
Domestic Cold Water Systems (Includes Pumped Storm Water)							
5-40 (40-104)	0.040 (0.28)	38 (100)	25 (1.0)	25 (1.0)	25 (1.0)	25 (1.0)	40 (1.0)
Cooling Systems (Chilled Water, Chilled Glycol, Brine, Refrigerant)							
5-13 (40-60)	0.039 (0.27)	24 (75)	25 (1.0)	25 (1.0)	25 (1.0)	25 (1.0)	40 (1.0)

Notes:

- .1 Piping installed exterior to buildings shall be insulated to the minimum requirements specified above for Heating Systems with a fluid operating temperature above 177 deg C (350 deg F).
- .2 Piping indicated to be traced with electric heating cable shall be insulated to a minimum 50 mm (2 in) thickness using mineral wool/fibreglass insulation.
- .3 Applies to recirculating domestic hot water or service water systems, and the first 2.4 m (8 ft) from the heater or storage tank for non-recirculating systems.
- .4 For piping smaller than 40 mm (1.5 in) and located in partitions within conditioned spaces, reduction of these thicknesses by 25 mm (1 in) shall be permitted, but not to thicknesses below 25 mm (1 in).

3.2 Pipe Insulation – Penetrating Fire-Rated Construction:

- .1 Where piping is to be insulated, as specified above, is required to pass through fire-rated construction, provide mineral wool fire-rated non-combustible sectional insulation.
- .2 Apply fire-rated non-combustible insulation on portion of the pipe which passes through the fire barrier, and extend for a distance of 50 mm (2 in) on either side of the fire-barrier.
- .3 Insulation thickness shall be as specified above, but not less than 25 mm (1 in).

3.3 Pipe Insulation Finish- Interior

- .1 Exposed piping insulation within mechanical and service spaces will have canvas coated in lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove any lagging splatter from adjacent surfaces. Provide neat, water and vapour tight installation.
- .2 Exposed piping insulation outside of mechanical and service space to have PVC jacket. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water and vapour tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.
- .3 PVC coverings on elbows are permitted.
- .4 Concealed piping insulation to have no exterior finish. Secure pipe insulation using 13 mm (½ in) aluminum bands spaced on 400 mm (16 in) centers. Provide minimum 2 bands per length of each insulation section. Banding shall be done for each individual run of piping. Double or group banding will not be accepted.

3.4 Pipe Insulation Finish - Exterior:

- .1 Piping systems installed exterior to building and in unconditioned spaces shall be insulated using 50 mm (2 in) pre-molded rigid, sectional, sleeve type fiberglass or glass wool insulation.
- .2 Exterior piping shall be installed complete with aluminum or stainless steel faced self-adhering sheet-type protective air vapour barrier membrane installed over rigid sleeve type insulation. Install sheet vapour barrier membrane in accordance with manufacturer recommendations. Ensure continuous air vapour barrier.
- .3 Provide rigid aluminum or stainless steel jacket over air vapour barrier membrane and secure in place using bands.
- .4 Secure insulation and jacket assembly using 13 mm (½ in) aluminum or stainless steel bands spaced on 400 mm (16 in) centers. Provide minimum 2 bands per length of each insulation section. Banding shall be done for each individual run of piping. Double or group banding will not be accepted.
- .5 Where additional vapour barrier is required apply vapour barrier mastic sealant prior to application of rigid jacket.
- .6 All exterior piping shall be sealed water and vapour tight.

3.5 Refrigerant Line Set Insulation Finish – Exterior

- .1 Refrigerant line set insulation to be protected from UV by either factory applied protection or field applied latex finish.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplemental mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 ANSI/ASME B31.2 – Fuel Gas Piping
 - .2 CAN/CSA B149.1- Natural Gas and Propane Installation Code, as amended by local Gas Codes.
 - .3 CAN/CGA 3.16-M88 – Lever Operated Non-Lubricated Gas Shut-Off Valves
 - .4 Gas system work is to be in accordance with requirements of CAN/CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.
 - .5 Gas system work is to be performed only by licensed gas pipe fitters (holding Gas Technician 1 Certificate) authorized under TSSA Act.
 - .6 Apply for, on TSSA forms, approval of gas system design by TSSA prior to work beginning at site and prior to ordering any equipment. Submit completed TSSA Form and copies of shop drawings/product data sheets as required to TSSA and obtain an approval certificate. Pay costs for TSSA review and approval process. If TSSA requires revisions to the system and revisions result in an extra cost, a Notice of Change will be issued by Consultant for the revision.

1.3 Submittals

- .1 Submit shop drawings/product data for all products specified in Part 2 of this Section except for pipe, fittings, and unions. Indicate performance criteria, conformance to appropriate reference standards, and limitations.
- .2 For each gas pressure regulating station, submit:
 - .1 selection sheet for each PRV, indicating connected equipment, heating loads, design allowance, meter model, body size, spring range and orifice size;
 - .2 selection sheet for each relief valve(s) serving a PRV.

Part 2 Products

2.1 Pipe, Fittings and Joints – Above Ground

- .1 Uncoated Black Steel - Screwed Joints:
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with malleable cast iron screwed fittings to ANSI B2.1, and screwed joints.
- .2 Uncoated Black Steel - Welded Joints:

- .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, mill or site bevelled, complete with factory made forged steel butt welding fittings and welded joints.
- .3 Copper – Uncoated:
 - .1 Type "G" seamless copper tubing to ASTM B837, hard temper with wrought copper capillary brazed joint type fittings to ASTM B.61, and brazed joints made with "Sil-Fos" or "Sil-Fos 5" brazing alloy, or, soft temper with flared brass fittings of a single 45° flare type, forged or with a machined long nut and copper to copper threaded connectors, and, where required, flared brass copper to NPS adapters.

2.2 Piping Unions

- .1 Screwed Piping:
 - .1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 Flanged Piping:
 - .1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.
- .3 Copper to Steel:
 - .1 Equal to Kamco Products "Copper Stopper".

2.3 Shut-Off Valves

- .1 Valves for Natural Gas and Propane systems shall be selected in accordance with the following tables and be CSA/CGA 3.16 approved. Manufacturers' model numbers are provided to indicate a standard of acceptance.
- .2 Ball Valves - Threaded/Screwed Connection
 - .1 Application: Shut-off, equipment isolation.
 - .1 Size: Up to 50 mm (2 in) diameter
 - .2 Body & Shell Working Pressure Rating:
 - .1 1034 kPa (150 psi) 600 WOG Rating.
 - .3 Materials of Construction:
 - .1 Body: Bronze or brass, full port
 - .2 Ball: Chrome plated solid Bronze ball
 - .3 Seats: PTFE or TFE
 - .4 Seals: PTFE or TFE
 - .5 Stem: Blow-out proof
 - .6 Stem Seal: Double O-ring design or Teflon packing
 - .7 Operator: Lever handle (removable)
 - .8 Connections: NPT threaded or soldered
 - .4 Manufacturers:
 - .1 Kitz Corp. 58
 - .2 M.A. Stewart B3
 - .3 Toyo Red & White Valve Co. Fig. 5044A
- .3
- .4 Ball Valves - Flanged Connection
 - .1 Application: Shut-off, equipment isolation.
 - .1 Size: 65 mm (2.5 in) diameter and larger

- .2 Body & Shell Working Pressure Rating:
 - .1 125WSP/200WOG
- .3 Materials of Construction:
 - .1 Body: Class 150 Carbon steel A216WCB, full port
 - .2 Ball: Stainless steel
 - .3 Seats: RPTFE
 - .4 Seals: RPTFE
 - .5 Stem: Stainless steel, Blow-out proof
 - .6 Stem Seal: RPTFE adjustable packing
 - .7 Operator: : Lever handle, locking (removable) or gear operated
 - .8 Connections: Flanged
- .4 Manufacturers:
 - .1 Kitz 150SCTDZM (2 Piece, full port)

2.4 Pressure Regulators

- .1 Acceptable Manufacturers:
 - .1 Maxitrol Co.
 - .2 Fisher Controls
 - .3 Leslie Controls Inc.
 - .4 Lakeside Process Controls
- .2 CSA certified pressure regulators as follows:
 - .1 non-vented type: lever action, dead end lockup type, each complete with a vent limiter, self-aligning valve, die-cast aluminium housing, and synthetic rubber compound diaphragm;
 - .2 vented type: spring-loaded self-operated design, tight closing, selected for facility gas pressure and piping pressure loss, and connected equipment load at full firing rate plus 20% spare, and complete with:
 - .1 1035 kPa (150 psi) rated cast iron body finished with corrosive resistant epoxy enamel;
 - .2 aluminum diaphragm and spring case with Nitrile diaphragm, disc, and body o-ring;
 - .3 throttling type, high flow rate, tight shut-off relief valve selected to protect equipment downstream of regulator in coordination with regulator capacity.
- .3

Part 3 Execution

3.1 Natural Gas Piping Installation Requirements

- .1 Provide required natural gas distribution piping and connect gas fired or operated equipment, and provide required vent piping to atmosphere, including vent piping from pressure regulators. Perform piping work in accordance with requirements of CAN/CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.
- .2 Piping is to be as follows:
 - .1 for underground piping, coated Schedule 40 black steel, coated soft copper, or polyethylene;
 - .2 for aboveground piping, uncoated Schedule 40 black steel, hard temper or soft copper.
 - .3 Slope gas piping in direction of flow to low points.

- .4 Ensure supports for roof mounted piping are sized (height) to accommodate roof slope and required piping slope, and to permit installation of low point dirt pockets.
- .5 Provide full pipe diameter 150 mm (6 in) long drip pockets at bottom of vertical risers, at piping low points, and wherever else shown and/or required.
- .6 Paint new natural gas piping aboveground with 2 coats of safety yellow enamel paint applied over primer, and SMS Ltd. or equal coil type vinyl identification markers with arrows.
- .7 For underground gas piping, provide continuous 75 mm (3 in) wide yellow PVC warning tape with "CAUTION - GAS LINE BURIED BELOW" wording at 750 mm (30 in) intervals located above pipe approximately 250 mm (10 in) below grade.
- .8 Rough-in required natural gas piping for kitchen and laundry equipment in accordance with drawing plans and schedules. Obtain accurately dimensioned rough-in drawings for equipment and confirm exact locations prior to roughing-in. When equipment has been installed, connect equipment from the roughed-in Work. Provide shut-off valves in piping connections to equipment.
- .9 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- .10 Paint new natural and/or propane gas piping with primer and 2 coats of yellow alkyd paint in accordance with Code requirements and requirements of Painting Section in Division 09. Identify piping at intervals as specified above. Prior to painting outdoor gas pipe confirm with Engineer and Architect paint colour; generally, paint with alkyd paint to match colour of surface or colour selected by Architect.

3.2 Installation of Shut-Off Valves

- .1 Provide CSA approved ball type valves to isolate equipment, regulators and wherever else shown.
- .2 Ensure valves are located for easy accessibility and maintenance.

3.3 Installation of Pressure Regulators

- .1 Provide pressure regulators in gas distribution piping where indicated and/or required.
- .2 For indoor appliances, use lever acting design vent limiter type, sized as shown and mounted in a horizontal upright position in strict accordance with manufacturer's instructions. Note: these pressure regulators do not require vent piping.
- .3 Use vented type pressure regulators for all other applications.
- .4 Install regulating stations in accordance with requirements of CAN/CSA B149.1.
- .5 Provide 6 mm (¼ in) diameter test ports upstream and downstream of each regulator assembly.
- .6 Locate outdoor regulating stations a minimum of 300 mm (12 in) away from walkways, and 3 m (10 ft) away from equipment air intakes and building openings. Provide required vent piping and terminate vents in a turn-down elbow fitting with bronze bug screen secured in place.
- .7 Locate indoor regulating stations in locations accessible without use of ladders or lifts. Combine vents where permitted and increase vent pipe size accordingly. Extend vent piping up through roof 3 m (10 ft) away from equipment air intakes and building openings and terminated in a turn-down elbow fitting with bronze bug screen secured in place.
- .8 Indicate operating set-points, relief settings and vent arrangements for each regulating station on as-built record drawings.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 0 and 1 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 ANSI/AWWA C-606 – Standard for Grooved and Shouldered Joints
 - .2 ASME B16.18- Cast Copper Alloy Solder Joint Pressure Fittings
 - .3 ASME B16.22- Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - .4 ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 & 300
 - .5 ASME B16.4 – Gray Iron Threaded Fittings: Classes 125 & 250
 - .6 ASME B16.39 – Malleable Iron Threaded Pipe Unions
 - .7 ASME B31.9 - Building Services Piping
 - .8 ASTM A105 – Standard for Specification for Carbon Steel Forgings for Piping Applications
 - .9 ASTM A53/A53M-12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - .10 ASTM A234/A234M-11a - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - .11 ASTM B88M-05(2011) - Standard Specification for Seamless Copper Water Tube
 - .12 ASTM B88-09 - Standard Specification for Seamless Copper Water Tube
 - .13 ASTM F477-10 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.3 Submittals for Review

- .1 Include data on valves, and accessories. Provide manufacturers catalogue information. At a minimum, indicate intended use, product materials of construction, temperature and pressure ratings.

1.4 Submittals for Closeout

- .1 Maintenance Data: Include maintenance instructions, spare parts lists, exploded assembly views.
- .2 Record Documentation: Record actual locations of valves.
- .3 When installation of expansion anchors is complete, arrange, and pay for anchor design engineer or manufacturer to visit site to review anchor installation. Submit a letter confirming each anchor is properly installed.

Part 2 Products

2.1 Pipe, Fittings and Joints - Heating Water, Chilled Water and Glycol

.1 Black Steel – Screwed Joint

- .1 Pipe in sizes ranging from 12 mm (1/2 in) to 50 mm (2 in) shall be schedule 40 ERW (electric resistance welded) black carbon steel, Grade B, ASTM-A53/A53M, ERW (electric resistance welded) with threaded fittings and screwed joints suitable for system working temperatures and pressures.

.2 Fittings shall be:

.1 Class 150 malleable iron threaded fittings to ANSI/ASME B16.3

Temperature		Pressure Rating	
Deg C	(Deg F)	kPa	(psi)
-28.9 to 65.6	(-20 to 150)	2070	(300)
121.1	(250)	1550	(225)

.2 Class 125 cast iron (gray iron) threaded fittings to ANSI/ASME B16.4

Temperature		Pressure Rating	
Deg C	(Deg F)	kPa	(psi)
-28.9 to 65.6	(-20 to 150)	1210	(175)
121.1	(250)	1030	(150)

.2 Black Steel - Welded Joint

- .1 Pipe in sizes 65 mm (2-1/2 in) and larger, shall be Schedule 40/Standard weight black carbon steel, Grade B, ASTM-A53/A53M, ERW (electric resistance welded), mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM-A234, Grade WPB with long sweep pattern elbows and welded joints.

.3 Hard Copper –Solder Joint

- .1 In lieu of black steel screwed piping, pipe in sizes ranging from 12 mm (1/2 in) to 50 mm (2 in) shall be Type “L” hard drawn copper to ASTM B88, complete with wrought copper fittings to ANSI/ASME B16.22, and ASTM-B32 95% tin/5% antimony soldered joints.

- .2 Propress and Crimp joints are not permitted.

2.2 Piping Unions

- .1 Screwed Piping – Class 150 conforming to ASME B16.39 constructed of malleable iron, ground joint, bronze or brass-to-iron or bronze seat screwed unions and union elbows suitable for system working temperatures and pressures.
- .2 Flanged Piping – Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb Class for steel pipe, and slip-on 150 lb Class bronze flanges for copper pipe.

2.3 Valves

- .1 Valves for hydronic systems shall be selected in accordance with the following tables. Manufacturers' model numbers are provided to indicate a standard of acceptance. Approved equivalent products of other manufacturers will be acceptable.

.2 Ball Valves - Threaded/Screwed Connection

- .1 Application: Shut-off, equipment isolation.
- .1 Size: Up to 50 mm (2 in) diameter

- .2 Body & Shell Working Pressure Rating:
 - .1 4137 kPa (600 psig) C.W.P, 1034 kPa (150 psi) W.S.P.
 - .3 System Operating Temp/ Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .4 Materials of Construction:
 - .1 Body: Bronze or brass, full port
 - .2 Ball: Solid Ball, Brass or chrome plated bronze
 - .3 Seats: PTFE or TFE
 - .4 Seals: PTFE or TFE
 - .5 Stem: Blow-out proof
 - .6 Stem Seal: Double O-ring design or Teflon packing
 - .7 Operator: Lever handle (removable)
 - .8 Connections: NPT threaded or soldered
 - .5 Manufacturers:
 - .1 Watts Industries Canada Inc., #FBV-3C, FBVS-3C
 - .2 Toyo Valve Co., Fig. 5044A, 5049A
 - .3 Kitz Corp, Code 58, 59
 - .4 Apollo Valve, #77-100
- .3 Ball Valves - Flanged Connection
- .1 Application: Shut-off, equipment isolation.
 - .1 Size: 65 mm (2.5 in) diameter and larger
 - .2 Body & Shell Working Pressure Rating:
 - .1 125WSP/200WOG
 - .3 System Operating Temp/ Pressure Limits:
 - .1
 - .4 Materials of Construction:
 - .1 Body: Cast Iron epoxy coated, full port
 - .2 Ball: Teflon fused solid ball
 - .3 Seats: PTFE or TFE
 - .4 Seals: PTFE or TFE
 - .5 Stem: Stainless steel, Blow-out proof
 - .6 Stem Seal: PTFE adjustable packing
 - .7 Operator: : Lever handle, locking (removable) or gear operated
 - .8 Connections: Flanged
 - .5 Manufacturers:
 - .1 American Valve 4000
- .4 Balancing Valves – Globe Type, Threaded/Screwed Connection
- .1 Applications: : Balancing (calibrated) and flow measurement. Valves shall be capable of positive shut off against system pressure.
 - .1 Size: Up to 50 mm (2 in) diameter
 - .2 Maximum Service Pressure:
 - .1 2065 kPa (300 psi)
 - .3 Maximum Service Temperature:
 - .1 120 deg C (248 deg F)
 - .4 System Operating temperature/Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .5 Materials of Construction:

- .1 Body: Y- Pattern, Brass or copper
- .2 Disc: Bronze, brass, or metal copper alloy
- .3 Seats: Brass, or metal copper alloy
- .4 Stem: Brass, copper alloy
- .5 Stem Seal: EPDM O-ring
- .6 Memory Lock: Brass
- .7 Operator: Vernier type handwheel
- .8 Meter Ports: NPT brass body with EPDM check
- .9 Drain Tappings: Built-in drain connection complete with shut-off valve and protective caps, and integral valve insulation.
- .10 Connections: NPT threaded or soldered
- .6 Manufacturers:
 - .1 S.A. Armstrong Ltd., Series CBV.
 - .2 Victaulic (Tour & Andersen) Series 786 soldered, 787 screwed,
 - .3 Red White Valve # 9517, 9519
- .5 Balancing Valves – Globe Type, Flanged
 - .1 Applications: : Balancing (calibrated) and flow measurement. Valves shall be capable of positive shut off against system pressure.
 - .1 Size: 65 mm (2 1/2 in) - 300 mm (12 in) diameter
 - .2 Maximum Service Pressure:
 - .1 1724 kPa (250 psi)
 - .3 Maximum Service Temperature:
 - .1 120 deg C (248 deg F)
 - .4 System Operating temperature/Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .5 Materials of Construction:
 - .1 Body: Y- Pattern, Ductile Iron
 - .2 Disc: Bronze
 - .3 Seats: High strength engineered resin, ductile iron
 - .4 Stem: Brass
 - .5 Stem Seal: EPDM O-ring
 - .6 Memory Lock: Brass
 - .7 Operator: Vernier type handwheel
 - .8 Meter Ports: NPT brass body with EPDM check
 - .9 Drain Tappings: Provide two (2) 8 mm (1/4") ports with brass plug
 - .10 Connections: Flanged
 - .6 Manufacturers:
 - .1 S.A. Armstrong Ltd., Series CVB
 - .2 Victaulic (Tour & Andersen), Series 788 flanged
 - .3 Red White Valve # 9574P
 - .6 Drain Valves
 - .1 Applications: Install at bases of risers, at main shut-off valves, in drain connections to equipment, low points of horizontal piping, and other locations as required to permit drainage of the respective hydronic system.
 - .1 Size: 20 mm (3/4 in)
 - .2 Body & Shell Working Pressure Rating:
 - .1 4137 kPa (600 psig) C.W.P, 1034 kPa (150 psi) W.S.P.

- .3 System Operating Temp/ Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
- .4 Materials of Construction:
 - .1 Body: Standard port, bronze or brass
 - .2 Ball: Bronze, chrome-plated brass
 - .3 Seat: PTFE
 - .4 Outlet: 20 mm (3/4 in) threaded hose end with cap and chain
 - .5 Operator: Lever handle
 - .6 Connections: NPT threaded
- .5 Manufacturers:
 - .1 Watts Industries Canada Inc., #B-6000-CC
 - .2 Toyo Valve Co., Fig. 5046
 - .3 Kitz Corp, Code No. 68C
 - .4 Apollo Valve, #70-HC
- .7 Check Valves - Non-Slam Swing Type
 - .1 Applications: Flow reversal protection – horizontal piping
 - .1 Size: 13 mm - 50 mm (1/2 in - 2-1/2 in)
 - .2 Body & Shell Working Pressure Rating:
 - .1 2070 kPa (300 psig) C.W.P 1034 kPa (150 psi) W.S.P.
 - .3 System Operating Temp/ Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .4 Materials of Construction:
 - .1 Body: Bronze
 - .2 Disc: Bronze
 - .3 Seat: PTFE
 - .4 Shaft: Stainless Steel
 - .5 Spring: Stainless Steel
 - .6 Cap: Forged brass
 - .7 Hinge Pin: Copper
 - .8 Connections: Threaded, soldered
 - .5 Manufacturers:
 - .1 Kitz Corp, Code No 36, 26
 - .2 Toyo Valve Co., Fig 236A
 - .3 Kitz Corp, Code No. 22
- .8 Check Valves - Non-Slam Swing Type
 - .1 Applications: Flow reversal protection – horizontal piping
 - .1 Size: 13 mm - 50 mm (3 in - 12 in)
 - .2 Body & Shell Working Pressure Rating:
 - .1 2070 kPa (300 psig) C.W.P 1034 kPa (150 psi) W.S.P.
 - .3 System Operating Temp/ Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .4 Materials of Construction:
 - .1 Body: Cast Iron
 - .2 Disc: Cast Iron, Bronze
 - .3 Seat: Bronze
 - .4 Hinge Pin: Stainless steel

- .5 Connections: Flanged
- .5 Manufacturers:
 - .1 Toyo Valve Co., Fig 435A
 - .2 Kitz Corp, Code 78
- .9 Check Valves - Non-Slam Wafer Type
 - .1 Applications: Flow reversal protection – vertical piping
 - .1 Size: 65 mm (2-1/2 in) and larger
 - .2 Body & Shell Working Pressure Rating:
 - .1 1378 kPa (200 psi) C.W.P @ 66 deg C (150 deg F)
 - .3 System Operating Temp/ Pressure Limits:
 - .1 100 deg C (212 deg F) @ 862 kPa (125 psi)
 - .4 Materials of Construction:
 - .1 Body: Cast iron, ductile iron
 - .2 Disc: Aluminum bronze, stainless steel
 - .3 Seal: EPDM
 - .4 Seat: EPDM, or ductile iron with electroless nickel plating
 - .5 Spring: Stainless steel
 - .6 Connections: Flanged
 - .5 Manufacturers:
 - .1 Watts Industries Canada Inc., Series ICV-125
 - .2 Gulf Valve Co., MB Series
 - .3 The Metraflex Co., Style CVXX
 - .4 Victaulic, Series W715
 - .5 Mueller 70 Series

2.4 Air Vents

- .1 Hydronic Rads and Terminal units
 - .1 Watts Series FV-4M1 – capped so not automatic.
 - .1 Provide solid ball valve for isolation at replacements. Air vents shall be rated to 1034 kPa (150 psi).
- .2 Piping Mains, Coils, Mechanical Rooms
 - .1 Float Type: Sarco 13W
 - .1 Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating ball valve.
 - .2 Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating ball valve.
- .3 Manual Type: Short vertical sections of 50 mm (2 inch) diameter pipe to form air chamber, with 3 mm (1/8 inch) brass needle valve at top of chamber.

2.5 In-line Air Separators:

- .1 Manufacturers: Amtrol, Armstrong
- .2 Cast iron for sizes 40 mm (1-1/2 inch) and smaller, or steel for sizes 50 mm (2 inch) and larger; tested and stamped to BPVC Section VIII; for 860 kPa (125 psig) operating pressure.

2.6 Expansion Tanks – Hydronic

- .1 Replaceable bladder-type expansion tanks.

- .2 Construction: Welded steel, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code with flexible butyl or EPDM diaphragm sealed into tank and steel support stand.
- .3 Accessories: Air-charging fitting, tank drain, bladder replacement access, tapping for installation of a pressure gauge.
- .4 Factory secured seismic restraint connection hardware.
- .5 Manufacturers: Amtrol, Armstrong, ITT Bell & Gossett

2.7 Strainers

- .1 Strainers: Size 50 mm (2 inch) and Under:
 - .1 Screwed brass or iron body for 1200 kPa (175 psig) working pressure, Y pattern with 0.8 mm (1/32 inch) stainless steel perforated screen.
- .2 Strainers: Size 65 mm (2-1/2 inch) to 100 mm (4 inch):
 - .1 Flanged iron body for 1200 kPa (175 psig) working pressure, Y pattern with 1.2 mm (3/64 inch) stainless steel perforated screen.
- .3 Strainers: Size 125 mm (5 inch) and Larger:
 - .1 Flanged iron body for 1200 kPa (175 psig) working pressure, basket pattern with 3.2 mm (1/8 inch) stainless steel perforated screen.

2.8 Pump Suction Guide Fitting

- .1 Fitting: Angle pattern, cast-iron body, rated for 1200 kPa (175 psig) working pressure, with inlet vanes, cylinder strainer with 5 mm (3/16 inch) diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.
- .2 Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.9 Equipment Drains and Overflows

- .1 Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized.
 - .1 Fittings: Galvanized cast iron, or ASME B146.3 malleable iron.
 - .2 Joints: Threaded, or grooved mechanical couplings.
- .2 Copper Tubing: ASTM B88M, ASTM B88, Type L hard drawn.
 - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
 - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver.

2.10 Pressure Relief Valves

- .1 Manufacturers: Watts
- .2 Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities BPVC certified and labelled.
- .3 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1725 kPa (250 psi) rated pressure relief valves, each capable of relieving full output of equipment it is associated with, and each factory set at 415 kPa (60 psi) unless otherwise specified.
- .4 Manufacturers: McDonnell & Miller, Conbraco, Watts Industries (Canada) Inc.

Part 3 Execution

3.1 Installation

- .1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- .2 Remove scale and dirt on inside and outside before assembly.

- .3 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- .4 Route piping in orderly manner, parallel to building structure, and maintain gradient.
- .5 Install piping to conserve building space, and not interfere with use of space.
- .6 Group piping whenever practical at common elevations.
- .7 Sleeve pipe passing through partitions, walls and floors.
- .8 Slope piping and arrange to drain at low points. Use eccentric reducers to maintain top of pipe level. Slope horizontal piping mains to provide a minimum continuous upgrade of 25 mm (1in) in 6 m (20 ft) to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1in) in 1.2 m (4 ft). Leave sufficient room at high points for installation and maintenance of air vents.
- .9 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .10 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- .11 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.
- .12 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations with balancing contractor prior to installation.
- .13 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work.
- .14 Install valves with stems upright or horizontal, not inverted.
- .15 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with other trades and architectural reflected ceiling plans.
- .16 Connect equipment provided as part of the work of other Sections with piping as indicated and/or required. Refer to pipe connection details on drawings.
- .17 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.
- .18 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- .19 Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings.
- .20 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- .21 Pipe relief valve outlet to nearest floor drain.

3.2 Installation of Pressure Relief Valves

- .1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to near drain unless otherwise shown or specified.
- .2 Signs of operation of pressure relief to be visible on floor before discharging to drain.
- .3 Confirm relief valve settings.

3.3 Installation of Air Vents

- .1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.
- .2 Provide 12 mm (1/2") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.4 Installation of Expansion Tanks

- .1 Provide expansion tanks with supports, drain valve, isolation valves and pressure gauge.
- .2 Record initial charge on tank for future reference.

3.5 Installation of Glycol Solution Tank

- .1 Provide a mixing and storage tank and feed assembly for each glycol solution circulating system.
- .2 Secure tank stand to a concrete housekeeping pad. Connect with system piping.
- .3 Brace and secure each unit in accordance with requirements for Seismic Control and Restraint.
- .4 When system is filled and at completion of work, fill tank with water and mark level on tank.
- .5 When installation is complete, test operation of assembly, including alarms, and adjust as required. Adjust pressure switch to suit solution circulating system pressure.

3.6 Cleaning and Flushing

- .1 Refer also to specification section regarding Chemical Treatment.
- .2 Coupons and cuttings from hot tap drilling into existing system piping shall be captured and retained for review by Engineer.
- .3 Make temporary end connections between supply and return piping to allow circulation for flushing and cleaning,
- .4 Provide connections for attaching cleaning circulating pump and flushing and filling and draining connections.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 HI – Hydraulic Institute
 - .2 ANSI – American National Standards Institute
 - .3 OSHA – Occupational Safety and Health Administration
 - .4 ASHRAE – American Society of Heating, Refrigeration and Air-Conditioning Engineers
 - .5 NEMA – National Electrical Manufacturers Association
 - .6 UL – Underwriters Laboratories
 - .7 ETL – Electrical Testing Laboratories
 - .8 CSA – Canadian Standards Association
 - .9 NEC – National Electrical Codes
 - .10 ISO – International Standards Organization
 - .11 IEC- International Electrotechnical Commission
 - .12 ASME – American Society of Mechanical Engineers
- .3 Products Requiring Electrical Connection: Listed and classified by UL testing firm acceptable to the authority having jurisdiction CSA as suitable for the purpose specified and indicated.

1.3 Performance Requirements

- .1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.

1.4 Submittals For Review

- .1 Provide certified pump curves showing performance characteristics with pump and system operating point plotted. For VFD pumps curves shall also indicate relevant part load operating points and minimum stable operating point for VFD operation.
- .2 Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- .3 Pump motors are to comply with requirements of Basic Mechanical Materials and Methods and Motors.

1.5 Closeout Submittals

- .1 Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.
- .2 Certificate: Certify that base mounted pumps have been aligned.

Part 2 Products

2.1 General – Pumps

- .1 Centrifugal pumps are to be non-overloading under all operating conditions.

2.2 Horizontal End-Suction Base Mounted Pumps

- .1 Acceptable Manufacturers:
 - .1 S.A. Armstrong Limited, "Series 4030"
 - .2 ITT Bell and Gossett, "Series e-1510"
 - .3 Grundfos, Peerless Pump "Series F"
- .1 General Description: Specified equal to Armstrong Series 4030 split coupled, (long coupled), single stage, horizontal base mounted centrifugal pump.
- .2 Casing: Radially split, self venting, cast iron construction complete with top center-line discharge and plugged tapings for gauges and drain. Supply casing complete with ANSI-125 flanges suitable for working pressures up to 1200 kPa (175 psig) at 65 deg C (150 deg F); 1000 kPa (140 psig) at 121 deg C (250 deg F). The casing-to-cover gasket shall be confined on the atmospheric side to prevent the possibility of blow-out.
- .3 Impeller/Shaft: Impeller shall be hydraulically and dynamically balanced cast bronze construction. Shaft shall be constructed of carbon steel and shall be complete with stainless steel shaft sleeve extending the full length of the mechanical seal area to completely cover the wetted area under the seal and protect the shaft from corrosion and wear. Shaft shall connect to the motor by means of a flexible coupling complete with coupling guard. Shaft shall be supported on ball-type, heavy-duty, lifetime lubricated sealed bearings with back pull out design bearing frame to accommodate removal of the rotating assembly without disconnecting piping connections.
- .4 Mechanical Seals: Shall be single-spring, elastomeric bellow type with inside balanced non-pusher type with springs constructed of stainless steel. Provide bronze gland plate with stainless steel bolts to secure the stationary seat. Provide factory installed flush line with manual vent. Materials for rotating face, stationary seat and secondary seal shall be per specification article entitled "Mechanical Seal Materials".
- .5 Motor: Provide motors conforming to the requirements of Specification Section 20 05 29 Electric Motors and Wiring.

2.3 Wet Rotor Variable Speed In-Line Pump

- .1 Grundfos Canada Inc. "Magna3" Series wet rotor design, horizontal, variable frequency drive in-line pump with a head-capacity curve that has a steady rise in head from maximum to minimum flow within preferred operating range, factory tested as an assembly and with a maximum noise level when operating of 41 dBA, capable of continuous operation at 120°C (248°F), and equipped with:
 - .1 cast iron housing with flanged inlet and outlet with gauge taps, laser welded stainless steel impeller, bearing plate and shaft, stainless steel neck ring, dynamically balanced rotor with stainless steel cladding, and tungsten carbide sleeve type motor bearings;
 - .2 squirrel cage, self-venting motor suitable for a VFD, cooled by pumped fluid and complete with stator housing drain holes to permit condensed water to drain;

- .3 bolt-on, integrated, CSA or ETL certified variable frequency drive assembly with "AUTOADAPT" function which automatically adjusts proportional pressure and sets an efficient performance curve whenever possible, an operating panel with control modules and clear indications for pump flow rate and head, and a bus communication module for site connection into building automation system.
- .2 Acceptable manufacturers:
 - .1 Grundfos Canada Inc. "Magna" Series;
 - .2 Taco Canada Ltd. "Delta T".
 - .3 Xylem

2.4 Wet Rotor 3-Speed In-Line Pump

- .1 Grundfos Canada Inc. "VersFlo" Series UPS wet rotor design, 3-speed horizontal in-line pump with a head-capacity curve that has a steady rise in head from maximum to minimum flow within preferred operating range, factory tested as an assembly and with a maximum noise level when operating of 41 dBA, capable of continuous operation at 120°C (248°F), and equipped with:
 - .1 cast iron housing with flanged inlet and outlet with gauge taps, laser welded stainless steel impeller, bearing plate and shaft, stainless steel neck ring, dynamically balanced rotor with stainless steel cladding, and tungsten carbide sleeve type motor bearings;
 - .2 3-speed asynchronous, squirrel cage, self-venting motor cooled by pumped fluid and complete with stator housing drain holes to permit condensed water to drain;
 - .3 bolt-on terminal box with 3-speed switch assembly with each speed having a distinct pump performance curve, and fibre optic indicator lights for visual inspection of on/off, rotation, and troubleshooting;
- .2 Acceptable manufacturers:
 - .1 Grundfos Canada Inc.;
 - .2 S. A. Armstrong Ltd.
 - .3 Xylem

2.5 Mechanical Seal Materials

- .1 Mechanical shaft seals for split coupled vertical inline pumps, close coupled vertical inline pumps and horizontal end-suction base mounted pumps specified above shall be in accordance with the following table:

Working Fluid	Max. Temp.	Rotating Face	Stationary Seat	Secondary Seal
Ethylene Glycol (Max. 50%)	90 deg C (194 deg F)	Silicon Carbide	Silicon Carbide	EPDM
Ethylene Glycol (Max. 50%)	90 deg C (194 deg F)	Tungsten Carbide	Tungsten Carbide	EPDM
Boiler Feed Water	120 deg C (248 deg F)	Silicon Carbide [1]	Silicon Carbide	EPDM

- .1 Notes:
 - .1 Seal face shall be self-lubricating, sintered silicon carbide.

Part 3 Execution

3.1 Installation

- .1 Provide centrifugal circulating pumps.
- .2 Install to manufacturer's written instructions.
- .3 Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

- .4 Provide flexible connectors in pump suction and discharge piping 450 mm (18") from suction and discharge connection accessories.
- .5 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes.
- .6 Provide air vent and drain connection on horizontal pump casings.
- .7 Provide drains for bases and seals, piped to and discharging into floor drains.
- .8 Secure base mounted pumps in place on seismic rated structural steel bases. Secure base mounted pumps in place on a concrete housekeeping pad. Shim pump baseplate level using metal wedges prior to tightening bolts. When installation is complete and pump-motor alignment has been checked, fill void between pump base and housekeeping pad with non-shrink grout. Provide flexible connections in pump suction and discharge piping 450 mm (18") from suction and discharge connection accessories.
- .9 Remove suction guide start-up strainer screens after piping flushing and cleaning is complete.
- .10 Supply variable frequency drives (VFD) for pumps as scheduled. Hand VFD's to electrical trade at site for installation as part of the electrical work.
- .11 If circulating pumps are used for piping flushing and cleaning, and pump seal flush line filters are not installed, replace pump mechanical seals when flushing and cleaning is complete.
- .12 Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.
- .13 Check, align, and certify alignment of base mounted pumps prior to start-up.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References

- .1 ASHRAE 15-2010 - Safety Standard for Refrigeration Systems.
- .2 ASHRAE 34-2010 - Designation and Classification of Refrigerants.
- .3 ASME B16.22-12 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ASME B16.26-2011 - Cast Copper Alloy Fittings for Flared Copper Tubes.
- .5 ASME B31.5-2010 - Refrigeration Piping and Heat Transfer Components.
- .6 ASME B31.9-2011 - Building Services Piping.
- .7 ASTM A234/A234M-11a - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .8 ASTM B88M-05(2011) - Standard Specification for Seamless Copper Water Tube.
- .9 ASTM B88-09 - Standard Specification for Seamless Copper Water Tube.
- .10 ASTM B280-08 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.3 Submittals for Review

- .1 Provide rated capacities, weights specialties and accessories, electrical nameplate data, and wiring diagrams. Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.

1.4 Submittals for Closeout

- .1 Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.
- .2 Warranty Documentation.
- .3 Test Reports: Indicate results of leak test, acid test.

1.5 System Description

- .1 Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .2 Provide pipe hangers and supports to MSS SP-69 ASME B31.5 unless indicated otherwise.
- .3 Liquid Indicators:

- .1 Use line size liquid indicators in main liquid line leaving condenser.
- .2 If receiver is provided, install in liquid line leaving receiver.
- .3 Use line size on leaving side of liquid solenoid valves.
- .4 Valves:
 - .1 Use service valves on suction and discharge of compressors.
 - .2 Use gauge taps at compressor inlet and outlet.
 - .3 Use gauge taps at hot gas bypass regulators, inlet and outlet.
 - .4 Use check valves on compressor discharge.
 - .5 Use check valves on condenser liquid lines on multiple condenser systems.
- .5 Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
- .6 Strainers:
 - .1 Use line size strainer upstream of each automatic valve.
 - .2 Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
 - .3 On steel piping systems, use strainer in suction line.
 - .4 Use shut-off valve on each side of strainer.
- .7 Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.
- .8 Permanent Filter-Driers:
 - .1 Use in low temperature systems.
 - .2 Use in systems utilizing hermetic compressors.
 - .3 Use filter-driers for each solenoid valve.
- .9 Replaceable Cartridge Filter-Driers:
 - .1 Use vertically in liquid line adjacent to receivers.
 - .2 Use filter-driers for each solenoid valve.
- .10 Solenoid Valves:
 - .1 Use in liquid line of systems operating with single pump-out or pump-down compressor control.
 - .2 Use in liquid line of single or multiple evaporator systems.
 - .3 Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.
- .11 Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.6 Quality Assurance

- .1 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

1.7 Delivery, Storage, And Protection

- .1 Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- .2 Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

Part 2 Products

2.1 Piping

- .1 Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
 - .1 Fittings: Wrought copper.
 - .2 Joints: Braze, BCuP silver/phosphorus/copper alloy
- .2 Copper Tubing to 22 mm (7/8 inch) OD: ASTM B88M (ASTM B88), Type K, annealed.
 - .1 Fittings: cast copper.

.2 Joints: Flared.

Part 3 Execution

3.1 Preparation

- .1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- .2 Remove scale and dirt on inside and outside before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.2 Installation

- .1 Install refrigeration specialties to manufacturer's written instructions.
- .2 Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- .3 Install piping to conserve building space and not interfere with use of space.
- .4 Group piping whenever practical at common elevations and locations. Slope piping 1% in direction of oil return.
- .5 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .6 Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40% in direction of flow.
- .7 Provide clearance for installation of insulation and access to valves and fittings.
- .8 Provide access to concealed valves and fittings.
- .9 Flood piping system with nitrogen when brazing.
- .10 Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- .11 Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.
- .12 Insulate piping and equipment

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
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1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 CSA (Canadian Standards Association).
 - .2 UL (Underwriters Laboratories Inc.) and ULC (Underwriters Laboratories Canada)
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience. Company to have local representatives with water analysis laboratories and full time service personnel.
- .4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.3 Submittals For Review

- .1 Provide system initial water condition test report prior to start of work.
- .2 Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- .3 Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- .4 Manufacturer's special installation requirements including placement of equipment in systems, piping configuration, and connection requirements.

1.4 Submittals For Closeout

- .1 Manufacturer's Field Reports:
 - .1 Indicate initial condition of system prior to start of work
 - .2 Indicate start-up of treatment systems when completed and operating properly.
 - .3 Indicate analysis of system water after cleaning.
 - .4 Indicate analysis of system water after treatment.
- .2 Maintenance Contracts:
 - .1 Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.
 - .2 Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

- .3 Provide laboratory and technical assistance services during this maintenance period.
- .4 Include two (2) hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems
- .3 Record Documentation: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
- .4 Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.5 Maintenance Material Submittals

- .1 Extra Stock Materials:
 - .1 Provide one (1) box of thirty (30) 20 micron cartridge filters per system.
 - .2 Provide sufficient chemicals for treatment and testing during warranty period.

Part 2 Products

2.1 Materials

- .1 System Cleaner:
 - .1 Manufacturers: ChemAqua
 - .2 Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
 - .3 Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.
- .2 Closed System Treatment (Water):
 - .1 Manufacturers: ChemAqua
 - .2 Sequestering agent to reduce deposits and adjust pH; polyphosphate.
 - .3 Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
 - .4 Conductivity enhancers; phosphates or phosphonates.
- .3 Closed System Treatment (Ethylene Glycol/Water):
 - .1 Manufacturers: ChemAqua
 - .2 Ethylene Glycol blended with corrosion inhibitors.
 - .3 Sequestering agent to reduce deposits and adjust pH; polyphosphate.
 - .4 Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
 - .5 Conductivity enhancers; phosphates or phosphonates.

2.2 Water Meter

- .1 Manufacturers: Neptune or as recommended by ChemAqua.
- .2 Displacement type cold water meter with sealed, tamper-proof drive.

Part 3 Execution

3.1 System Preparation

- .1 Systems to be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- .2 Control valves to be in open position during cleaning and treatment.
- .3 Verify that electric power is available and of the correct characteristics.

- .4 Provide Portable circulation pump for temporary use. Connect to new systems chemical treatment ports.
- .5 System Flushing
 - .1 Thoroughly flush new closed system with raw water to remove loose debris. Remove and clean all new and existing strainers and flush low points.
 - .2 Acceptability of water condition to be determined through testing and visual examination of representative water samples by the water treatment supplier. Copies of test reports to be submitted by the water treatment supplier.
- .6 System Treatment
 - .1 Add system cleaner as prescribed by water treatment supplier. Allow circulation ensuring full circulation involving all system piping. Systems shall be circulated with all control valves open to ensure effective cleaning. The system shall be drained and refilled with fresh water as often as necessary to remove all traces of cleaning chemical. The water treatment representative shall test for residue of cleaner to determine when system is ready for chemical treatment.
 - .2 Acceptability of water condition to be determined through testing and visual examination of representative water samples by the water treatment supplier. Copies of test reports to be submitted by the water treatment supplier.
 - .3 Obtain from the water treatment representative the chemicals required for the water treatment. Add corrosion inhibitor as prescribed by water treatment supplier.

3.2 Cleaning Sequence

- .1 Hot Water Heating Systems:
 - .1 Apply heat while circulating, slowly raising temperature to 71 degrees C (160 degrees F) and maintain for twelve (12) hours minimum.
 - .2 Remove heat and circulate to 37.8 degrees C (100 degrees F) or less; drain systems as quickly as possible and refill immediately with clean water as quickly as possible.
 - .3 Circulate for six (6) hours at design temperatures, then drain.
 - .4 Refill with clean water and repeat until system cleaner is removed.
- .2 Chilled Water (chilled water with glycol) Systems:
 - .1 Apply heat while circulating, slowly raising temperature to 71 degrees C (160 degrees F) and maintain for twelve (12) hours minimum.
 - .2 Remove heat and circulate to 37.8 degrees C (100 degrees F) or less; drain systems as quickly as possible and refill immediately with clean water as quickly as possible.
 - .3 Circulate for six (6) hours at design temperatures, then drain.
 - .4 Refill with clean water and repeat until system cleaner is removed.
- .3 Remove, clean, and replace strainer screens.
- .4 Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 Installation

- .1 Install to manufacturer's written instructions.
- .2 Insert cartridges in filter.
- .3 Provide test report indicating water condition prior to start of work.

3.4 Closed System Treatment

- .1 Provide chemical injection ball valve cap and chain on each system. Install isolating ball valves and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- .2 Introduce closed system treatment through chemical injection valves when required or indicated by test.
- .3 Test treatment chemical levels and provide written reports indicating proper levels of inhibitors are present.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
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1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible
 - .2 NFPA 80 – Standard for Fire Doors and Other Opening Protectives
 - .3 NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilation Systems
 - .4 NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
 - .5 NFPA 92 - Standard for Smoke Control Systems, 2012 Edition
 - .6 NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
 - .7 NFPA 101 – Life Safety Code
 - .8 NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives
 - .9 UL 33 - Standard for Heat Responsive Links for Fire-Protection Service
 - .10 UL 181 – Standard for Factory-Made Air Ducts and Air Connectors
 - .11 UL 555 - Standard for Fire Dampers
 - .12 UL 555S - Standard for Smoke Dampers
 - .13 CAN/ULC S102 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .14 ULC CAN S110 – Standard Methods for Test of Air Ducts
 - .15 ULC CAN S112 – Standard Method of Fire Test for Fire Damper Assemblies
 - .16 ULC CAN S112.1 – Standard for Leakage Rated Dampers for Use in Smoke Control Systems
 - .17 ULC CAN S112.2 – Standard Method of Fire Test of Ceiling Firestop Flap Assemblies
 - .18 ULC CAN S662 – Standard for Factory Built Grease Ducts
 - .19 CSA (Canadian Standards Association)
 - .20 UL (Underwriters Laboratories Inc.)

1.3 Performance Requirements

- .1 Ductwork configuration, (sizes, aspect ratios, locations) may be altered, when reviewed by Consultant, to meet requirements of equipment, materials, other equipment or systems being installed, and of the building.
- .2 Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions, work of other trades and other architectural and/or structural details but not shown on Drawings.

1.4 Submittals for Review

- .1 Provide data for flexible duct connectors, flexible duct materials.
- .2 Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for kitchen hood exhaust duct systems.
- .3 Fire-rated ductwork and ULC listed at the sizes indicated on the drawings.
- .4 Internal duct liner
- .5 Volume control dampers, duct access doors, duct test holes, fire dampers, smoke dampers, motorized dampers, balancing dampers, silencers
- .6 Provide equipment rated capacities, weights, accessories, electrical characteristics and connection requirements.
- .7 Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

1.5 Submittals for Closeout

- .1 Record Documentation: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used. Provide record drawings referencing actual installed locations of access doors test holes.
- .2 Submit certification of proper installation from the fire-rated duct manufacturer.

1.6 Environmental Requirements

- .1 Ambient Conditions:
 - .1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
 - .2 Maintain temperatures during and after installation of duct sealants.

Part 2 Products

2.1 Galvanized Steel Ducts

- .1 ASTM A653/A653M galvanized steel having Z180 (G60) for bare uncovered duct to be finish painted, and Z275 (G90) for all other applications. Zinc coating shall be tested to ASTM A90/A90M.
- .2 Rectangular
 - .1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.
- .3 Round
 - .1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.
- .4 Flat Oval
 - .1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.
- .5

2.2 Semi-Rigid Flexible Ductwork – Non-Insulated:

- .1 Manufacturers:
 - .1 Flexmaster Triple Lock – T/L
- .2 ULC- S110, UL-181 Class 1 semi-rigid air duct fabricated of spiral wound aluminum strip, mechanically joined with triple lock seam. Product shall have a flame spread rating of not more than 25 without evidence of continued smoke developed rating of not more than 50.
 - .1 Pressure Rating: 3.0 kPa (6 in WG) positive and 3 kPa (12 in WG) negative.
 - .2 Maximum Velocity: 20.3 m/s (4000 fpm)
 - .3 Temperature Range: -40 to 316 deg C (-40 to 600 deg F)

2.3 Semi-Rigid Flexible Ducts – Factory Insulated:

- .1 Manufacturers:
 - .1 Flexmaster Triple Lock – T/L-M
- .2 ULC- S110, UL-181 Class 1 semi-rigid air duct fabricated of spiral wound aluminum strip, mechanically joined with triple lock seam. Factory insulated with 25 mm (1 in) reinforced sleeve type insulation covered with scrim foil mylar vapour barrier. Product shall have a flame spread rating of not more than 25 without evidence of continued smoke developed rating of not more than 50.
 - .1 Pressure Rating: 2.5 kPa (10 in WG) positive and 3 kPa (12 in WG) negative.
 - .2 Maximum Velocity: 27.9 m/s (5500 fpm)
 - .3 Temperature Range: -40 to 112 deg C (-40 to 250 deg F)

2.4 Acoustic Lining

- .1 Minimum 25 mm (1") thick acoustic lining material with GreenGuard Permacote meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.
- .2 Acceptable manufacturers are:
 - .1 Johns Manville;
 - .2 Manson Insulation;
 - .3 Knauf Insulation.

2.5 Duct Sealant:

- .1 Manufacturers:
 - .1 Johns Mansville
 - .2 Manson Insulation
 - .3 Knauf Insulation
 - .4 Transcontinental MP
 - .5 Durodyne S2
- .2 ULC listed and labelled, non-hardening, water resistant, fire resistant duct sealer. May be brush or gun applied with a flame spread rating of 5 and smoke developed rating of 0 in accordance with CAN/ULC S102. Sealant shall be compatible with mating materials; liquid used alone or with tape, or heavy mastic.

2.6 Air Turning Devices/Extractors

- .1 Air turning devices are to be constructed of the same material as the duct they are associated with.
 - .1 Manufacturers:
 - .1 Ductmate Industries Inc.

- .2 Duro Dyne Inc.
- .2 Square Elbow Turning Vanes: Provide multiple, single wall, curved radius turning vanes adequately reinforced to suit pressure and velocity of system. Vanes shall be interconnected with support bars perpendicular to blade set and set into vane runners suitable for duct mounting.
 - .1 Manufacturers:
 - .1 Nailor Industries Inc.
 - .2 Titus
 - .3 Price Industries Inc.
- .3 Duct Branches at Grilles and Diffuser Connections: Provide air extractor type multi-blade device with blades aligned in short dimension attached to pivoting frame and bracket, with push-pull operator strap.

2.7 Duct Access Doors

- .1 Fabrication: Rigid and close-fitting constructed of material matching the duct construction, complete with sealing gaskets and quick fastening locking devices. Access doors for insulated ductwork, shall be double-wall, complete with minimum 25 mm (1 in) thick insulation and sheet metal cover.
 - .1 Less Than 300 mm (12 in) Square: Secure with sash locks.
 - .2 Up to 450 mm (18 in) Square: Provide two (2) hinges and two (2) sash locks.
 - .3 Up to 600 x 1200 mm (24 x 48 in): Three (3) hinges and two (2) compression latches with outside and inside handles.
 - .4 Larger Sizes: Provide an additional hinge.
- .2 Access doors with sheet metal screw fasteners are not acceptable.

2.8 Ductwork Drain Ports

- .1 Ductmate Canada Ltd. "Moisture Drain". Provide 20 mm (3/4 in) diameter moisture drains with galvanized sheet metal funnel and chrome plated brass threaded drain, nut and cap.

2.9 Duct Test Ports

- .1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- .2 Permanent Test Holes: Factory fabricated, equal to Duro-Dyne Canada Ltd. #1P1 or #1P2 as required to suit insulation thickness where applicable. Provide gasketed, leakproof instrument test ports for round or rectangular ducts as required. Air tight flanged fittings each complete with cap, neoprene expansion plug and plug securing chain. Provide extended neck fittings to clear insulation.

2.10 Wire Mesh (Birdscreen)

- .1 Heavy-gauge stainless steel or aluminum mesh with 12 mm x 12 mm (1/2 in x 1/2 in) opening size secured in a rigid steel or aluminum framework. Framework shall be constructed such that it can be removed.

2.11 Flexible Duct Connections

- .1 Manufacturers:
 - .1 Duro-Dyne Canada Inc.
 - .2 Dyn Air Inc.
- .2 Indoor Flexible Connector: Fabric crimped into metal edging strip.
 - .1 Fabric: UL listed fire-retardant neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m (30 oz/sq yd).

- .2 Net Fabric Width: Approximately 50 mm (2 inches).
- .3 Metal: 75 mm (3 inch) wide, galvanized steel 0.6 mm thick (24 gauge).
- .4 Temperature Range: -40 to 93 deg C (-40 to 200 deg F)
- .3 Outdoor Flexible Connector: Fabric crimped into metal edging strip.
 - .1 Fabric: UL listed fire-retardant hypalon coated woven glass fibre fabric to NFPA 90A, minimum density 814 g/sq m (24 oz/sq yd).
 - .2 Net Fabric Width: Approximately 50 mm (2 inches).
 - .3 Metal: 75 mm (3 inch) wide, galvanized steel 0.6 mm thick (24 gauge).
 - .4 Temperature Range: -40 to 121 deg C (-40 to 250 deg F)
- .4 High Temperature Flexible Connector: Fabric crimped into metal edging strip.
 - .1 Fabric: UL listed flame-proof silicon rubber coated woven glass fibre fabric to NFPA 90A, minimum density 576 g/sq m (17 oz/sq yd).
 - .2 Net Fabric Width: Approximately 50 mm (2 inches).
 - .3 Metal: 75 mm (3 inch) wide, galvanized steel 0.6 mm thick (24 gauge).
 - .4 Temperature Range: -54 to 260 deg C (-75 to 500 deg F)

2.12 Fire and Smoke Dampers

- .1 Manufacturers:
 - .1 Nailor Industries Inc.
 - .2 Greenheck Fan Corp.
 - .3 Price Industries Inc.
 - .4 Ruskin Co.
 - .5 Ventex/Alumavent
 - .6 United Enertech
- .2 Ceiling Fire Dampers/ Fire Flaps: Fabricated to NFPA 90A and UL-555C and as indicated. ULC classified to CAN/ULC S112.2. Rectangular or round, blade type G60 galvanized steel (unless otherwise specified) fire stop flaps assemblies each consisting of 0.76 mm (22 gauge) frame and 1.5 mm (16 gauge) flap, 74 deg C (165 deg F) fusible link, locking clip and ceramic fibre insulation for units 300 mm (12 in) diameter or 516 sq-cm (80 sq-in) and larger. Ceramic fibre material in accordance with 25/50 flame/smoke developed ratings in accordance with CAN/ULC S102. Provide thickness as necessary to suit required fire rating.
- .3 Curtain Type Fusible Link Dampers: Fabricated to NFPA 90A and UL 555 and as indicated. ULC classified to CAN/ULC S112. Galvanized steel (unless otherwise specified), curtain blade type fire damper with interlocking blades. Provide dynamic fire dampers factory tested for closure under airflow conditions. Dampers shall have 1-1/2 hour or 3 hour rating as required, steel sleeve, retaining angles and a 74 deg C (165 deg F) rated fusible link. Provide stainless steel closure springs and latches for closure under air flow conditions in horizontal installations. Configure with blades out of air stream using Type B or Type C dampers except for 250 Pa (1.0 inch) pressure class ducts up to 300 mm (12 inches) in height.
- .4 Smoke Dampers: ULC listed to CAN/ULC S112.1, UL-555S and meeting the requirements of NFPA 90A, 101 and 105. Consisting of a failsafe, normally closed, opposed blade, motorized damper with factory installed and tested 120 V external electric actuator to automatically close damper upon receiving an external signal, and automatically open damper when system is reset. Assembly shall be ULC Class 1 leakage rated for smoke. Dampers shall be supplied with factory installed sleeve, length to the field verified by contractor to suit wall thickness.

- .5 Combination Fire/Smoke Dampers: ULC listed to CAN/ULC S112, CAN/ULC S112.1, UL-555, UL-555S and meeting the requirements of NFPA 80, 90A, 101 and 105. Consisting of type B or C dynamic fusible link dampers and a failsafe, normally closed, opposed blade, motorized damper with factory installed and tested 120 V external electric actuator. ULC Class 1 leakage rated for smoke, 1-1/2 hour fire rated, and complete with a 74 deg C (165 deg F) fusible link. Dampers shall be supplied with factory installed sleeve, length to the field verified by contractor to suit wall thickness. Sleeves shall be 1.01 mm (20 guage) for ductwork sizes up to and including 2.1 m (84 in) wide, and 1.31 mm (18 guage) for larger sizes.
- .6 Dampers in ductwork materials other than galvanized steel are to be as specified above, except constructed of 316 stainless steel.

2.13 Backdraft Dampers.

- .1 Gravity Backdraft Dampers, Size 450 x 450 mm (18 x 18 in) or Smaller, Provided with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- .2 Manufacturers:
 - .1 Nailor Industries Inc.
 - .2 T.A. Morrison & Co. Inc. "TAMCO"
 - .3 Greenheck Fan Corp.
 - .4 Ruskin Co.
 - .5 Ventex/Alumavent
- .3 Multi-Blade, Parallel Action Counterbalanced Gravity Backdraft Dampers: Suitable for vertical or horizontal mounting, 50 mm (2 in) wide frame constructed of extruded aluminum with mitred corners. Centre pivoted, extruded aluminum blades of maximum 150 mm (6 in) width, complete with felt or flexible vinyl sealed edges. Blades shall be linked together in rattle-free manner with 90 degree stop, concealed blade linkage located out of the airstream, corrosion resistant synthetic bearings, and plated steel pivot pin. Adjustable, plated steel counterweights mounted internally in the air stream shall permit device set up for various differential static pressure settings.

2.14 Volume Control/Balancing Dampers

- .1 Splitter Dampers:
 - .1 Material: Same gauge as duct for sizes up to 600 mm (24 inches) in either direction, and two gauges heavier for sizes over 600 mm (24 inches).
 - .2 Blade: Fabricated of single thickness sheet metal to streamline shape and reinforced as necessary to suit blade size, system velocity, and to prevent vibration noise. Secured with continuous hinge or rod.
 - .3 Operator: Minimum 6 mm (1/4 inch) diameter rod in self aligning, universal joint action, flanged bushing with set screw. Operating hardware shall be equal to DynAir Inc. "Dyn-A-Quad" damper regulator.
 - .4 Single Blade Dampers: for duct sizes up to 150 x 760 mm (6 x 30 in) 300 x 1220 mm (12 x 48 in).
 - .5 Multi-Blade Damper: Opposed blade pattern with maximum blade sizes 200 x 1825 mm (8 x 72 in). Assemble centre and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - .6 End Bearings: Except in round ductwork 300 mm (12 in) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
 - .7 Quadrants: Provide locking, indicating quadrant regulators on single and multi-blade dampers. On insulated ducts mount quadrant regulators on 50 mm (2 in) stand-off mounting brackets, bases, or adapters. Where rod lengths exceed 750 mm (30 in) provide regulator at both ends.
- .2 Manual Balancing Dampers:

- .1 Manufacturers:
 - .1 Nailor Industries Inc.
 - .2 T.A. Morrison & Co. Inc. "TAMCO"
 - .3 Greenheck Fan Corp.
 - .4 Ruskin Co.
 - .5 Alumavent
- .2 Manual Balancing Dampers: Flanged and drilled single or parallel blade, depending on damper size. Manual balancing dampers shall be constructed of the same material as the connecting ductwork. Dampers shall be supplied complete with hexagonal or square shaft extension through frame, blade linkage for multiple blade dampers, non-stick, corrosion resistant, synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers, and blade stops for single blade dampers to prevent blade rotation of more than 90 degrees. Provide dampers complete with hand locking quadrant operator. For insulated ducts provide quadrant operator with 50 mm (2 in) stand-off mounting.
- .3 Ducts 24 inch in width and larger or 4 square feet and larger to have opposed blade dampers.
- .4 Ducts smaller than 24 inch in width or smaller than 4 square feet to be single blade or opposed blade.
- .5 Multiple Rectangular Damper Section Assembly: Rectangular assembly shall be supplied with the dampers of the same material as the damper and designed for tight and secure mounting of the individual dampers.

2.15 Motorized Control Dampers

- .1 Manufacturers:
 - .1 Nailor Industries Inc.
 - .2 T.A. Morrison & Co. Inc. "TAMCO"
 - .3 Greenheck Fan Corp.
 - .4 Ruskin Co.
 - .5 Price Industries Inc.
 - .6 Alumavent
- .2 Low-Leakage Motorized Control Dampers: Low leakage rated and bearing AMCA 500-D certifications for air leakage, air performance and pressure drop. Opposed blade damper with linkage out of air stream.
 - .1 Frame:
 - .1 Hat channel shaped 1.62 mm (16 gauge) thick galvanized steel with mitered and welded corners.
 - .2 Flange to duct mount.
 - .2 Blades:
 - .1 Multiple 1.62 mm (16 gauge) thick galvanized steel blades arranged in an opposed blade design.
 - .2 Maximum blade width 150 mm (6 in). Blade seals shall be constructed of vinyl/PVC coated polyester, thermoplastic elastomer, silicone or dual durometer bulb type PVC.
 - .3 Thermally insulated, thermally broken, high density polyurethane insulation.
 - .3 Bearings: Moulded synthetic. Dampers in ducts with pressure class 750 Pa (3 in) or less shall have axels the full length of the damper blades and shall be equipped with bearings at both ends of the shaft. Provide thrust bearings at the end of every blade.
 - .4 Damper Motors: Modulating or Two position control
 - .5 Operating Temperatures: -32 deg C to 85 deg C (-25 deg F to 185 deg F)

- .3 Dampers in ductwork materials other than galvanized steel are to be as specified above, except constructed of 304 stainless steel.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer instructions.
- .2 Provide required ductwork, rectangular, round and/or flat oval.
- .3 Duct dimensions shown on drawings are clear internal dimensions. For lined ducts, maintain sizes inside lining.
- .4 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .5 Confirm routing of ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.
- .6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.
- .7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete without compromising fire rating of sprayed fireproofing.
- .8 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct.
- .9 Support round inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.
- .10 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.
- .11 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:
 - .1 ductwork outside building or otherwise exposed to the elements;
 - .2 fresh air intakes;
 - .3 wherever else shown.
- .12 Round exposed ductwork in Gymnasium is to be 1 metal gauge heavier than standard metal gauge for same size duct, and duct hangers are to be pairs of 9.5 mm ($\frac{3}{8}$ ") diameter hanger rods secured to 40 mm (1- $\frac{1}{2}$ ") wide #12 gauge galvanized steel split clamps around full circumference of duct at maximum 1.8 m (72") centres. Provide double nuts and lock washers on each hanger rod above and below each clamp.

- .13 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- .14 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .15 Open end ducts (OED) that do not have a grille/diffuser shall have a protective screen mounted in a suitable frame covering the inlet.
- .16 Connect diffusers or light troffer boots to low pressure ducts with 1.5 m (5 ft maximum length of flexible duct held in place with strap or clamp.
- .17 Isolate equipment with flexible connectors with finished fabric width greater than 4".
- .18 Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- .19 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- .20 Flange connect ductwork to motorized dampers, back draft dampers and hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .21 Frame and install motorized dampers. Unless otherwise shown, attached each motorized damper module to the channel framing.
- .22 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ductwork to NFPA 96. Provide minimum 200 x 200 mm (8 x 8 inch) size for hand access, 450 x 450 mm (18 x 18 inch) size for shoulder access, and as indicated. Review locations prior to fabrication.
- .23 Provide duct test holes where indicated and required for testing and balancing purposes.
- .24 Provide fire dampers at locations indicated and where ducts and outlets pass through fire rated components and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- .25 Demonstrate re-setting of fire dampers to Owner's representative.
- .26 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators with DuroDyne (or approved equivalent) neoprene 0.32" thick flexible connectors with finished fabric width not less than 100mm (4").
- .27 Use splitter dampers only where indicated.
- .28 Provide balancing dampers at all points on the supply and return systems where small ducts are taken from larger ones and opposed blade dampers in the main ducts for balancing purposes. Dampers shall be installed with operators.
- .29 Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- .30 Elbows tees or bends shall be made with an inside radius of not less than the width of the duct. Where space does not permit a radius at least equal to the radius of the duct, the turn shall be made square with turning vanes set in the elbow.
- .31 During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 Ductwork Fabrication

- .1 Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- .2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes.
- .3 Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fibre insulation.

- .4 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- .5 Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

3.3 Installation of Turning Vanes

- .1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.4 Duct Sealing

- .1 Duct joints for the supply systems shall be sealed with an approved fire retardant compound in an approved manner. Type GC tape shall not be used with sealed compound. All ductwork shall be proven airtight to SMACNA standards before ceilings are installed and ductwork covered.
- .2 Low pressure ducts shall be sealed to SMACNA/ASHRAE Class "B". All transverse joints and longitudinal seams.
- .3 Duct Seal Levels shall be as per the following Table 1 and Table 2:

Table 1: Minimum Duct Seal Levels ^(a)

Duct Location	Duct Type			
	Supply		Exhaust	Return
	< 2in. w.c. ^(b)	>2 in. w.c. ^(b)		
Outdoors	B	A	C	A
Unconditioned Spaces	B	A	C	B
Conditioned Spaces ^(c)	B	B	B	C

Notes:

- a) See Table 2: Definition of Duct Seal Levels.
- b) Duct design static pressure classification.
- c) Includes indirectly conditioned spaces such as return air plenums

Table 2: Definition of Duct Seal Levels

Seal Level	Sealing Requirements ^(a)
A	All transverse joints, longitudinal seams, and duct wall penetrations. Pressure-sensitive tape shall not be used as the primary sealant.
B	All transverse joints and longitudinal seams. Pressure-sensitive tape shall not be used as the primary sealant.
C	Transverse joints only.

Notes:

- a) Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod, or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

3.5 Cleaning

- .1 Temporarily cover all open ends of ducts during construction.
- .2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.

- .3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.
- .4 Provide cloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.
- .5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
 - .2 AMCA 211 – Product Rating Manual for Fan Air Performance
 - .3 AMCA 300 - Reverberant Room Method for Sound Testing of Fans
 - .4 AMCA 30 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data
 - .5 AMCA 99 - Standards Handbook
 - .6 NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
 - .7 UL 705 - Standard for Power Ventilators
- .3 Fan manufacturers are to be current members of the Air Movement and Control Association International Inc. (AMCA). Fans are to be rated for capacity and sound performance in accordance with applicable AMCA standards.
- .4 Each fan shall bear the AMCA Licensed Ratings Seal for Air and Sound Performance and shall be UL and CSA listed.

1.3 Submittals for Review

- .1 Provide data on fans, motors, and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements, product data sheets for all accessories, product data sheets for fan motors.
- .2 For VFD fans curves shall also indicate relevant part load operating points and minimum stable operating point for VFD operation.
- .3 Installation Data: Manufacturer's special installation requirements.
- .4 Supply copies of the fan/curb assembly shop drawings to trade who will form or cut openings in roof structure, and wall assemblies and ensure that openings are properly located and coordinated in the field.

1.4 Closeout Submittals

- .1 Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

Part 2 Products

2.1 Downblast Centrifugal Exhaust Fan

- .1 Manufacturers:
 - .1 Greenheck Fan Corp.
 - .2 Twin City Fan and Blower
 - .3 Loren Cook Co.
 - .4 PennBarry
 - .5 JencoFan
 - .6 Leader
 - .7 Carnes
- .2 General Description:
 - .1 Specified equal to Greenheck G/GB Series roof downblast centrifugal exhaust fan.
 - .2 Maximum continuous operating temperature 82 deg C (180 deg F)
 - .3 Each fan shall bear the AMCA Licensed Ratings Seal for Air and Sound Performance, and shall be UL and CSA listed.
- .3 Wheel:
 - .1 Constructed of aluminum.
 - .2 Non-overloading, backward inclined centrifugal.
 - .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05.
 - .4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
- .4 Motor:
 - .1 Refer to Specification Section 20 05 29 Electric Motors and Mechanical Wiring for motor requirements.
 - .2 Provide factory wired NEMA 4 disconnect switch.
- .5 Housing:
 - .1 Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum.
 - .2 Shroud shall have an integral rolled bead for extra strength.
 - .3 Shroud shall be drawn from a disc and direct air downward.
 - .4 Lower windband shall have a formed edge for added strength.
 - .5 Motor cover shall be drawn from a disc.
 - .6 All housing components shall have final thicknesses equal to or greater than preformed thickness.
 - .7 Curb cap shall have pre-punched mounting holes to ensure correct attachment.
 - .8 Rigid internal support structure.
 - .9 Leak proof.
- .6 Housing Supports and Drive Frame:
 - .1 Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
 - .2 Roof Curb: Provide prefabricated, minimum 300 mm (12 in) high heavy-duty aluminum roof mounting curb with factory installed wood nailer, 40 mm (1-1/2 in) insulation, continuously welded seams and damper tray.
 - .3 For fans as scheduled, provide factory supplied accessories as follows:
 - .4 gravity backdraft damper with #20 gauge galvanized steel frame and #26 gauge aluminum blades with felt edge blade seals;
 - .5 non-corrosive motorized damper with linkage, end switch, and motor with voltage to match fan motor;
 - .6 continuous non-corrosive piano type curb hinge to permit access to fan, damper and connecting duct, complete with retaining chain and a security hasp to

- prevent removal of unit from curb cap and prevent building entry through connecting ductwork;
- .7 Discharge sound levels for downblast centrifugal exhaust fans shall be in accordance with the schedules on the drawings.

2.2 Cabinet and Ceiling Exhaust Fans

- .1 Manufacturers:
 - .1 Broan- NuTone Canada Inc.
 - .2 Reversomatic
 - .3 Greenheck Fan Corp.
 - .4 Twin City Fan and Blower
 - .5 Loren Cook Co.
 - .6 Carnes
 - .7 PennBarry
- .2 General Description:
 - .1 Specified equal to Broan Losone Select Series
- .3 Blower:
 - .1 Polymeric, dynamically-balanced, direct drive centrifugal blower wheel. Blower shall be removable from housing unit.
 - .2 Low RPM for quiet operation.
 - .3 Permanently lubricated, thermally protected motor, designed for continuous operation and mounted on resilient anti-vibration mounts.
 - .4 Fans shall be provided with cord, plug, and receptacle inside the housing. Entire fan, motor and wheel assembly shall be removable.
 - .5 Fans shall have forward curved centrifugal wheel(s). Fan motors shall be multi-speed, positively cooled, have thermal overload protection, be suitably grounded, & mounted on vibration isolators.
- .4 Housing:
 - .1 1.01 mm (20 gauge) galvanized steel internally lined with minimum 13 mm (1/2 in) acoustic insulation.
 - .2 150 mm (6 in) round duct collar complete with gravity backdraft damper.
 - .3 Complete with adjustable mounting brackets. Suitable for installation in ceiling or wall.
- .5 Grille:
 - .1 Moulded white plastic or aluminum with baked white enamel finish as noted in Fan Schedule on Drawings.
- .6 Discharge sound levels for cabinet and ceiling exhaust fans shall be in accordance with the schedules on the drawings.

2.3 Square Inline Centrifugal Fans

- .1 Manufacturers:
 - .1 Greenheck Fan Corp.
 - .2 Twin City Fan and Blower
 - .3 Loren Cook Co.
 - .4 PennBarry
 - .5 JencoFan
 - .6 Leader
 - .7 Carnes
- .2 General Description:
 - .1 Specified equal to Greenheck SQ/BSQ Series square inline centrifugal fan.
 - .2 Maximum continuous operating temperature 82 deg C (180 deg F)

- .3 Each fan shall bear the AMCA Licensed Ratings Seal for Air and Sound Performance, and shall be UL and CSA listed.
- .3 Wheel:
 - .1 Constructed of aluminum.
 - .2 Non-overloading, backward inclined centrifugal.
 - .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05.
 - .4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
- .4 Motor:
 - .1 Refer to Specification Section 20 05 29 Electric Motors and Mechanical Wiring for motor requirements.
 - .2 Provide factory wired NEMA 4 disconnect switch.
- .5 Housing:
 - .1 Square design constructed of heavy gauge galvanized steel and shall include square mounting collars.
 - .2 Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and beating assembly.
- .6 Housing Supports and Drive Frame:
 - .1 Housing supports are constructed of structural steel with formed flanges.
 - .2 Drive frame shall be welded steel which supports the shaft and bearings and reinforcement for the housing.

Part 3 Execution

3.1 Installation

- .1 Install fans in accordance with manufacturer's installation and maintenance instructions.
- .2 Secure roof and wall exhausters with stainless steel lag screws to roof curb structure.
- .3 Install flexible connections between fan inlet and ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm (1 inch) flex between ductwork and fan while running.
- .4 Provide sheaves required for final air balance.
- .5 Install backdraft dampers and motorized dampers on inlet to roof and wall exhausters.
- .6 Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.
- .7 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.
- .8 Provide vibration isolators.
- .9 Provide access door in ductwork to allow servicing of motor, damper and fan blade.

3.2 Operational Test

- .1 The Mechanical Contractor, in cooperation with the other divisions and manufacturers shall be prepared to conduct a full operational test of the ventilating, and air conditioning systems in the presence of the Engineer. They shall be required to be in attendance as long as necessary, and shall be prepared to make any necessary adjustments and corrections at their own expense to make the systems operational as designated by the Engineer.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 ANSI/AHRI Standard 880, Performance Rating of Air Terminals;
 - .2 AMCA 210-Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
 - .3 AMCA 30-Methods for Calculating Fan Sound Ratings from Laboratory Test Data
- .3 Air terminals manufacturers are to be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI), and terminals are to be in accordance with requirements of following standards:
- .4 Each terminal shall bear the AHRI/AMCA Licensed Ratings Seal for Air and Sound Performance and shall be UL and CSA listed.

1.3 Submittals for Review

- .1 Provide data on fans, motors, and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements, product data sheets for all accessories, product data sheets for fan motors.
- .2 Include following:
 - .1 capacity and pressure drop
 - .2 sound power data to verify conformance with specified sound power levels
 - .3 leakage and dimensions
 - .4 mounting details to suit locations shown, indicating methods and hardware to be used
 - .5 control components and a control wiring schematic.

1.4 Closeout Submittals

- .1 Maintenance Data: Start-up reports.

Part 2 Products

2.1 Fan Powered Variable Air Volume Terminal Boxes (FB)

- .1 Provide variable air volume, pressure independent, fan powered boxes in accordance with drawing schedule, complete with a return air fan section, individually field adjustable to minimum and maximum air volumes, and complete with:
 - .1 #22 gauge galvanized steel housing, sealed and gasketed, internally lined with 25 mm (1") thick glass fibre duct lining material with a neoprene coating meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with:
 - .1 exposed cut edges of the liner material factory coated with NFPA 90A and CAN/ULC S102 approved sealant;
 - .2 50 mm (2") long, round inlet duct connection;
 - .3 rectangular discharge opening with slip and drive cleat duct connection
 - .4 protective galvanized steel shroud for controller and damper actuator.
 - .5 removable bottom access panel;
 - .6 duct connection collar, and a backdraft damper;
 - .7 direct connected fan-motor assembly, resiliently mounted, and consisting of an overload protected permanent split capacitor motor and a centrifugal, steel, dynamically balanced blower wheel with forward curved blades;
 - .8 ECM motor.
 - .2 air valve damper, normally open, galvanized steel blade with peripheral gasket, pivoting in self-lubricating bearings and with air leakage past a closed damper of 2% or less of rated capacity at 750 Pa (3" wc) inlet static pressure;
 - .3 air flow sensor located at box inlet, complete with gauge taps, multiple pressure sensing ports, and an averaging chamber designed to accurately average the flow across the inlet of box with an accuracy of within 5% with a 90° sheet metal elbow located directly at inlet, and amplify the sensed air flow signal;
 - .4 controller/actuator supplied as part of controls work specified in Section entitled Automatic Control Systems, shipped to box manufacturer's plant by controls supplier, and factory installed, connected, tested, calibrated and set by box manufacturer;
- .2 Galvanized steel attenuators lined as per box housings.
- .3 For boxes as scheduled, factory tested hot water reheat coils in accordance with drawing schedule, each complete with copper tubes mechanically expanded into plate type aluminum fins, factory mounted in an enclosure insulated with foil faced insulation meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with a quick-opening insulated access panel sized and located for coil inspection and maintenance.
- .4 Filters: MERV 8 inlet filter
- .5 Terminal box to be complete with attenuator or lined discharge duct in place. Maximum sound power levels in decibels and specific static pressure are scheduled on drawings for each size of box.
- .6 Equip boxes with factory secured seismic restraint connection hardware.
- .7 Acceptable manufacturers:
 - .1 Trane
 - .2 Price Industries Inc.
 - .3 Metalaire
 - .4 Titus
 - .5 Nailor Industries Inc.
 - .6 Krueger

2.2 Variable Air Volume Terminal Units (VAV)

- .1 Provide single duct, controller type, pressure independent variable air volume boxes in accordance with drawing schedule, each individually field adjustable to minimum and maximum air volumes, and complete with:
 - .1 #22 gauge galvanized steel housing, sealed and gasketed, internally lined with 25 mm (1") thick glass fibre duct lining material with a neoprene coating meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with:
 - .1 exposed cut edges of the liner material factory coated with NFPA 90A and CAN/ULC S102 approved sealant;
 - .2 50 mm (2") long, round inlet duct connection;
 - .3 rectangular discharge opening with slip and drive cleat duct connection
 - .4 protective galvanized steel shroud for controller and damper actuator.
 - .2 air valve damper, normally open, galvanized steel blade with peripheral gasket, pivoting in self-lubricating bearings and with air leakage past a closed damper of 2% or less of rated capacity at 750 Pa (3" wc) inlet static pressure;
 - .3 air flow sensor located at box inlet, complete with gauge taps, multiple pressure sensing ports, and an averaging chamber designed to accurately average the flow across the inlet of box with an accuracy of within 5% with a 90° sheet metal elbow located directly at inlet, and amplify the sensed air flow signal;
 - .4 controller/actuator supplied as part of controls work specified in Section entitled Automatic Control Systems, shipped to box manufacturer's plant by controls supplier, and factory installed, connected, tested, calibrated and set by box manufacturer;
 - .5 galvanized steel attenuators, lined as per box housings, each factory supplied loose and with a length in accordance with drawing schedule;
 - .6 Terminal box to be complete with attenuator or lined discharge duct in place. Maximum sound power levels in decibels and specific static pressure are scheduled on drawings for each size of box.
- .2 Acceptable manufacturers:
 - .1 Trane
 - .2 Price Industries Inc.
 - .3 Metalaire
 - .4 Titus
 - .5 Nailor Industries Inc.
 - .6 Krueger

Part 3 Execution

3.1 Installation

- .1 Install air terminal units in accordance with manufacturer's installation and maintenance instructions.
- .2 Secure each air terminal unit in place from structure with hanger rods and independent of connecting ductwork.
- .3 Where Seismic Control and Restraint is required, brace and secure each unit in accordance with requirements specified in by Seismic Control and Restraint.
- .4 Coordinate provision of transformers, actuators, and controllers with Controls Contractor.
- .5 Connect each box with ductwork as indicated. Provide straight inlet duct same size as box inlet and of a length equal to a minimum of 4 duct diameters.

3.2 Operational Test

- .1 The Mechanical Contractor, in cooperation with the other divisions and manufacturers shall be prepared to conduct a full operational test of the ventilating, and air conditioning systems in the presence of the Engineer. They shall be required to be in attendance as long as necessary and shall be prepared to make any necessary adjustments and corrections at their own expense to make the systems operational as designated by the Engineer.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 - .2 NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
 - .3 ASHRAE 52 - Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
 - .4 ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets
 - .5 AMCA 500 - Test Method for Louvers, Dampers and Shutters
 - .6 ARI 890 - Rating of Air Diffusers and Air Diffuser Assemblies
 - .7 SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- .3 Products of This Section: Manufactured to ISO certification requirements.
- .4 Test and rate louver performance to AMCA 500.
- .5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.3 Submittals for Review

- .1 Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 Submittals for Closeout

- .1 Record Documentation: Record actual locations of air outlets and inlets.

1.5 Rectangular Ceiling Diffusers

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: Square and rectangular, multi-louvered Square, stamped, multi-core, adjustable pattern diffuser to discharge air in three-way four-way two-way one-way 360 degree pattern with sectorizing baffles where indicated.
- .3 Frame: Spline Inverted T-bar Snap-in Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
- .4 Fabrication: Steel Aluminum with baked enamel off-white finish.

- .5 Accessories: Combination splitter Butterfly Radial opposed blade damper and multi-louvred equalizing grid with damper adjustable from diffuser face.

1.6 Ceiling Supply Registers/Grilles

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way one-way deflection.
- .3 Frame: 25 mm (1 inch) 32 mm (1-1/4 inch) margin with concealed countersunk screw mounting and gasket.
- .4 Fabrication: Aluminum extrusions with factory off-white enamel clear lacquer prime coat finish.
- .5 Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

1.7 Ceiling Exhaust and Return Registers/Grilles

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: Streamlined blades, 19 mm (3/4 inch) minimum depth, 19 mm (3/4 inch) maximum spacing, with blades set at 45 degrees, horizontal vertical face.
- .3 Frame: 32 mm (1-1/4 inch) 25 mm (1 inch) margin with countersunk screw concealed mounting.
- .4 Fabrication: Steel with 0.90 mm (20 gauge) minimum frames and 0.80 mm (22 gauge) minimum blades, steel and aluminum with 0.90 mm (20 gauge) minimum frame, or aluminum extrusions, with factory off-white enamel prime coated clear lacquer baked enamel finish colour to be selected.
- .5 Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.
- .6 Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

1.8 Grid Core Exhaust and Return Registers/Grilles

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: Fixed grilles of 13 x 13 x 13 mm (1/2 x 1/2 x 1/2 inch) 25 x 25 x 25 mm (1 x 1 x 1 inch) 13 x 13 x 25 mm (1/2 x 1/2 x 1 inch) louvres.
- .3 Fabrication: Aluminum baked enamel clear lacquer finish Polystyrene with chrome off-white finish Acrylic plastic off-white chrome finish.
- .4 Frame: 32 mm (1-1/4 inch) 25 mm (1 inch) margin with countersunk screw mounting concealed mounting.
- .5 Frame: Channel lay-in frame for suspended grid ceilings.
- .6 Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

1.9 Ceiling Linear Exhaust and Return Grilles

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: Streamlined blades with 90 degree two-way one-way deflection, 3.2 x 19 mm (1/8 x 3/4 inch) on 13 mm (1/2 inch) 6 mm (1/4 inch) centres.
- .3 Frame: 25 mm (1 inch) 32 mm (1-1/4 inch) margin, extra heavy for floor mounting with concealed countersunk screw mounting.
- .4 Fabrication: Steel with 0.90 mm (20 gauge) minimum frames and 0.80 mm (22 gauge) minimum blades, steel and aluminum with 0.90 mm (20 gauge) minimum frame, or aluminum extrusions, with factory off-white enamel clear lacquer prime coated baked enamel finish colour to be selected.

- .5 Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

1.10 Wall Supply/Exhaust Registers/Grilles

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: Streamlined and individually adjustable blades, 19 mm (3/4 inch) minimum depth, 19 mm (3/4 inch) maximum spacing with spring or other device to set blades, horizontal vertical face, double single deflection.
- .3 Frame: 32 mm (1-1/4 inch) 25 mm (1 inch) margin with concealed countersunk screw mounting and gasket.
- .4 Fabrication: Steel with 0.90 mm (20 gauge) minimum frames and 0.80 mm (22 gauge) minimum blades, steel and aluminum with 0.90 mm (20 gauge) minimum frame, or aluminum extrusions, with factory clear lacquer off-white enamel baked enamel prime coat finish colour to be selected.
- .5 Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.
- .6 Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

1.11 Door Grilles

- .1 Manufacturers: Price, Titus, Kreuger, Metal Aire, Nailor
- .2 Type: V-shaped louvres of 0.90 mm (20 gauge) thick steel, 25 mm (one inch) deep on 13 mm (1/2 inch) centres.
- .3 Frame: 0.90 mm (20 gauge) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

1.12 Gravity Hoods

- .1 Manufacturers: Greenheck, Price, Titus, Ventex
- .2 Fabricate air inlet or exhaust hoods to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Fabricate of aluminum, minimum 1.50 mm (16 gauge) base and 1.20 mm (18 gauge) hood; suitably reinforced; with removable hood; birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake, and factory prime coat baked enamel finish.
- .4 Fabricate roof hoods with mitred corners and reinforce with structural angles.
- .5 Mount unit on minimum 300 mm (12 inch) high curb base with insulation between duct and curb.
- .6 Make hood outlet area minimum of twice throat area.

1.13 Wall Boxes - Exhaust

- .1 Supply and install exhaust wall boxes for sidewall exhausting. Provide single, double or triple wall box, as appropriate to match grouped exhaust terminations complete with top baffle, backdraft damper and extruded aluminum grille. Water shall drain from box and not penetrate the building.
- .2 Colour: To match exterior.
- .3 Manufacturer: Reversomatic Htg & Mrg. Ltd. model Quiet Leakproof.

Part 2 Execution

2.1 Installation

- .1 Install to manufacturer's instructions.
- .2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- .3 Install diffusers to duct work with air tight connection.
- .4 Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- .5 Paint ductwork visible behind air outlets and inlets matte black.
- .6 Position of all diffusers and grilles shown on the drawings are approximate only and the contractor shall check the location of each outlet with the Architect and shall make any adjustments in position as are necessary to ensure they conform with Architectural features of the rooms and the outlets required by other trades without extra charge.
- .7 Standard lay-in diffuser shall be installed with hard 90 degree elbow connected to diffuser neck. A length of flexible duct may be then connected to this 90 degree elbow.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - .2 ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
 - .3 ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
 - .4 AHRI Compliance: Boilers shall be AHRI listed and must meet the minimum efficiency specified under AHRI BTS-2000 as defined by Department of Energy in 10 CFR Part 431.
 - .5 ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US and Canada.
 - .6 CSA Compliant: Boilers shall be compliant with CSA certification.

1.3 Equipment Certification Labels

- .1 ASME labeling.

1.4 Submittals for Review

- .1 Product Data:
 - .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
 - .2 Wiring Diagrams: Power, signal, and control wiring.
 - .3 Source quality-control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.
 - .4 Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.
 - .5 Warranty.
- .2 Shop Drawings: Indicate assembly, individual sections, shipping splits, dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- .3 Installation Data: Manufacturer's special installation requirements.

1.5 Closeout Submittals

- .1 Operation and Maintenance Data: Include instructions for maintenance, emergency and repair.
- .2 Start-up report by Boiler manufacturer or factory-authorized agent.

1.6 Delivery, Storage, And Protection

- .1 Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- .2 Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- .3 Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 Environmental Requirements

- .1 Ambient Conditions: Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8 Warranty

- .1 Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
- .2 Warranty Period for Fire-Tube Condensing Boilers:
 - .1 Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and failure due to thermal shock.
 - .2 All other components shall carry a one year warranty from date of boiler start up.

Part 2 Products (Tags: B1, B2)

2.1 Acceptable Manufacturers

- .1 Basis of Design:
 - .1 Lochinvar Crest
- .2 Acceptable Alternates:
 - .1

2.2 General Description

- .1 Description: Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.
- .2 Heat Exchanger: The heater exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel and of fire tube design. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.
- .3 Efficiency: Boilers shall have an AHRI certified minimum thermal efficiency of 97 percent.

- .4 Condensate Collection Basin: Fully welded 316L stainless steel and shall include a stainless steel combustion analyzer test port.
- .5 Intake Filter and Dirty Filter Switch: Boiler shall include an intake air filter with a factory installed air pressure switch. The pressure switch will alert the end user on the screen of the boiler that the intake filter is dirty and needs to be changed.
- .6 Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop.
- .7 Burner: Natural gas, forced draft single burner premix design with an upper and lower chamber supplied by individual combustion systems. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency. The burner shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet requirements of South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.2 (FB1500-FB2000), San Diego Air Control Pollution District as compliant with Regulation 69.2.1 (FB1500-FB5000), Bay Area Quality Management District as compliant with Regulation 9 Rule 7 (FB1500-FB5000) and Texas Commission on Environmental Quality (FB1500-FB2000) as being compliant with Section 117.465.
- .8 Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.
- .9 Gas Train: The boiler shall be supplied with a negative pressure regulation gas train and shall be capable of the following minimum turndowns.
- .10 Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
- .11 Casing:
 - .1 Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.
 - .2 Control Compartment Enclosures: NEMA 250, Type 1A.
 - .3 Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
 - .4 Combustion-Air Connections: Inlet and vent duct collars.

2.3 Trim

- .1 Provide boiler complete with the following accessories and trim:
 - .1 Safety relief valve.
 - .2 Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.
 - .3 Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.
 - .4 Low-Water cutoff switch.
 - .5 Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.4 Controls

- .1 Boiler controls shall feature a standard, factory installed multi-color graphic LCD screen display with navigation dial and includes the following standard features:
 - .1 Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 20 degrees F and a maximum temperature rise of 60 degrees F.

- .2 Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.
- .3 Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
- .4 Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
- .5 Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
- .6 Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
- .7 PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.
- .8 Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
- .9 Maintenance reminder: Boiler shall have the ability to display a yellow colored, customizable maintenance notification screen. All notifications are adjustable by the installer based upon months of installation, hours of operation, and number of boiler cycles.
- .10 English Error codes: Boiler shall have a user interface that displays a red error screen with fault codes that are displayed in English and include a date and time stamp for ease of servicing.
- .11 Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
- .12 Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.
- .13 Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.
- .14 BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.
- .15 Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, space heat run hours, domestic hot water run hours and ignition attempts. All data should be visible on the boiler screen.
- .2 The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include:
 - .1 Lead lag:
 - .2 Efficiency optimization: The Control module shall allow multiple boilers to fire at minimum firing rate in lieu of Lead/Lag.
 - .3 Front end loading:
 - .4 Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.
- .3 Boiler operating controls shall include the following devices and features:

- .1 Set-Point Adjust: Set points shall be adjustable.
- .2 Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
- .3 Sequence of Operation: Electric, factory-fabricated and factory-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.
- .4 High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
- .5 Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
- .6 Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
- .7 High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
- .8 Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
- .9 Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.
- .4 Building Automation System Interface:
 - .1 Boiler shall have the ability to receive a 0-10V signal from a building management system and control by the following:
 - .2 0-10V DC input to control Modulation or Setpoint
 - .3 0-10V DC input from Variable speed Boiler pump
 - .4 0-10V DC output signal to a Variable speed system pump
 - .5 0-10V DC input Enable/Disable signal

2.5 Electrical Power

- .1 Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

2.6 Venting

- .1 Exhaust flue must be Category IV approved stainless steel double wall insulated sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.
- .2 Intake piping must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.
- .3 Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.
- .4 Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.

- .2 Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
- .3 Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Boiler Installation

- .1 Install equipment on 4" concrete housekeeping pad.
- .2 Install gas-fired boilers according to NFPA 54.
- .3 Assemble and install boiler trim.
- .4 Install electrical devices furnished with boiler but not specified to be factory mounted.
- .5 Install control wiring to field-mounted electrical devices.

3.3 Connections

- .1 Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems
- .2 Install boilers level on concrete bases.
- .3 Install piping adjacent to boiler to allow service and maintenance.
- .4 Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- .5 Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.
- .6 Connect hot-water piping to supply and return boiler tapings with shutoff valve and union or flange at each connection.
- .7 Install piping from safety relief valves to nearest floor drain.
- .8 Boiler Venting: Install Stainless Steel double wall insulated flue venting and pvc/polypropylene combustion-air intake.
- .9 Connect wiring according to Division 26.

3.4 Field Quality Control

- .1 Perform tests and inspections and prepare test reports.
- .2 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- .3 Tests and Inspections:
 - .1 Perform installation and start-up checks according to manufacturer's written instructions. Complete start-up form included with Boiler and return to Manufacturer as described in the instructions.
 - .2 Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - .3 Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - .4 Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
 - .5 Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 Demonstration

- .1 Engage a factory representative or a factory-authorized service representative for boiler start-up. Start-up sheet shall be completed and a copy shall be sent to the Engineer and the Manufacturer. A combustion analysis shall be completed and the gas valve adjusted per the Installation and Operations manual and note in start-up report.
- .2 Factory representative or a factory-authorized representative shall provide Owners training to instruct maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specification and specification to be used in conjunction with the project specifications include, but are not limited to:
 - .1 AHRI 550/590 (I-P)- Performance Rating of Water Chilling Packages Using the Vapor Compression Cycle
 - .2 CSA-B52 - Mechanical Refrigeration Code
 - .3 CSA (Canadian Standards Association)
 - .4 UL (Underwriters Laboratories Inc.)
 - .5 Comply applicable Standards and Codes of Air-Conditioning, Heating & Refrigeration Institute (AHRI) 550 / 590
 - .6 AHRI 370 - Standard for Sound Rating of Large outdoor Refrigerating and Air-conditioning Equipment
 - .7 Comply with the most recent versions of applicable Standards and Codes of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 - .8 Units shall meet the efficiency standards of ASHRAE 90.1
 - .9 Manufacturer facility to be International Organization for Standardization (ISO) 9001
 - .10 UL 60335-2-40 - Standard for HVAC equipment for safety requirements

1.3 Submittals for Review

- .1 Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.

1.4 Closeout Submittals

- .1 Maintenance Contracts: Provide service and maintenance of complete assembly for one (1) year from Date of Substantial Completion.
- .2 Warranty Documentation.
- .3 Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

1.5 Warranty

- .1 Provide a full parts and labour warranty for one year from start-up or 18 months from shipment, whichever occurs first.
- .2 Provide a 5-year compressor warranty.

1.6 Delivery, Handling and Storage

- .1 Comply with manufacturer's installation instructions for rigging, unloading, and transporting chillers.

Part 2 Products

2.1 Acceptable Manufacturers

- .1 Basis of Design:
 - .1 Trane Model CGAM
- .2 Acceptable Alternates:
 - .1 Carrier
 - .2 Daikin
 - .3 York
 - .4 Engineered Air

2.2 Manufactured Units

- .1 Provide factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the package shall be all factory wiring, piping, controls, and refrigerant charge (R454B).

2.3 Chiller Operation

- .1 Chiller shall be capable of operating with a leaving solution temperature range 42°F to 65°F (5.6°C to 20°C) with glycol.
- .2 Chiller shall be capable of starting up with 95°F (35°C) entering fluid temperature to the evaporator. Maximum water temperature that can be circulated with the Chiller not operating is 125°F (52°C).
- .3 Chiller shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
- .4 The Chiller shall be capable of starting in 85 seconds after power restoration and be able to attain 80% load in less than 150 seconds after power restoration.
- .5 Chiller shall be able to operate within 4 feet of a solid wall and/or 8 feet between two chillers side by side.
- .6 Chiller shall be able to operate with a 2 minute loop time for comfort cooling applications.

2.4 Compressors

- .1 Construct chiller using fully hermetic scroll type compressors with R454B optimized and dedicated scroll profile. Refrigerant shall have a GWP of less than 600.
- .2 Provide direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber that leads to increased efficiency.
- .3 Each compressor shall have overload protection internal to the compressor.
- .4 Each compressor shall include: centrifugal oil pump, oil level sight glass and oil charging valve.
- .5 Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

2.5 Evaporator

- .1 The evaporator shall be a high efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.
- .2 The water side working pressure shall be rated at 150 psig (10.3 bar) and tested at 1.5 times maximum allowable water side working pressure.
- .3 The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.
- .4 Insulate the evaporator with a minimum of 0.75 inch (K=0.28) UV rated insulation.
- .5 Evaporator heaters shall be factory installed and shall protect chiller down to -20°F (-29°C). Contractor shall wire separate power to energize heat tape and protect evaporator while chiller is disconnected from the main power.
- .6 Provide water drain connection, vent and fittings. Factory installed leaving water temperature control and low temperature cutout sensors.
- .7 Water connections shall be grooved pipe.
- .8 Proof of flow shall be provided by the equipment manufacturer, mechanically installed and electrically wired, at the factory of origin.
- .9 Factory installed cleanable strainer.

2.6 Fans

- .1 Low sound fans shall be dynamically balanced and direct driven.
- .2 All condenser fan TEAO motors have permanently lubricated ball bearings and external overload protection.

2.7 Condenser

- .1 The condenser coils shall consist of copper tubes mechanically bonded into plate-type aluminum fins. A subcooling coil shall be an integral part of the main condenser coil.
- .2 The condenser coils shall have an integral sub-cooling circuit and shall be designed for at least 650 psig (44.8 bar) working pressure. Leak tested at 650 psig (44.8 bar).

2.8 Enclosures / Chiller Construction

- .1 Units shall be constructed of a galvanized steel frame with galvanized steel panels and access doors.
- .2 Chiller panels, base rails and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays.
- .3 Mount starters and Terminal Blocks in a UL 60335-2-40 rated weatherproof panel provided with full opening access doors.
- .4 The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B117.

2.9 Unit Electrical

- .1 The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.
- .2 Unit shall have a single point power connection.
- .3 A control power transformer shall be factory-installed and factory-wired to provide unit control power.
- .4 Control panel shall be dead front construction for enhanced service technician safety.
- .5 Unit wiring shall run in liquid-tight conduit.

- .6 A molded case standard interrupting capacity circuit breaker shall be factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, making it available to disconnect the chiller from main power.
- .7 High short circuit current rating (SCCR) with selection of high fault protection device.

2.10 Refrigerant Circuit

- .1 Chillers shall have 2 refrigeration circuits, each with two (manifolded) compressors on each circuit.
- .2 Provide for refrigerant circuit:
 - .1 Liquid line shutoff valve
 - .2 Discharge service valve
 - .3 Filter
 - .4 Liquid line sight glass.
 - .5 Electronic expansion valve sized for maximum operating pressure
 - .6 Charging valve
- .3 Full operating charge of R454B and oil.

2.11 Controls

- .1 Factory-mounted to the control panel door, the operator interface has a 7 inch LCD touch-screen display
- .2 Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor, evaporator, and motor information as well as associated diagnostics.
- .3 The chiller control panel shall provide password protection of all set-points
- .4 Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer.
- .5 The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
 - .1 Run time.
 - .2 Number of starts.
 - .3 Current chiller operating mode.
 - .4 Chilled water set point and set point source.
 - .5 Electrical current limit set point and set point source.
 - .6 Entering and leaving evaporator water temperatures.
 - .7 Saturated evaporator and condenser refrigerant temperatures.
 - .8 Evaporator and condenser refrigerant pressure.
 - .9 Differential oil pressure.
 - .10 Phase reversal/unbalance/single phasing and over/under voltage protection.
 - .11 Low chilled water temperature protection.
 - .12 High and low refrigerant pressure protection.
 - .13 Load limit thermostat to limit compressor loading on high return water temperature.
 - .14 Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize chiller efficiency.
 - .15 Display diagnostics.
 - .16 Compressors: Status (on/off), %RLA, anti-short cycle timer, and automatic compressor lead-lag.
- .6 On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer.

- .7 The chiller controller shall utilize a microprocessor that will automatically take action to prevent chiller shutdown due to abnormal operating conditions associated with: evaporator refrigerant temperature, high condensing pressure and motor current overload.
- .8 Provide the following safety controls with indicating lights or diagnostic readouts.
 - .1 Low chilled water temperature protection.
 - .2 High refrigerant pressure.
 - .3 Loss of chilled water flow.
 - .4 Contact for remote emergency shutdown.
 - .5 Motor current overload.
 - .6 Phase reversal/unbalance/single phasing.
 - .7 Over/under voltage.
 - .8 Failure of water temperature sensor used by controller.
 - .9 Compressor status (on or off).
- .9 Provide the following operating controls:
 - .1 A variable method to control capacity in order to maintain leaving chilled water temperature based on PI algorithms. Five minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes. If a greater than 5 minute start-to-start, or greater than 2 minute stop-to-start timer is included, hot gas bypass shall be provided to insure accurate chilled water temperature control in light load applications.
 - .2 Chilled water pump output relay that closes when the chiller is given a signal to start.
 - .3 Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance trip outs.
 - .4 High ambient unloader pressure controller that unloads compressors to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.
 - .5 Compressor current sensing unloader chiller that unloads compressors to help prevent current overload nuisance trip outs.
 - .6 Low ambient lockout control with adjustable setpoint.
 - .7 Condenser fan sequencing which adjusts the speed of all fans automatically in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing chiller efficiency.
- .10 Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
 - .1 Leaving chilled water setpoint adjustment from LCD input
 - .2 Entering and leaving chilled water temperature output
 - .3 Pressure output of condenser
 - .4 Pressure output of evaporator
 - .5 Ambient temperature output
 - .6 Voltage output
 - .7 Current limit setpoint adjustment from LCD input.
- .11 The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.
- .12 Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring.
- .13 The controller shall be capable of controlling chiller in variable applications. At flow rate changes of 10% or less per minute, controller shall maintain leaving temperature control of +/-2degF). At flow rate changes of up to 30% or less per minutes, chiller shall stay online.

2.12 Sound

- .1 Acoustics: Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided at full load.
- .2 Provide acoustical treatment for compressor(s).

Acoustical Performance

Chiller CH1 Acoustics									
Sound Power									
	63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz	Overall A-Wtd (dBA)
Full Load Cooling (100%)	85	86	90	91	87	81	77	68	91
Half Load Cooling (50%)	84	85	86	89	84	80	77	68	-
Sound Pressure at 10 meters									
	63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Full Load Cooling (100%)	58	60	63	65	60	54	50	42	
Half Load Cooling (50%)	57	59	59	63	58	54	50	42	

2.13 Accessories

- .1 Chiller shall have full architectural louvers panels.
- .2 Chiller shall ship with elastomeric isolators

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Level the chiller using the base rail as a reference. The chiller must be level within 1/2" in over the entire length and width. Use shims as necessary to level the chiller.
- .3 Align chiller package on steel or concrete foundations.
- .4 Install units on isolators.
- .5 Connect to chilled water piping.
 - .1 On inlet, provide:
 - .1 Thermometer well for temperature controller.
 - .2 Thermometer well for temperature limit controller.
 - .3 Flexible pipe connector.
 - .4 Shut-off valve.
 - .2 On outlet, provide:
 - .1 Flexible pipe connector.
 - .2 Shut-off Balancing valve.
- .6 Arrange piping for easy dismantling to permit heat exchanger cleaning.

3.2 Manufacturer's Field Services

- .1 OEM Startup is performed by factory trained and authorized servicing technicians confirming equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty.

3.3 Closeout Activities

- .1 Demonstrate system operation and verify specified performance.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 AHRI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment
 - .2 AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils
 - .3 AHRI 430 – Performance Rating of Central-Station Air-Handling Unit Supply Fans
 - .4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
 - .5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - .6 AMCA 301- Methods for Calculating Fan Sound Ratings from Laboratory Test Data
 - .7 AMCA 500-D - Laboratory Methods of Testing Dampers for Rating
 - .8 AMCA 500-L - Laboratory Methods of Testing Louvers for Rating
 - .9 AMCA 611 – Methods for Testing Airflow Measurement Stations for Rating
 - .10 AMCA 99 - Standards Handbook
 - .11 ASHRAE 52.1/52.2 – Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size
 - .12 ASHRAE 62 – Ventilation for Acceptable Indoor Air Quality
 - .13 ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
 - .14 NFPA 90A – Standard for Installation of Air-Conditioning and Ventilation Systems
 - .15 NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
 - .16 UL 1995 – Standard for Safety for Heating and Cooling Equipment
 - .17 UL 900 – Standard for Air Filter Units
 - .18 SMACNA – HVAC Duct Construction Standards – Metal and Flexible

1.3 Equipment Certification Labels

- .1 Air Coils: Certify capacities, pressure drops and selection procedures in accordance with current AHRI Standard 410. Units shall be provided with certification label affixed to the unit.
- .2 Air handling units with fan sections utilizing single fans shall be rated and certified in accordance with AHRI Standard 430. Units shall be provided with certification label affixed to the unit.

- .3 Airflow monitoring station: Certify airflow measurement station performance in accordance with AMCA 611. Airflow measurement stations shall be provided with certification label affixed to the measurement station.
- .4 Unit shall be manufactured to conform to UL 1995 and shall be listed by either UL/CUL or ETL. Units shall be provided with listing agency label affixed to the unit.

1.4 Submittals for Review

- .1 Product Data:
 - .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
 - .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
 - .3 Provide fan curves with specified operating point clearly plotted. For VFD fans curves shall also indicate relevant part load operating points and minimum stable operating point for VFD operation.
 - .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
 - .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
 - .6 Sound data shall be provided using AHRI 260 test methods. Unit discharge, inlet, and radiated sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000 and 8000Hz.
- .2 Shop Drawings: Indicate assembly, individual sections, shipping splits, dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- .3 Installation Data: Manufacturer's special installation requirements.

1.5 Closeout Submittals

- .1 Operation and Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.6 Maintenance Material Submittals

- .1 Extra Stock Materials: Provide one set of filters for each air handling unit

1.7 Delivery, Storage, And Protection

- .1 Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- .2 Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- .3 Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.8 Environmental Requirements

- .1 Ambient Conditions: Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.9 Warranty

- .1 AHU manufacturer shall provide, at no additional cost, a standard parts and labour warranty that covers a period of one year from unit start-up or 18 months from shipment, whichever occurs first. This warrants that all products are free from defects in material and workmanship and shall meet the capacities and ratings set forth in the equipment manufacturer's catalog and bulletins.

Part 2 Products (AH1, AH2, AH3, AH4)

2.1 Acceptable Manufacturers

- .1 Basis of Design:
 - .1 Trane – “Performance Climate Changer”
- .2 Acceptable Alternates:
 - .1 Carrier – “Aero” 39MN
 - .2 Johnson Controls – York “Solution”
 - .3 Daikin – “Vision”
 - .4 Eng Air

2.2 General Description

- .1 Configuration: Fabricate with fan and coil sections plus accessories, including:
 - .1 Heating coil.
 - .2 Cooling coil.
 - .3 Mixing box section(s).
 - .4 Combination filter/mixing box section.
 - .5 Dampers and damper actuators.
 - .6 Return plenum fans
 - .7 Supply plenum fans
 - .8 Airflow monitoring stations.
 - .9 Variable frequency drives.
 - .10 Starters
 - .11 Fused Disconnects
 - .12 Energy Recovery Wheel
 - .13 Filtration
- .2 Unit layout and configuration shall be as defined in project plans and equipment schedules.

2.3 Unit Casing

- .1 Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. Removable panels shall be gasketed. Doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.
- .2 Casing air leakage shall not exceed 1% of design airflow at 1.25 times the specified design static pressure, or a maximum of +/- 2 kPa (8 in). Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.

- .3 Under 12.8 deg C (55 deg F) supply air temperature and design conditions on the exterior of the unit of 27.2 deg C (81deg F) dry bulb and 22.8 deg C (73 deg F) wet bulb, condensation shall not form on the casing exterior.
- .4 Provide full perimeter galvanized steel integral base frame to support and raise all sections of the unit for proper trapping.
- .5 Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or +/- 2 kPa (8 in) whichever is less stringent, and shall not exceed 0.0042 per inch of panel span (L/240).
- .6 Floor panels shall be double-wall construction and designed to support a 300-lb load during maintenance activities and shall deflect no more than 0.0042 per inch of panel span.
- .7 Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.
- .8 Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 0.23 K*m/W (13 Hr*Ft²*F/BTU).
- .9 Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.
- .10 Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
- .11 Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
- .12 Traction enhancements shall be applied to the unit floor to improve the walking surface in those unit sections where the floor is fully accessible, and not impeded by internal structural or functional features.

2.4 Access Doors

- .1 Access sections shall be provided to allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual.
- .2 Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
- .3 Doors shall be provided with a thermal break construction of door panel and door frame.
- .4 Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
- .5 Door hardware and hinges shall be stainless or galvanized steel and shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
- .6 Handle hardware shall be designed to prevent unintended closure.
- .7 Access doors shall be hinged and removable without the use of specialized tools.
- .8 Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
- .9 Doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.
- .10 Provide thermal pane reinforced glass viewing windows in the access doors and panels unit access sections, sections before and after heat wheels, fan sections.

2.5 Drain Pans

- .1 Cooling coil sections shall be provided with an insulated, double-wall, stainless steel primary drain pan.

- .2 Drain pans shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements.
- .3 Drain connections shall be of the same material as the primary drain pan and shall have threaded connections that extend beyond the base to ensure adequate room for field piping of condensate traps.
- .4 Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.

2.6 Fans

- .1 Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components.
- .2 Provide fans of drive type, style, arrangement and class indicated in the Air Handling Unit Schedules on the project plans.
- .3 Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM.
- .4 Fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free, circumferential conductive micro fiber shaft grounding ring installed on the fan motor to discharge shaft currents to ground.
- .5 Fans shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. A flexible connection constructed of neoprene coated woven fiberglass shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements.
- .6 Fan belts shall be enclosed as required by OSHA standard 29 CFR 1910 to protect worker from accidental contact with the belts and sheaves.

2.7 Fan Airflow and Outdoor Air Airflow Measurement

- .1 Factory-mounted airflow measurement station tested in accordance with AMCA Standard 611. Airflow probes shall be provided around the fan inlet cones and at outdoor air intakes. Probes shall be provided by the fan manufacturer to ensure accurate airflow measurement & zero resistance to airflow. All electronics and controls required to output airflow measurement are provided by the manufacturer.
- .2 Airflow measurement station shall be capable of measuring from 15 percent to 100 percent of unit nominal airflow. The airflow measurement station shall adjust for temperature variations.
- .3 The accuracy of the devices shall be no less than +/- 5 percent when operating within stable fan operating conditions. Devices shall not affect the submitted fan performance and acoustical levels. Devices that obstruct the fan inlet or outlet shall not be acceptable.
- .4 Devices shall be connected to transducers with selectable 4-20 mA or 2-10 VDC output. Signal shall be proportional to air velocity.

2.8 Direct Drive Motors

- .1 Electric motors shall be as specified in Section 20 05 23 Electric Motors and Mechanical Wiring.
- .2 Motors and drives shall be factory-installed and run tested.
- .3 Fan wheels shall be keyed into the shaft and shall be designed for continuous operation at maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected with a maximum operating speed that is 25% below the first critical speed.

2.9 Coils

- .1 Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.
- .2 Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
- .3 Coils shall be manufactured with aluminum plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled.
- .4 Construct cooling coil casings of stainless steel and heating coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
- .5 Hydronic Coils:
 - .1 All water, steam and direct expansion (DX) refrigerant coils shall be certified in accordance with AHRI 410.
 - .2 Coils containing water and propylene or ethylene glycol shall be certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air- Heating Coils Certification Program, which is based on AHRI 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard.
 - .3 Supply and return header connections shall be clearly labeled on unit exterior such that direction of coil water-flow is counter to direction of unit air-flow.
 - .4 Coils shall be proof-tested to 300 psig and leak-tested to 200 psig air pressure under water.
 - .5 Headers shall be constructed of round copper pipe or cast iron.
 - .6 Tubes shall be 5/8-inch .020 copper, with aluminum fins.
 - .7 Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
 - .8 Hydronic coils shall be supplied with factory installed drain and vent piping to the unit exterior.

2.10 Filters

- .1 Filter holding frames shall be constructed of galvanized steel and equipped with foam gaskets to seal filters against filter frames. Frame seams shall be sealed to eliminate air bypass. Access door(s) shall be provided to facilitate filter removal. Filter holding frames shall be of a universal type to accommodate standard filters sizes.
- .2 The filter shall have a Minimum Efficiency Reporting Value of MERV-A when evaluated under the guidelines of ASHRAE Standard 52.2 and when tested under Appendix J of that standard.
- .3 Filter type, MERV-A rating, and arrangement shall be provided as defined in project plans and equipment schedules. Filter types, efficiencies, and nominal depths shall be as follows:

- .1 Stage 1 filter – MERV-A 14 – CamfilFarr Opti-Pac 100 mm (4 in) cartridge.
- .4 Provide one set of startup filters for each air handling unit.
- .5 Provide one clean set of filters at turnover of equipment to owner.
- .6 Provide a factory-installed, flush mounted dial-type, differential pressure gauge a each filter. Gauge shall be, 52 mm (2-1/16 in) and piped to both sides of each filter to indicate status. Gauge housing shall be constructed of glass filled nylon with polycarbonate lens, and be rated for 207 kPa (30 psi) continuous pressure. Gauge shall maintain a +/- 5 percent accuracy throughout the complete pressure range and operating temperature limits of -6.7 deg C to 49 deg C (20 deg F to 120 deg F). Filter sections consisting of multiple pre- and post-filters shall have a gauge for each.

2.11 Energy Wheel

- .1 The air-handling unit shall have a total energy wheel and shall be an integral part of the air-handling unit. Unit shall be installed as a complete system with no additional outside air unit, or other field assembled and ducted energy recovery device. Manufacturer shall include performance information in the submittal that meets or exceeds scheduled wheel performance.
- .2 Wheel section shall include Exhaust Damper, Outdoor air Damper and Wheel Bypass dampers for economizer and frost protection control.
- .3 The air-handling unit shall be certified by ARI to contain a rotary energy recovery wheel that is ARI 1060 certified. The air-handling unit nameplate shall bear the ARI 1060 certification label. Performance characteristics of the energy wheel shall be provided as defined by ARI 1060. The energy wheel shall be an enthalpy wheel capable of sensible and latent heat transfer. Sensible, latent and total net effectiveness of the wheel performance shall meet or exceed performance as defined on schedule. Wheel face velocity and pressure drop shall not exceed performance as defined on schedule. The energy recovery cassette shall be an Underwriters Laboratories (UL) Recognized Component certified for mechanical, electrical, and fire safety in accordance with UL Standard 1812.
- .4 Wheel Media: The dehumidification or desiccant wheel shall be fabricated of a material suitable of withstanding regeneration temperatures of 350 F. Wheels shall be constructed permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated, bonded, or synthesized onto the media are not acceptable due to delamination and/or erosion of the desiccant material over time. Media shall be synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Face flatness of the wheel shall be maximized (+/- 0.015 in) in order to minimize wear on inner seal surfaces and to prevent cross leakage. The minimum acceptable dehumidification performance shall be as specified in the drawings/submittal.
- .5 Desiccant Material: The desiccant material shall be commercial grade silica gel. Alternatively, a type 1M molecular sieve may be used. Required performance of the system shall determine desiccant selection. Where low temperature, low energy reactivation is required, a suitable low energy desiccant. Lithium chloride, or lithium chloride containing desiccant shall not be used because of the deliquescent property of LiCl₂ during the adsorption process.
- .6 Wheel Media support system: The wheel frames shall consist of evenly spaced galvanized steel spokes, aluminum outer band and rigid center hub. The wheel construction should allow for post fabrication wheel alignment. The media shall be removable in pie sections.
- .7 Wheel Seals: The wheel seals shall be high temperature extruded contact seals which are easily adjustable, and which prevent leakage at up to 8" w.c. differential pressure. Inner seal shall be Teflon coated to maximize wear resistance

- .8 Wheel cassette: Cassettes shall be fabricated of heavy duty reinforced minimum 14 gauge galvanized steel. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings or alternatively, sealed pillar block bearings for larger wheels. Drive systems shall consist of fractional horsepower A.C. drive motors. The drive mechanism shall be heavy duty chain and sprocket drive assemblies or equivalent
- .9 Energy recovery wheel will require a separate and individual electrical power supply.

2.12 Dampers

- .1 Dampers shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent. Leakage rate shall not exceed 3 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.
- .2 Damper actuators shall be supplied by the AHU manufacturer and wired by the BAS controls contractor.

2.13 Electrical

- .1 Provide starters and Fused disconnects shipped loose for installation and wiring to load by Electrical Division.
- .2 Wire according to NEC and ETL list the entire unit. ETL listing of electrical panel only is unacceptable. All major electrical components shall be UL listed.
- .3 Provide non-fused disconnect, fan motor starters/protectors, contactors, control transformer, control circuit fusing, service switch, and terminal block. Units supplied with VFDs shall have individual branch fusing per drive.
- .4 Provide NEMA 3R electrical/control panel.
- .5 Factory test wiring and controls before shipment.
- .6 A phase protection relay shall be provided for each unit. Upon sensing a loss of phase the unit shall be de-energized
- .7 Provide starters and disconnects shipped loose for installation and wiring by Electrical Division.

2.14 Variable Frequency Drives (VFDs)

- .1 Variable frequency drives shall be provided with a Fused Disconnect and shall be provided loose for mounting and wiring to load by the Electrical Division.
- .2 Standard and optional features shall be included within the VFD enclosure, unless otherwise specified. The VFDs shall be UL listed.
- .3 The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
- .4 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- .5 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

- .6 The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.
- .7 The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
- .8 The VFDs full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- .9 The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
- .10 An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
- .11 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
- .12 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
- .13 Galvanic and/or optical isolation shall be provided between the VFDs power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
- .14 The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
- .15 Protective Features
 - .1 Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
 - .2 The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.
 - .3 The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
 - .4 The VFD package shall include semi-conductor rated input fuses to protect power components.
 - .5 To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
 - .6 The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
 - .7 The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

- .8 The VFD shall catch a rotating motor operating forward or reverse up to full speed.
- .9 The VFD shall be rated for 100,000 amp interrupting capacity (AIC).
- .10 The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
- .11 The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.
- .16 Interface Features
 - .1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
 - .2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
 - .3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
 - .4 A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
 - .5 The keypads for all sizes of VFDs shall be identical and interchangeable.
 - .6 To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
 - .7 The display shall be programmable to display in English, Spanish and French at a minimum.
 - .8 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
 - .9 A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
 - .10 The VFD shall include a standard EIA-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.
 - .11 At a minimum, the following points shall be controlled and/or accessible:
 - .1 VFD Start/Stop
 - .2 Speed reference
 - .3 Fault diagnostics
 - .12 Meter points: Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD
 - .13 Bacnet communication shall be available for factory or field installation within the VFD.
 - .14 Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
 - .15 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
 - .16 Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.

- .17 Sleep mode shall be provided to automatically stop the VFD when its speed drops below set sleep level for a specified time. The VFD shall automatically restart when the speed command exceeds the set wake level.
- .18 The sleep mode shall be functional in both follower mode and PID mode.
- .19 A run permissive circuit shall be provided to accept a system ready signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
- .20 The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
- .21 The display shall be programmed to read in inches of water column (in-wg).
- .22 The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
- .23 If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
- .24 The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
- .25 The VFD shall store in memory the last 10 faults and related operational data.
- .26 Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- .27 Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
- .28 Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
- .29 Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.
- .30 Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.
- .17 Adjustments
 - .1 The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
 - .2 A minimum of sixteen preset speeds shall be provided.
 - .3 Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
 - .4 Four current limit settings shall be provided.
 - .5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
 - .6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

- .7 An automatic delay shall be selectable from 0 to 120 seconds.
- .18 Service Conditions
 - .1 VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
 - .2 VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
 - .3 VFDs shall provide full output up to 3,300 feet elevation without derating.
 - .4 VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
 - .5 No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.
- .19 Warranty
 - .1 The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, which ever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

2.15 Low Temperature Limit Switches (Freeze Stat)

- .1 Provide on the discharge side of the first water coil in the air stream.
 - .1 Mount element horizontally across coil in a serpentine pattern ensuring each square foot of coil is protected.
 - .2 Freeze stat is to be 120V, manual reset type.
 - .3 Wire to factory starter or VFD.
 - .4 Freeze stat is to disable fans when starter or VFD is in either hand or auto position/mode. No BMS override.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 The Mechanical Contractor shall level all unit sections. in accordance with the unit manufacturer's instructions.
- .3 Install to AHRI 430.
- .4 Assemble units by bolting sections together.
- .5 Perform the following tests and services and submit a report outlining the results:
 - .1 Record date, time, and person(s) performing service.
 - .2 Lubricate all moving parts.
 - .3 Check all motor and starter power lugs and tighten as required.
 - .4 Verify all electrical power connections.
 - .5 Conduct a start up inspection per the AHU manufacturer's recommendations.
 - .6 Record fan motor voltage and amperage readings.
 - .7 Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.
 - .8 Check fan for excessive vibration.
 - .9 Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.
 - .10 Disengage all shipping fasteners on vibration isolation equipment.
 - .11 Check safety guards to insure they are properly secured.
 - .12 Secure all access doors to the fan, the unit and the ductwork.
 - .13 Switch electrical supply "on" and allow fan to reach full speed.
 - .14 Physically check each fan at start up and shut down to insure no abnormal or problem conditions exist.

- .15 Check entering and leaving air temperatures (dry bulb and wet bulb) and simultaneously record entering and leaving chilled water temperatures and flow, and outside air temperature.

3.2 Demonstration

- .1 The manufacturer or manufacturer's representative shall instruct the owner's personnel in the proper use, operation and maintenance of the equipment.
.2 The manufacturer or manufacturer's representative shall train the owner's personnel in normal procedures to be followed in case of an operation failure or equipment malfunction.

3.3 Sound Schedules

- .1 Air handling unit sound power levels (dB) shall be in accordance with the following schedules:

AHU1, AHU2, AHU3

	63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz
Discharge	76	79	86	82	77	77	75	64
Return Air Inlet	75	73	77	72	68	70	64	54
Casing	79	78	89	81	77	63	56	48

AHU4 - Gym

	63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz
Discharge	70	73	80	73	73	73	64	56
Return Air Inlet	72	69	83	66	68	65	58	48
Casing	73	76	84	72	70	56	46	40

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References

- .1 CSA (Canadian Standards Association).
- .2 UL (Underwriters Laboratories Inc.).

1.3 Submittals for Review

- .1 Provide typical catalogue of information including arrangements.
- .2 Shop Drawings:
 - .1 Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - .2 Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
 - .3 Indicate mechanical and electrical service locations and requirements.
- .3 Installation Data: Manufacturer's special installation requirements and recommendations.

1.4 Closeout Submittals

- .1 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- .2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by UL CSA testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Wall Fin Radiation

- .1 Continuous convector type radiation shall have heating elements consisting of square aluminum fins with flanged collars, mechanically bonded to copper tubing. Provide even fin spacing of 52 fins/foot. Fins shall have round corners and the collars shall provide for spacing as well as bond. Tube ends shall be sized to fit standard solder connections.

- .2 Tubes: Copper tubes, refer to wall fin drawing schedule for tube sizes.
- .3 Brackets: Duplex brackets shall be provided on maximum 4'-0" centers to support the cabinet and/or element.
- .4 Enclosures:
 - .1 Fabricated from 16 gauge sheet steel with integral grilles.
 - .2 The units shall be complete with trim pieces, end plates, and trim panels. Trim panels shall be used as access doors.
 - .3 Enclosures shall have pencil proof louvers.
 - .4 Prime powder coat epoxy/ceramic finish.
 - .5 Site measured for wall to wall installation allowing space for valves.
- .5 Acceptable Manufacturers:
 - .1 Rosemex
 - .2 Trane
 - .3 Engineered Air
 - .4 Sigma

2.2 Unit Heaters

- .1 Casings shall be 18 gauge (1.2mm) cold rolled steel with electrostatically applied epoxy powder coat prime finish and two 3/8" (10mm) threaded hanger connections.
- .2 Provide four way adjustable louvered diffuser, factory mounted on each unit.
- .3 Coils shall be 5/8" copper tube with rippled aluminum fins. Headers include steel NPT pipe connections located at back of unit. Coils to be factory tested with air at 300 psig (2070 kPa).
- .4 Fans shall be aluminum blade type, dynamically balanced and direct connected to motor shaft.
- .5 Motors shall be 115V/1/60 and incorporate sleeve bearings and automatic re-set overload protection.
- .7 Provide 24 volt transformer as required for control valve and thermostat.
- .8 Provide units complete with fan guards and disconnects.
- .9 Unit shall be CSA approved and bear the CSA label.
- .10 Acceptable Manufacturers:
 - .1 Rosemex
 - .2 Trane
 - .3 Engineered Air
 - .4 Sigma

2.3 Cabinet Heaters

- .1 Install cabinet heaters of model type, rating, and size shown on the drawing schedule. Heaters shall have non-ferrous heating element constructed for 300psig.
- .2 Motor shall be ball bearing type; 3-speed permanent split capacitor, open type, resiliently mounted, incorporating sleeve bearings and internal automatic re-set overload protection.
- .3 Units to be CSA approved and bear the CSA label.
- .4 Casings
 - .1 shall be 16 gauge steel
 - .2 electrostatically applied epoxy powder coat prime finish.
 - .3 integral piping pocket, removable front panel, hinged access door to electrical junction box.
 - .4 Recessed units shall be furnished with a recessing frame.
- .5 The heaters shall be complete with filter, thermostat, and three speed controller, and disconnect switch, which shall be mounted inside the unit by the unit manufacturer.
- .6 Set integral thermostat setpoint to 16C (adjustable lower only). Provide limit screw to prevent higher setpoints.

- .7 Wall mounted thermostats and/or switches where indicated on drawings shall be provided by mechanical contractor.
- .8 Acceptable Manufacturers:
 - .1 Rosemex
 - .2 Engineered Air
 - .3 Sigma

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Protection: Provide finished cabinet units with protective covers during balance of construction.
- .4 Wall Fin Radiation: Locate on outside walls and run cover continuously wall-to-wall unless otherwise indicated. Centre elements under windows. Where multiple windows occur over units, divide element into equal segments centred under each window. Install end caps where units butt against walls.

3.2 Cleaning

- .1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- .2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.
- .3 Install new filters.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specifications and specifications to be used in conjunction with the project specifications include, but are not limited to:
 - .1 CSA (Canadian Standards Association).
 - .2 UL(c) (Underwriters Laboratories Inc./ Underwriters Laboratories Canada Inc).
 - .3 AHRI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment
 - .4 AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils
 - .5 AHRI 430 – Performance Rating of Central-Station Air-Handling Unit Supply Fans
 - .6 ASHRAE 62 – Ventilation for Acceptable Indoor Air Quality
 - .7 ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
 - .8 NFPA 90A – Standard for Installation of Air-Conditioning and Ventilation Systems
 - .9 NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
 - .10 ASHRAE 52.1/52.2 – Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size
 - .11 UL 1995 – Standard for Safety for Heating and Cooling Equipment
 - .12 UL 900 – Standard for Air Filter Units
 - .13 SMACNA – HVAC Duct Construction Standards – Metal and Flexible
- .3 Insulation and insulation adhesive comply with NFPA-90A for flame spread and smoke generation.
- .4 Products of This Section: Manufactured to ISO 14000 ISO 9000 certification requirements.
- .5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum of five (5) years documented experience.
- .6 Products Requiring Electrical Connection: Listed and classified by UL CSA testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.3 Equipment Certification Labels

- .1 Performance data certified in accordance with ARI 430.

1.4 Shop Drawings Submittals For Review

- .1 Product Data: Provide typical catalogue of information including arrangements.
- .2 Shop Drawings:
 - .1 Shop drawings shall contain as a minimum: Job name, Equipment tag, Dimensions, Model, Performance curves, Capacity, HP, Voltage, efficiencies, Sound data, materials of construction, accessories listed in the specifications and/or being provided, operating points of the proposed equipment. Delete information not applicable to project.
 - .2 Include shop drawing data sheet for control valve, isolation valves, balance valve, strainer, actuator, dampers, ECM controller and indicate manufacturer and model.
 - .3 Select options and features shown in tables, charts or lists.
 - .4 Indicate cross sections of cabinets, grilles, reinforcing, and typical elevations.
 - .5 Indicate mechanical and electrical service locations and requirements.
- .3 Installation Data: Manufacturer's special installation requirements and recommendations.

1.5 Submittals for Closeout at Completion of Construction

- .1 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- .2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 Maintenance Material Submittals

- .1 Extra Stock Materials: For each unit supplied provide one (1) extra set of filters in addition to the set of filters shipped in the unit.

1.7 Warranty

- .1 Provide one (1) year manufacturer's labour and material warranty for unit ventilators and components supplied with the unit ventilators. Defects arising during this period shall be corrected without cost to the owner.

Part 2 Products

2.1 Unit Ventilators (UVx)

- .1 Acceptable Manufacturers:
 - .1 ChangeAir
- .2 General Description:
 - .1 Generally, each unit shall be a complete, factory finished complete with outdoor air dampers (intake), filter section, centrifugal supply fan, dampers, integral wiring to terminal strip, and DX cooling coil, heating coil, and drain pans.
 - .2 Individual heights to be confirmed on site prior to ordering.
 - .3 Units shall be CSA, UL or ETL certified and labeled indicating that the equipment has been independently tested and meets the applicable safety standards required both in the United States and Canada. Units shall be manufactured in an ISO 9001 registered facility or by a company manufacturing ventilation equipment for at least ten years.
 - .4 Manufacturer shall provide sound data in accordance to AHRI Standard 260 "Sound Rating of Ducted Air Moving and Conditioning Equipment"
 - .5 Data to be collected in a qualified and accredited reverberant Laboratory.

- .6 Sound Ratings are to be in the form of Octave Band Sound Power Levels (dB) from 63 to 8000 Hz derived from One-Third Octave Band measurements.
- .7 Data provided must meet or exceed minimum requirements for use within ANSI S12.60-2010 calculations.
- .8 Unit sound ratings shall meet or exceed the data as per Schedule 2 attached.
- .3 Cabinet Construction:
 - .1 Cabinet construction shall be internal 16-gauge frame supports all internal metal pans and components. Exterior panels shall not support any internal components.
 - .2 Outer cabinet shall be made of 20-gauge steel with a powder coat baked enamel-textured finish to an appliance standard. Cabinet panels shall attach to the frame without visible screws, rivets or fasteners.
 - .3 Cabinet front shall incorporate two fully insulated full sized hinged panels held closed by no less than two tamper resistant cam lock in each panel. Manufacturer shall supply four, half turn adjustable, dual action cam fasteners operated with a removable key/tool.
 - .4 Cabinet panels shall be thermally/acoustically insulated with 1"(2.54 cm) thick closed cell flexible insulation. Density to be a minimum of 1.5 lb/ft³. Insulation shall comply with 25/50 Flame Smoke requirement as per UL 1995/ CSA 22.2 No. 236 standards in addition to UL94-HF-1 flame rating. Insulation with only UL94-HF-1 flame rating is not acceptable.
 - .5 Duct collar, 24" x 12", is supplied with the unit ventilator for connection of ductwork. Ducting and ceiling diffusers should be sized to operate with the units at .25" ESP or less. All external ductwork and diffusers must be correctly sized, fabricated, and supplied by installer. Ducting must be insulated for the first 10 feet from the unit.
 - .6 Unit shall be supplied with punched return grille openings.
- .4 Refrigerant /Chilled Water Cooling Coils:
 - .1 The drain pan shall be constructed from stainless steel metal and shall be coated with closed cell insulation.
 - .2 Coil performance shall be as per schedule. Coil performance data shall be certified in accordance with ARI Standard 410 where applicable.
- .5 Hot Water Heating Coils
 - .1 Enclose coil headers and return bends fully within unit casing.
 - .2 Copper tubes mechanically expanded into evenly spaced aluminum fins.
 - .3 Coil performance shall be as per schedule. Coil performance data shall be certified in accordance with ARI Standard 410 where applicable.
 - .4 Coils are burst tested to 300 psig and proof tested under water to 200 psig.
- .6 Dampers and Damper Actuators:
 - .1 The outside air damper shall be a low leakage parallel blade design. The frame and blades shall be constructed of extruded aluminum with blade design being Insulated airfoil construction, operated by zero maintenance, concealed linkage, 1/2" (13mm) axles bolted to the blades shall operate on bronze oilite bearings. Both blade edge and jamb seals shall be of the pressure sensitive type for low leakage. The return air damper shall be a single insulated galvanized steel blade operated by zero maintenance linkage, 1/2" nylon axles bolted to the blades.
 - .2 The dampers shall be equipped with a Belimo spring return damper actuator with a minimum torque of 18 in/lb. The actuator must provide proportional damper control in response to input of 2 to 10 VDC. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation.

- .3 The damper actuator shall allow outside air to mix with return air, the volume of outside air during the occupied period to be fixed to a minimum outside air. It shall have the capability of opening during an economizer cycle to allow a minimum 80% of the total supply air through the outside air damper.
- .4 The outside air/economizer damper must facilitate the introduction of a nominal 100% outside air, bypassing the recovery system during "free cooling" cycles.
- .7 Filter Section:
 - .1 Easily removed 50 mm (2 inch) thick pleated MERV 8 disposable filter. The location of the filter shall provide 100% filtration of both re-circulated and outside fresh air.
- .8 Supply Fans and Motors:
 - .1 Supply Motor and Fan Assembly shall consist of two fan bodies to supply the specified cfm. Each fan body shall be a double inlet centrifugal type blower with the two fans driven by one electrically commutated motor (ECM). The ECM shall be programmed to deliver the specified airflow at a maximum external static pressure of .25"w.c. Standard permanent split capacitor (PSC) motors will not be acceptable.
 - .2 The supply fan shall be draw through both the heating and cooling coils before reaching the supply fan.
- .9 Electrical:
 - .1 Main power supply shall connect to the unit through a wire race way directly to either a terminal block or to the unfused disconnect provided by the unit manufacturer.
 - .2 Each unit shall be supplied with a line voltage service disconnect and a door switch for control voltage interrupt to disable the mechanical components when the service panel is removed
 - .3 Each unit shall be supplied with a door switch for control voltage interrupt to disable the mechanical components when the service panel is removed.
 - .4 Internal Protections
 - .1 120V Freeze stat shall be supplied and installed by Controls contractor.
 - .2 All internal functions must be fuse protected by a time delay fuse properly rated for the amperage load.
- .10 Controls:
 - .1 BACnet Compatible DDC
 - .1 A native BACnet, fully programmable, direct digital controller shall be supplied and installed by the factory. The controller shall be programmed to operate the ventilator and be site ready to be connected to a BACnet compatible head end.
 - .2 The controller must also be able to run standalone and occupancy determined by an internal weekly and annual schedule.
 - .3 The controller must have a separate output to control wall fin radiation.
 - .4 The controller must also include Room Sensor that can be wall or unit mounted. This sensor will sense the temperature in the room and provide an operator interface with limited programming adjustments and over-rides.
 - .2 Water Control Valves:
 - .1 A 2 way spring return modulating plug control valve with isolation valves, circuit balancing valve and strainer shall be supplied and installed by manufacturer.
 - .2 Control valve shall be Siemens Powermite 599 Series globe valve with union. Ball valve and rubber flapper control valves are not acceptable.
 - .3 Control valve shall be sized for no more than 1.0 PSIG pressure drop.

- .4 Ball valves shall be full port with solid brass ball and drain.
- .2 Motor Speed Controller:
 - .1 The supply ECM fan control board shall accept either a direct 0-10 VDC analog control signal for full modulated control of the fan output or a 24 VAC digital signal for required fan output or a 0-10V signal for non-modulated control of the fan.
- .11 Sound:
 - .1 Unit sound data shall be in accordance with the following schedule:

SCHEDULE 2 - UNIT VENTILATOR SOUND														
CFM	ESP ("W.C.)	OUTSIDE AIR (CFM)		FREQUENCY								Lw	LwA	OVERALL dBA
				63	125	250	500	1000	2000	4000	8000			
800	0.25	300	Lw-radiated	62.7	55.1	39.8	30.1	22.9	16.6	23.7	25.8	63.4	41.8	31.8
			Lw-discharge	70.8	67.3	63.8	60.1	57.8	53.4	46	35.5	73.4	62.8	52.8
1000	0.25	300	Lw-radiated	62.1	56.6	41.3	32.5	25.2	18.5	23.7	25.8	63.2	42.8	32.8
			Lw-discharge	73.9	70.4	66.4	63.6	61.7	58.8	63.4	44.9	76.5	66.7	56.7
1200	0.25	400	Lw-radiated	67.1	62.5	46.7	37.3	30.5	23.6	24	25.8	68.4	48.3	38.3
			Lw-discharge	78.1	74.8	69.9	68.5	67	65.5	62.7	56.7	80.9	72.3	62.3
1400	0.25	400	Lw-radiated	71.4	66.8	50.9	40.7	34.5	27.6	24.6	25.8			42.5
			Lw-discharge	80.3	77	72.1	71.6	70.5	69.7	68.1	63.1			66.1

2.2 Accessories

- .1 Exterior Louvers and Wall Sleeve:
 - .1 Louvers shall be provided by mechanical contractor. Refer to schedules on drawings.
 - .2 A 22-gauge metal wall sleeve suited to match the depth of the wall shall be included with the louver with appropriate metal dividers to separate intake and exhaust air if applicable.
- .2 Plenums, Stand-offs & Pipe Chases:
 - .1 A 3 sided, non-insulated cosmetic top duct cover shall be included with each unit ventilator. The cover shall be constructed of heavy 18-gauge steel with textured powder coat painted finish to match unit ventilator. The top duct cover come in 3 standard heights 20", 30", & 50" that can be cut down to be 2" to 3" above the suspended ceiling height.
 - .2 A rear plenum shall be included with each unit ventilator. The plenum shall be constructed of heavy 18 gauge steel with 1" (2.54 cm) flange for unit mount and painted in textured powder coat finished to match cabinet color. The plenum is factory insulated with 1" (2.54 cm) acoustic material and includes a full uninsulated back.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

- .3 Unit Ventilators: Level and shim units, and anchor to structure. Coordinate exact location of wall louvres.
- .4 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
- .5 Hydronic Units: Provide with shut-off valve on supply and return and balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- .6 Mechanical Contractor to install control valve within Unit Ventilator. Rework manufacturer piping with offsets and accessories as required.
- .7 Units with Cooling Coils: Connect drain pan to condensate drain.

3.2 System Start Up

- .1 Start up units in accordance with manufacturers start up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- .2 Start up and owner training for supplied equipment by manufacturer.

3.3 Cleaning

- .1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- .2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.
- .3 Install new filters.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 References and Quality Assurance

- .1 Abide by and perform work in accordance with laws, rules, regulations, by-laws and requirements of the Authorities Having Jurisdiction.
- .2 Supplementary mandatory specification and specification to be used in conjunction with the project specifications include, but are not limited to:
 - .1 CSA (Canadian Standards Association)
 - .2 UL (Underwriters Laboratories Inc.)
 - .3 Comply with the most recent versions of applicable Standards and Codes of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 - .4 Ontario Electrical Safety Code
 - .5 Ontario Building Code
 - .6 National Electric Manufacturer's Association (NEMA)
 - .7 American Society of Mechanical Engineers (ASME)
 - .8 National Fire Protection Association (NFPA) standards; including NFPA 70, NFPA 90A and NFPA 92A & 92B
 - .9 Institute of Electrical and Electronic Engineers (IEEE)
 - .10 ANSI/ASHRAE Standard 135 - BACnet®- A Data Communication Protocol for Building Automation and Control Networks
 - .11 EN/ISO Standard 16484-5 - Building automation and control systems (BACS) - Part 5: Data communication protocol
- .3 Installer shall have an established working relationship with BAS Manufacturer of not less than three years.
- .4 Installer shall have successfully completed BAS control system training. Upon request, Installer shall present certification of completed training including hours of instruction and course outlines.

1.3 Building Automation System Description

- .1 General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers.
- .2 System software shall be based on a server/thin-client architecture, designed around the open standards of web technology. The control system server shall be accessed using a web browser over the control system network, the Owner's local area network, and remotely over the Internet (through the Owner's LAN).
- .3 The intent of the thin-client architecture is to provide operators complete access to the control system via a web browser. No special software other than a web browser shall

- be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to edit programming.
- .4 Performance Monitoring: The BAS will provide the specified performance monitoring functionality, including required monitoring points and performance metrics, improved through system accuracy, data acquisition and data management capabilities, and required graphical and data displays.
- .5 Event Response: The BAS will provide the specified operational changes based on event response from the energy service provider.

1.4 Products Not Furnished or Installed but Integrated with the Work of this Section

- .1 General: Coordination Meeting:
 - .1 The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the products listed below to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface including PICS for BACnet equipment, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting:
 - .1 Split AC Units
 - .2 Air Handling Units
 - .3 Energy Recovery Units
 - .4 Terminal Heating & Cooling Units
 - .5 Air Terminal Equipment
 - .6 Variable Frequency Drives
 - .7 Boilers
 - .8 Miscellaneous
- .2 Communications with Third Party Equipment: Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interface for integration into the Direct Digital Control System described in this section. Open system protocol shall be maintained, and no proprietary equipment will be allowed to successfully complete any third party integrations. The controls contractor is responsible for all programming necessary to seamlessly integrate this third party equipment to the BAS. The controls contractor is responsible for providing device addresses for all devices that are going to be integrated to the BAS, such that no device communication issues will arise. The controls contractor is responsible for any meetings, correspondence or communication required with the third party equipment suppliers in order to successfully integrate the equipment to the BAS. The controls contractor shall provide five (5) references detailing successful integrations on previous projects as part of their bid submittal.

1.5 Acceptable Manufacturers

- .1 Manufacturer:
 - .1 Johnson Controls
 - .2 Siemens
- .2 Use operator software, controller software, custom application programming language, building controllers, custom application controllers, and application specific controllers only from one of the manufacturers and product lines listed.

- .3 Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.6 Submittals for Review

- .1 Meet requirements of Section 20 05 05 for Submittals, Shop Drawings, Product Data, and Samples.
- .2 In addition, Contractor shall provide shop drawings or other submittals on all hardware, software, 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. Provide drawings as files in file format: .pdf.
- .3 When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include:
 - .1 BAS 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 DDC (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 Controlled Systems:
 - .1 Riser diagrams showing control network layout, communication protocol, and wire types.
 - .2 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.
 - .3 A schematic wiring diagram for each BAS. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the BAS schematic, it shall be labeled with the same name. All terminals shall be labeled.
 - .4 An instrumentation list for each controlled system. Each element of the BAS shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
 - .5 A mounting, wiring, and routing plan-view drawing. The drawing shall be done in 1/4 in. scale. The design shall take into account HVAC, electrical,

- and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
- .6 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.
 - .7 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.
- .4 Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
 - .5 A description of the proposed process along with all report formats and checklists to be used in paragraph "Control System Demonstration and Acceptance" of this specification.
 - .6 Instrumentation and Data Point Summary Table. Contractor shall submit in table format with the following information for each instrument and data point. The table is to be reviewed and approved by the owner's representative prior to hardware and software installation and programming.
 - .1 Point name
 - .2 Point description: provide building designation, system type, equipment type, engineering units, and functionality; include a description of its physical location
 - .3 Expected range (upper and lower limit)
 - .4 Instrumentation (as applicable): manufacturer, model number, range, and accuracy specification
 - .5 Type:
 - .1 AI: analog input
 - .2 BI: binary input
 - .3 NAI: network analog input
 - .4 NBI: network binary input
 - .5 CP: Configuration Property
 - .6 P: Programmed (e.g., soft or virtual point in control sequence such as a PID input or output)
 - .7 C: Calculated value; a soft or virtual point. If calculated value, provide logic diagrams or code and any constants used in formula. If time-based integrated values are required, provide time periods: minutes, daily, weekly, monthly, and yearly. Also indicate if it is a running average.
 - .6 Input resolution
 - .7 Data trend interval
 - .8 Number of samples stored in local controller before transfer to host computer/server database
 - .9 Data point address

1.7 Closeout Submittals

- .1 Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:
 - .1 Project Record Drawings. As-built versions of the submittal shop drawings provided as files on optical media and as 11" x 17" prints.
 - .2 Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Paragraph "BAS Demonstration and Acceptance" of this specification.
 - .3 Operation and Maintenance (O & M) Manual.
 - .4 As-built versions of submittal product data.
 - .5 Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.

- .6 Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
- .7 Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
- .8 Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
- .9 Documentation of all programs created using custom programming language including setpoints, tuning parameters, and object database.
- .10 Graphic files, programs, and database on magnetic or optical media.
- .11 List of recommended spare parts with part numbers and suppliers.
- .12 Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
- .13 Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
- .14 Licenses, guarantees, and warranty documents for equipment and systems.
- .15 Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

1.8 Warranty

- .1 Warrant work as follows:
 - .1 Warrant labor and materials for specified BAS free from defects for a period of twelve (12) months after final acceptance. BAS failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within twenty-four (24) hours of Owner's warranty service request.
 - .2 Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up.
 - .3 Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of engineer's acceptance.
- .2 Special warranty on instrumentation:
 - .1 All instrumentation shall be covered by manufacturer's transferable one (1) year "No Fault" warranty. If manufacturer warranty is not available, the BAS installer shall provide the same.

1.9 Ownership of Proprietary Material

- .1 Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
 - .1 Graphics
 - .2 Record drawings
 - .3 Database
 - .4 Application programming code
 - .5 Documentation

Part 2 Products

2.1 Materials

- .1 Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of twenty-five (25) installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's representative. Spare parts shall be available for at least seven (7) years after completion of this contract.

2.2 Communication

- .1 Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet Controller and operator interface communication shall conform to BACnet conformance and/or certification requirements.
- .2 Internetwork operator interface and value passing shall be transparent to internetwork architecture.
 - .1 An operator interface connected to the BAS shall allow the operator to interface with each internetwork controller as if directly connected. BAS information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internetwork controller.
 - .2 Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified BAS operation. An authorized operator shall be able to manage, maintain and access the BAS network of controllers.
- .3 System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.
- .4 Workstations, Building Control Panels and Controllers with real-time clocks shall use the BACnet time synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

2.3 Operator Interface

- .1 System Software:
 - .1 Operating System: Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Examples include Microsoft Excel, Microsoft Access or other SQL database software. Acceptable operating systems are Windows, the latest Windows Server release, Linux, and UNIX.
 - .2 System Graphics: The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
 - .3 Custom Graphics: Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF,

- and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.
- .4 Graphics Library: Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
- .2 System Applications: Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation:
- .1 Automatic System Database Save and Restore: Each workstation shall store on the hard disk a copy of the current database of each Building Controller. This database shall be updated whenever a change is made in any system panel. The storage of these data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel. This capability may be disabled by the operator.
- .2 Manual Database Save and Restore: A system operator with the proper password clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
- .3 System Configuration: The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection.
- .4 On-Line Help: Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
- .5 Security: 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.
- .6 System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- .7 Alarm Processing: Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, alarm limit differentials, states, and reactions for each object in the system.
- .8 Alarm Messages: Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying upon acronyms or other mnemonics.
- .9 Alarm Reactions: The operator shall be able to determine (by object) what, if any, actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation, or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day.

- .10 Trend Logs: The operator shall be able to define a custom trend log for any data object in the system. This definition shall include interval, start time, and stop time. Trend data shall be sampled and stored on the building controller panel, be archivable on the hard disk, and be retrievable for use in spreadsheets and standard database programs. Trend data shall be exportable in a standard electronic format [(xls, .csv, .xml)] for analysis external to the BAS.
- .11 Alarm and Event Log: The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.
- .12 Group Trend Time Series Plots:
 - .1 Provide user-selectable Y points.
 - .2 Provide user-editable titles, point names, and Y axis titles.
 - .3 Individual trended points shall be able to be grouped in groups of up to four points per plot with up to four plots per page
- .13 X-Y Trend Plots:
 - .1 User-selectable X and Y trend inputs.
 - .2 User-selectable display of up to 6 plots per screen in 2 columns.
- .14 Object and Property Status and Control: Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.
- .15 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.
- .16 Standard Reports: The following standard BAS system reports shall be provided for this project. Provide ability for the owner to readily customize these reports for this project.
 - .1 All Objects/Points/Variables: All system (or subsystem) objects and their current values.
 - .2 Alarm Summary: All current alarms (except those in alarm lockout).
 - .3 Disabled Objects/points: All objects that are disabled.
 - .4 Alarm Lockout Objects/points: All objects in alarm lockout (whether manual or automatic).
 - .5 Alarm Lockout Objects/points 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
- .17 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.

2.4 Controller Software

- .1 Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.
- .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 User Log On/Log Off attempts shall be recorded.
 - .4 The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
- .3 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.
- .4 Scheduling: Provide the capability to schedule each object or group of objects in the BAS. Each schedule shall consist of the following:
 - .1 Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.
 - .2 Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
 - .3 Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
 - .4 Before project close-out, the contractor shall create schedules for each piece of equipment (not just provide the capability to do so).
- .5 Binary Alarms: Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
- .6 Analog Alarms: Each analog object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
- .7 Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.
- .8 Remote Communication: The system shall have the ability to transmit the alarm/event using the BACnet control network.
- .9 Maintenance Management: The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.
- .10 Sequencing: Provide application software based upon the sequences of operation specified to properly sequence chillers, boilers, and pumps.
- .11 PID Control: A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. 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, set point, and PID gains shall be user-selectable.
- .12 Staggered Start: 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-selectable.

- .13 Energy Calculations:
 - .1 Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [gpm]) to be accumulated and converted to energy usage data.
 - .2 Provide an algorithm that calculates a sliding-window average (e.g., rolling average). The algorithm shall be flexible to allow window intervals to be user specified (e.g., 15 minutes, 30 minutes, 60 minutes).
 - .3 Provide an algorithm that calculates a fixed-window average. A digital input signal will define the start of the window period (e.g., signal from utility meter) to synchronize the fixed-window average with that used by the utility.
- .14 Anti-Short Cycling: All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.
- .15 On/Off Control with Differential: Provide an algorithm that allows a binary output to be cycled based on a controlled variable and set point. The algorithm shall be direct-acting or reverse-acting and incorporate an adjustable differential.
- .16 Run-Time Totalization: Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

2.5 Building Controllers

- .1 General. Provide an adequate number of building controllers to achieve the performance specified in "BAS Performance" section of this specification. Each of these panels shall meet the following requirements.
 - .1 The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor-based building controllers to manage the global strategies described in the System Software section.
 - .2 The building controller shall have sufficient memory to support its operating system, database, and programming requirements.
 - .3 Data shall be shared between networked building controllers.
 - .4 The operating system of the building controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
 - .5 Controllers that perform scheduling shall have a real-time clock.
 - .6 The building controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall
 - .1 assume a predetermined failure mode,
 - .2 generate an alarm notification.
 - .7 The Building Controller shall communicate with networked BAS devices on the network using the protocol-specific communication requirements. Controller-to-controller communication shall be peer-to-peer and not require a master or host server for communication.
 - .8 The Building Controller shall be certified, listed by or submitted for testing to a testing laboratory approved by BACnet communication.
- .2 Communication:
 - .1 Each building controller shall reside on the BACnet network.
 - .2 The controller shall provide a communication port connection or network interface for a portable operator's terminal.
 - .3 Network routers/repeaters/bridges shall be used to extend communications, change media type, or extend the network in order to ensure proper communication for the entire BAS.
- .3 Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - .1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 65°C (-40°F to 150°F).

- .2 Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- .4 Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
- .5 Memory: The building controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- .6 Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. 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 Custom Application Controllers

- .1 General: Provide an adequate number of Custom Application Controllers to achieve the performance specified in "BAS Performance." Each of these panels shall meet the following requirements.
 - .1 The custom application controller shall have sufficient memory to support its operating system, database, and programming requirements.
 - .2 Data shall be shared between networked custom application controllers.
 - .3 The operating system of the controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
 - .4 Controllers that perform scheduling shall have a real-time clock.
 - .5 The custom application controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
 - .1 assume a predetermined failure mode and
 - .2 generate an alarm notification.
 - .6 The custom application controller shall communicate with other BACnet devices on the network using the protocol specific services.
 - .7 All network controllers shall be tested and certified or listed by an official BACnet testing laboratory as being compliant with the standardized BACnet device capabilities.
- .2 Communication:
 - .1 Each custom application controller shall reside on a control network using the device-level protocol.
 - .2 The controller shall provide a service communication port or network interface using an BACnet for connection to a portable operator's terminal.
- .3 Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - .1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 65°C (-40°F to 150°F).
 - .2 Controllers used in conditioned space shall be mounted in dustproof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- .4 Keypad: A local keypad and display shall be provided. The keypad shall be provided for interrogating and editing data. An optional system security password shall be available to prevent unauthorized use of the keypad and display.
- .5 Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
- .6 Memory: The custom application controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- .7 Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal

voltage. 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).

2.7 Application Specific Controllers

- .1 General. Application specific controllers (ASCs) are microprocessor-based BAS controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user-programmable but are customized for operation within the confines of the equipment they are designed to serve. ASCs shall communicate with other BAS BACnet on the devices on the network using the BACnet-specific read (execute) property service.
 - .1 Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
 - .2 Each ASC will contain sufficient I/O capacity to control the target system.
 - .3 Each ASC shall be certified or listed for compliance to the BACnet standards.
- .2 Communication:
 - .1 The controller shall reside on the BACnet network using Physical media. Each network of controllers shall be connected to one building controller.
 - .2 Each controller shall have an BACnet compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown.
- .3 Environment: The hardware shall be suitable for the anticipated ambient conditions.
 - .1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 65°C (-40°F to 150°F).
 - .2 Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- .4 Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
- .5 Memory: The application specific controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.
- .6 Immunity to power and noise: Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
- .7 Transformer: Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type.

2.8 Input/ Output Interface

- .1 Hardwired inputs and outputs may tie into the BAS through building, custom application, or application specific controllers.
- .2 All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller.
- .3 Binary inputs shall allow the monitoring of On/Off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- .4 Pulse accumulation input objects. This type of object shall conform to requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.

- .5 Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with—and field configurable to—commonly available sensing devices.
- .6 Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- .7 Input/Output points shall be the universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point with appropriate properties. Application specific controllers are exempted from this requirement.

2.9 Power Supplies and Line Filtering

- .1 Control transformers shall be UL 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°C and 50°C (32°F and 120°F). 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 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

2.10 Auxiliary Control Devices

- .1 Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:
 - .1 Control dampers shall be the parallel or opposed blade type as below:
 - .1 Outdoor and/or return air mixing dampers and face and bypass (F&BP) dampers shall be parallel blade, arranged to direct airstreams toward each other.
 - .2 Other modulating dampers shall be the opposed blade type.
 - .3 Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
 - .2 Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.
 - .3 Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 fpm]). Blades shall be not less than 16 gauge.
 - .4 Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.

- .5 All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s·m² (10 cfm per ft²) at 1000 Pa (4 in. w.g.) differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s (1500 fpm).
- .6 Individual damper sections shall not be larger than 125 cm × 150 cm (48 in. × 60 in.). Provide a minimum of one damper actuator per section.
- .7 Modulating dampers shall provide a linear flow characteristic where possible.
- .8 Dampers shall have exposed linkages.
- .2 Electric damper/valve actuators:
 - .1 The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout the rotation of the actuator.
 - .2 Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing. Alternatively, an uninterruptible power supply (UPS) may be provided.
 - .3 Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range.
 - .4 All 24 VAC/VDC actuators shall operate on Class 2 wiring
 - .5 All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank for this purpose.
- .3 Control valves:
 - .1 Control valves shall be two-way or three-way type for two-position or modulating service as shown.
 - .2 Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - .1 Water Valves:
 - .1 Two-way: 150% of total system (pump) head.
 - .2 Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - .3 Water Control Valves:
 - .1 Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - .2 Sizing Criteria:
 - .1 Two-position service: Line size.
 - .2 Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 1.0 psi, whichever is greater. Minimum 3/4" diameter for Wallfin applications.
 - .3 Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa (2.5 psi) maximum.
 - .4 Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service.
 - .1 2 way modulating control valve with union:
 - .2 Control valve shall be Siemens Powermite 599 Series globe valve or equal. Ball valve with characterizing disc or valves with rubber flapper control are not acceptable.
 - .5 Valves 2½ in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.

- .3 Water control valves shall fail normally open or closed, as scheduled on plans, or as follows:
 - .1 RHC, Wallfin, terminal heaters—Fail in place.
 - .2 Heating coils in HVAC equipment with outdoor air—modulating normally open.
 - .3 Chilled water coil control valves—modulating normally closed.
 - .4 Other applications—as scheduled or as required by sequences of operation.
- .4 Low-voltage space thermostat
 - .1 Thermostat shall be 24 V, bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating.
 - .2 Concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential
 - .3 Vented ABS plastic cover.
- .5 Line-voltage space thermostat
 - .1 Thermostat shall be 120 V, bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating.
 - .2 Concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential
 - .3 Vented ABS plastic cover.
- .6 Low-limit thermostats.
 - .1 Low-limit airstream thermostats shall be UL listed, vapor pressure capillary type, with an element of suitable length for full protection.
 - .2 Element shall respond to the lowest temperature sensed by any 30 cm (1 ft) section.
 - .3 120V/1/60 circuit.
 - .4 Snap Acting.
 - .5 The low-limit thermostat shall be manual reset only.
 - .6 Field mounted by BAS.
- .7 Temperature Sensors:
 - .1 Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
 - .2 Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m² (10 ft²) of duct cross section.
 - .3 Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.
 - .4 Provide matched temperature sensors for differential temperature measurement.
- .8 Space Temperature Sensors:
 - .1 Space Sensors / Room Temperature Sensors:
 - .2 Room sensors shall be constructed for either surface or flush mounting as indicated on drawings
 - .3 Room sensors shall have the following capabilities:
 - .1 Adjust room setpoint, software limited to +/- 3F.
 - .2 LCD temperature display
 - .3 Push Button Timed override switch.
 - .4 Lockable tamper-proof covers in public areas and/or where indicated on the drawings.
- .9 Humidity Sensors:
 - .1 Duct and room sensors shall have a sensing range of 20% to 80%.

- .2 Duct sensors shall be provided with a sampling chamber.
- .3 Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient outdoor conditions.
- .4 Humidity sensor's drift shall not exceed 1% of full scale per year.
- .10 Flow Switches:
 - .1 Flow-proving switches shall be either paddle or differential pressure type, as shown.
 - .2 Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum) and shall have adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.
 - .3 Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as specified.
- .11 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 $\pm 200\%$ (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.
- .12 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.
- .13 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 $\pm 1\%$ 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.
- .14 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 $\pm 1\%$ 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.
- .15 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 $\pm 1\%$ 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.
- .16 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 $\pm 0.5\%$ accuracy at 24 VAC and a 5 VA load.
- .3 Windings (except for terminals) shall be completely enclosed with metal or plastic material.
- .17 Hydronic Flow Meters:
 - .1 Insertion-Type Turbine Meter:
 - .2 Dual counter-rotating axial turbine elements, each with its own rotational sensing system, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Single turbine for piping 2 inches and smaller. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.
 - .3 Insertion type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown.
 - .4 Sensing method shall be impedance sensing (nonmagnetic and non-photoelectric)
 - .5 Volumetric accuracy:
 - .1 $\pm 0.5\%$ of reading at calibrated velocity
 - .2 $\pm 1\%$ of reading from 3 to 30 ft/s (10:1 range)
 - .3 $\pm 2\%$ of reading from 0.4 to 20 ft/s (50:1 range)
 - .6 Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute Standards and Technology (NIST).
 - .7 Maximum operating pressure of 400 psi and maximum operating temperature of 200°F continuous (220°F peak).
 - .8 All wetted metal parts shall be constructed of 316 stainless steel.
 - .9 Analog outputs shall consist of non-interactive zero and span adjustments, a DC linearly of 0.1% of span, voltage output of 0-10 V, and current output of 4-20 mA.
- .18 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.
- .19 Pressure Transducers:
 - .1 Transducer shall have linear output signal. Zero and span shall be field adjustable.
 - .2 Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
 - .3 Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and block and bleed valves.
 - .4 Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and five-valve manifold.
- .20 Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as shown.
- .21 Local control panels:

- .1 All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
- .2 Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- .3 Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.11 Wiring and Raceways

- .1 General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Electrical Specifications.
- .2 All insulated wire to be copper conductors, UL labeled for 90°C minimum service.

2.12 Building Automation System Performance

- .1 Performance Standards. System shall conform to the following minimum standards over network connections:
 - .1 Reporting Accuracy: System shall report values with minimum end-to-end accuracy listed in Table 1 below:

Table 1 – Reporting Accuracy of Sensors and Meters

Measured Variable	Reported Accuracy
Space Temperature	+/- 0.5 °C (+/- 1 °F)
Ducted Air Temperature	+/- 0.5 °C (+/- 1 °F)
Outside Air Temperature	+/- 1.0 °C (+/- 2 °F)
Dew Point Temperature	+/- 1.5 °C (+/- 3 °F)
Water Temperature	+/- 0.5 °C (+/- 1 °F)
Delta – Temperature	+/- 0.15 °C (+/- 0.25 °F)
Relative Humidity	+/- 5 % RH
Water Flow	+/- 2 % of full scale
Airflow (Terminal)	+/- 10 % of full scale (Note 1)
Airflow (Measuring Stations)	+/- 5 % of full scale
Airflow (Pressurized Spaces)	+/- 3 % of full scale
Air Pressure (Ducts)	+/- 25 Pa (+/- 0.1 in. w.g.)
Air Pressure (Space)	+/- 3 Pa (+/- 0.01 in. w.g.)
Water Pressure	+/- 2 % of full scale (Note 2)
Electrical (A, V, W, Power Factor)	+/- 1% of full scale (Note 3)
Carbon Monoxide (CO)	+/- 5% of reading
Carbon Dioxide (CO ₂)	+/- 50 ppm

Notes:

- .1 Accuracy applies to 10% - 100% of scale.
 - .2 Accuracy applies for both absolute and differential pressure readings.
 - .3 Not including utility-supplied meters.
- .2 Control Stability and Accuracy: Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2 below:

.1 Table 2 – Control Stability and Accuracy of Sensors and Meters

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	+/- 50 Pa (+/- 0.2 in. wg.) +/- 3 Pa (+/- 0.01 in. wg.)	0 to 1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Air Flow	+/- 10 % of full scale	-
Space Temperature	+/- 1.0 °C (+/- 2 °F)	-
Duct Temperature	+/- 1.5 °C (+/- 3 °F)	-
Humidity	+/- 5% RH	-
Fluid Pressure	+/- 10 kPa (+/- 1.5 psi) +/- 250 Pa (+/- 1.0 in. w.g.)	6.9 – 1034 kPa (1- 150 psi) 0-12.5 kPa (0-50 in. w.g.) differential

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/engineer 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 engineer 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 engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.2 Protection

- .1 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.

3.3 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 Test and Balance:
 - .1 Provide a qualified technician to assist in the test and balance process, until the systems and components are balanced.
- .3 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 BAS 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 the section entitled 'Communication' of this specification.
 - .2 Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
 - .3 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 the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.4 General Workmanship

- .1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls).
- .2 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- .3 Install all equipment in readily accessible locations.
- .4 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- .5 Equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility.

3.5 Existing Equipment

- .1 Repair: Unless otherwise directed, the contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the contractor find existing equipment that requires maintenance, the engineer is to be notified immediately.
- .2 Temperature Sensor Wells: The contractor may reuse any existing wells in piping for temperature sensors. Modify wells as required for proper fit of new sensors.
- .3 Indicator Gauges: Where these devices remain and are not removed, they must be made operational and recalibrated to ensure reasonable accuracy.
- .4 Room Thermostats: Existing room thermostats are to be removed and returned to Owner. New thermostats are to be supplied and installed as specified in the "Controllers" section of this specification. Patch and finish holes and marks left by the removal to match existing wall finish.
- .5 Electronic Sensors and Transmitters: Existing sensors and transmitters may be reused, if possible, unless specifically noted otherwise. Remove and deliver unnecessary sensors and transmitters to the Owner.
- .6 Controllers and Auxiliary Electronic Devices. Existing controllers are to be removed and returned to Owner. Auxiliary electronic devices may be reused unless specifically noted otherwise. All pneumatically controlled valves, dampers, actuators or any other pneumatically-controlled equipment shall be removed and replaced with DDC electronically-controlled equivalents. Remove unnecessary sensors and transmitters.

- .7 Damper Actuators, Linkages, and Appurtenances: Existing damper actuators, linkages, and appurtenances may be reused unless specifically noted otherwise. Remove and deliver unnecessary equipment to Owner. All pneumatically controlled valves, dampers, actuators or any other pneumatic equipment shall be removed and replaced with DDC electronically-controlled equivalents.
- .8 Control Valves. Existing control valves may be reused, if possible, unless specifically noted otherwise. All pneumatically controlled valves, dampers, actuators or any other pneumatic equipment shall be removed and replaced with DDC electronically-controlled equivalents.
- .9 Existing System Operating Schedule. Mechanical system shall remain in operation and shall maintain space comfort at all times between the hours of 7 a.m. and 5 p.m., Monday through Friday. Modifications to the system shall not affect space comfort conditions or cause mechanical system to be shut down for more than 15 minutes. Perform cut-over of controls that cannot meet these conditions outside of operational hours.
- .10 Maintain fan scheduling using existing or temporary time clocks or control systems throughout the control system installation.
- .11 Install control panels where shown.
- .12 Modify existing starter control circuits, if necessary, to provide hand/off/auto control of each starter controlled. If new starters or starter control packages are required, these shall be included as part of this contract.
- .13 Patch holes and finish to match existing walls.
- .14 At Owner's request, items to be delivered to the Owner shall instead be properly disposed of. Hazardous materials shall be disposed of accordingly.

3.6 Wiring

- .1 Control and interlock wiring shall comply with national and local electrical codes and Division 16 of this specification. Where the requirements of this section differ from those in Division 16, the requirements of this section shall take precedence.
- .2 OESC Class 2 (under 120V, 100VA) wiring shall be ULc Listed in approved EMT conduit according to OESC and Division 16 requirements.
- .3 Low-voltage wiring shall meet OESC Class 1or2 (extra low voltage and under 100VA requirements and be installed in EMT conduit. (Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.)
- .4 Where OESC Class 1or2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in EMT conduit may be used provided that cables are ULc Listed for the intended application. For example, cables used in ceiling plenums shall be ULc Listed specifically for that purpose.
- .5 Wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage— shall be installed in EMT conduit.
 - .1 Install EMT conduit and raceways as high as possible to conserve head room and/or ceiling space.
 - .2 EMT Conduits / raceways shall not be run along floor or on concrete housekeeping pads.
 - .3 EMT Conduits / raceways shall be supported at intervals not exceeding 1.5 meter (5ft.) on center.
- .6 Flexible conduit shall not be permitted, except in the case of:
 - .1 Final connection from junction box to motors and equipment. Maximum length of 1meter (3 ft.).
 - .2 Final connection from junction box to boilers and pumps. Maximum length of 1meter (3 ft.). Provide liquid tight flexible conduit.
- .7 Do not install Class 1or2 wiring in EMT conduit containing low voltage power/lighting circuits wiring. Boxes and panels containing low/high-voltage wiring and equipment may not be used for Class 1or2 wiring except for the purpose of interfacing the two (e.g., relays and transformers).

- .8 Do not install wiring in EMT conduit containing pneumatic tubing.
- .9 Where Class 1 or 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 1.5 meter (5 ft) intervals.
- .10 Where plenum cables are used without EMT conduit, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical EMT conduits, piping, or ceiling suspension systems.
- .11 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.
- .12 Wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- .13 Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
- .14 Wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- .15 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations. Provide insulated bushing on ends of sleeves and conduits.
- .16 Size of EMT conduit and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer's recommendations and OESC requirements, except as noted elsewhere.
- .17 Include one pull string in each EMT conduit.
- .18 Use coded conductors throughout with conductors of different colors.
- .19 Conduit carrying 120V and higher shall be equipped with a green ground conductor the same size as the wiring in the conduit up to AWG #8, and sized as shown in Table 16 of the Ontario Electrical Safety Code for wiring with ampacities over 40 amps.
- .20 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.
- .21 Conceal all EMT conduits, except within mechanical, electrical, or service rooms. Install EMT conduit to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).
- .22 Secure EMT conduits with EMT conduit clamps fastened to the structure and spaced according to code requirements. EMT conduits and pull boxes may not be hung on flexible duct strap or tie rods. EMT conduits may not be run on or attached to ductwork.
- .23 Install conduit neatly in appearance, running parallel to or at right angles to building lines, parallel and equally spaced in groups not bent over sharp objects.
- .24 Adhere to this specification's Division 16 requirements where EMT conduit crosses building expansion joints.
- .25 Insulated Bushings
 - .1 Install insulated bushings on all EMT conduit ends and openings to enclosures. Seal top end of all vertical EMT conduits.
- .26 Flexible metal EMT conduits and liquid-tight flexible metal EMT conduits
 - .1 Length shall not exceed 1 m (3 ft) in length and shall be supported at each end.
 - .2 Flexible metal EMT conduit are to be $\frac{3}{4}$ " electrical trade size and larger.
 - .3 Outdoors: Provide rigid galvanized conduit
 - .4 In areas exposed to moisture, including chiller and boiler rooms, only liquid-tight, flexible metal EMT conduits shall be used.
- .27 EMT conduit must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. EMT conduit sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes and ends not terminating in boxes shall have bushings installed.
- .28 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.

3.7 Communication Wiring

- .1 All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- .2 Install communication wiring in separate EMT conduit and enclosures not containing Class 1 or other Class 2 wiring.
- .3 Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- .4 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- .5 Runs of communication wiring shall be unspliced length when that length is commercially available.
- .6 Communication wiring shall be labeled to indicate origination and destination data.
- .7 Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- .8 BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard. This includes but is not limited to:
 - .1 The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)
 - .2 The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
 - .3 The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
 - .4 An MS/TP EIA-485 network shall have no T connections.

3.8 BAS Line Voltage Power Source

- .1 BAS power wiring shall be provided by BAS contractor.
- .2 120-volt AC power circuits used for the Building Automation System shall be taken from panelboards and circuit breakers provided by Electrical Division.
- .3 Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.

3.9 Installation of Sensors

- .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/Space temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
 - .1 Mounting height shall be per ADA and Architect requirements.
 - .2 Provide lockable tamper-proof covers in public areas and/or where indicated on the plans and in public spaces.
 - .3 Wiring for Room/ space sensors shall be installed in EMT conduit within walls or panel systems.
- .4 Air seal wires attached to sensors in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- .5 Exposed sensors installed in the gymnasium area are to be installed complete with steel protective cages to prevent damage.

- .6 Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
- .7 Low-limit sensors shall be installed on all mechanical equipment with water coils, or mixed air plenums and shall be installed in a serpentine manner horizontally across coil/duct. Each bend shall be supported with a capillary clip. Provide 3 m of sensing element for each 1 m² (1 ft of sensing element for each 1 ft²) of coil area. Sensors shall be wired to shut down fan and close outdoor air dampers and prevent coil from freezing.
- .8 Pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- .9 Outdoor air temperature sensors to be installed on north wall, complete with sun shield at designated location.
- .10 Differential Air Static Pressure:
 - .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 The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
 - .5 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.
 - .6 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.

3.10 Flow Switch Installation

- .1 Use correct paddle for pipe diameter.
- .2 Adjust flow switch in accordance with manufacturer's instructions.

3.11 Actuators

- .1 Mount and link control damper actuators according to manufacturer's instructions.
 - .1 To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
 - .2 Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - .3 Provide all mounting hardware and linkages for actuator installation.
- .2 Electric/Electronic:
 - .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.

3.12 Warning Labels

- .1 Permanent warning labels shall be affixed to all equipment that can be automatically started by the BAS.
 - .1 Labels shall use white lettering (12-point type or larger) on a red background.
 - .2 Warning labels shall read as follows: "CAUTION – THIS EQUIPMENT IS OPERATING UNDER AUTOMATIC CONTROL AND MAY START OR STOP AT ANY TIME WITHOUT WARNING. 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 – THIS EQUIPMENT IS FED FROM MORE THAN ONE POWER SOURCE WITH SEPARATE DISCONNECTS. DISCONNECT ALL POWER SOURCES BEFORE SERVICING"

3.13 Identification of Hardware and Wiring

- .1 Wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm (2 in.) of termination with the BAS address or termination number.
- .2 Permanently label or code each point of field terminal strips to show the instrument or item served.
- .3 Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- .4 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.
- .5 Identify room sensors relating to terminal box or valves with nameplates.
- .6 Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- .7 Identifiers shall match record documents.
- .8 Where installed in ceiling space affix to ceiling grid yellow coloured label with black lettering indicating device tag above ceiling.
 - .1 Anything concealed to be identified.

3.14 Controllers

- .1 Provide a separate controller for each AHU or other HVAC system. A BAS controller may control more than one system provided that all points associated with the system are assigned to the same BAS controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
- .2 Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.
 - .1 Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional controller boards or point modules shall be required to implement use of these spare points.
- .3 Field cabinets and all controllers to have power and data as required supplied to each unit by BAS electrician.

3.15 Programming

- .1 Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.
- .2 Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Use the following naming convention: AA.BBB.CCDDE where:
 - .1 AA is used to designate the location of the point within the building, such as mechanical room, wing, or level, or the building itself in a multi-building environment,
 - .2 BBB is used to designate the mechanical system with which the point is associated (e.g., A01, HTG, CLG, LTG),
 - .3 CC represents the equipment or material referenced (e.g., SF for supply fan, RW for return water, EA for exhaust air, ZN for zone),
 - .4 D or DD may be used for clarification or for identification if more than one CC exists (e.g., SF10, ZNB),
 - .5 E represents the action or state of the equipment or medium (e.g., T for temperature, H for humidity, C for control, S for status, D for damper control, I for current).
- .3 Software Programming:
 - .1 Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
 - .1 Text Based:
 - .1 Must provide actions for all possible situations
 - .2 Must be modular and structured
 - .3 Must be commented
 - .2 Graphic Based:
 - .1 Must provide actions for all possible situations
 - .2 Must be documented
 - .3 Parameter Based:
 - .1 Must provide actions for all possible situations
 - .2 Must be documented
- .4 Operator Interface:
 - .1 Standard graphics—Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
 - .2 Show terminal equipment information on a “graphic” summary table. Provide dynamic information for each point shown.
 - .3 The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.
- .4 Graphics – Prepare to match DSBN Standards

3.16 BAS System Checkout and Testing

- .1 Start-up Testing: Testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating BAS. 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 binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
 - .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. Check control valves and automatic dampers to ensure proper action and closure. Make 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.

3.17 BAS Demonstration and Acceptance

- .1 Demonstration:
 - .1 Prior to acceptance, the BAS 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 Paragraph "BAS System Checkout and Testing" of this specification.
 - .3 The engineer may be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
 - .4 The demonstration process shall follow that approved in "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
 - .5 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.

- .6 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.
- .7 Demonstrate compliance with section entitled "BAS Performance."
- .8 Demonstrate compliance with sequences of operation through all modes of operation.
- .9 Demonstrate complete operation of operator interface.
- .10 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 Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. 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.
- .11 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.
- .2 Acceptance:
 - .1 Tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the BAS 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 engineer. Such tests shall then be performed as part of the warranty.
 - .2 Acceptance Check Sheets: Prepare check sheet that includes all points for all functions of the BAS as indicated on the point list included in this specification. Submit the check sheet to the Engineer for approval
 - .3 The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and accepted as required "Submittals."
 - .4 Acceptance Check Sheet: Prepare a check sheet that includes all points for all functions of the BAS as indicated on the point list included in this specification. Submit the check sheet to the Engineer for approval. The Engineer will use the check sheet as the basis for acceptance with the BAS Contractor.

3.18 Training

- .1 Provide training for a designated staff of Owner's representatives.
- .2 On-site Training shall be:

- .1 4 – 1/2 DAYS sessions
- .2 one (1) sessions of four (4) hour (1/2 day) duration each of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.
- .3 Training shall be provided via a combination of self-paced training, web-based or computer-based training, hands-on onsite training.
- .4 Training shall enable students to accomplish the following objectives.
 - .1 Understand control system architecture and configuration
 - .2 Understand DDC system components
 - .3 Understand system operation, including DDC system control and optimizing routines (algorithms)
 - .4 Access graphics, point reports, and logs
 - .5 Adjust and change system setpoints, time schedules, and holiday schedules
 - .6 Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
 - .7 Understand system drawings and Operation and Maintenance manual
 - .8 Understand job layout and location of control components
 - .9 Access data from DDC controllers
- .5 Instructors shall be factory-trained and experienced in presenting this material.

3.19 Sequences of Operation

- .1 Provide sequences of operation as shown on drawings and as written in specifications.

3.20 Control Valve Installation

- .1 Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.
- .2 Valves shall be installed in accordance with the manufacturer's recommendations.
- .3 Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.

3.21 Control Damper Installation

- .1 Damper submittals 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 ¼ in. 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 in.) 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.

3.22 Controls Communication Protocol

- .1 General. The electronic controls packaged with this equipment shall communicate with the building BAS. The BAS shall communicate with these controls to read the information and change the control set points as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the BAS and these controls shall be in the standard object format as defined for BACnet. Controllers shall communicate with other BACnet objects on the network using the protocol-specific service as defined by the protocol selected.
- .2 Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
- .3 I/O Capacity. The controller shall contain sufficient I/O capacity to control the target system.
- .4 Communication. The controller shall reside on a BAS BACnet network using the device level protocol. Each network of controllers shall be connected to one building controller.
- .5 The Controller shall have a network connection for a laptop computer or a portable operator's tool.
- .6 Environment. The hardware shall be suitable for the anticipated ambient conditions.
 - .1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 65°C (-40°F to 150°F).
 - .2 Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- .7 Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
- .8 Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days.
- .9 Immunity to Power and Noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. 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).
- .10 Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

3.23 Start-up and Checkout Procedures

- .1 Start up, check out, and test all hardware and software and verify communication between all components.
 - .1 Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 - .2 Verify that all analog and binary input/output points read properly.
 - .3 Verify alarms and interlocks.
 - .4 Verify operation of the integrated system.
- .2 Provide Start-up sheets as part of project closeout.

END OF SECTION

Part 1 General

1.1 Application

- .1 Mechanical work shall be governed by and subject to the provisions of this Section, and all other Sections of the Specifications. Read and conform to the General Requirements, General Instructions, Instructions to Bidders, Form of Tender, Form of Contract, General Conditions, Owner Instructions, and other requirements contained in Divisions 00 and 01 which apply to, and forms part of the work.
- .2 The work covered in this section shall be supplied and installed by the Mechanical Contractor responsible for work covered by Divisions 20, 21, 22, 23 and 25. Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractor.

1.2 Related Sections

- .1 Section 25 50 02 – Building Automation System.

1.3 System Description

- .1 This section defines the manner and method by which controls function.
- .2 Requirements for each type of control system operation are specified.
- .3 Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 Submittals for Review

- .1 Shop Drawings: Indicate mechanical system controlled and control system components.
 - .1 Label with settings, adjustable range of control and limits. Include written description of control sequence.
 - .2 Include flow diagrams for each control system, graphically depicting control logic.
 - .3 Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.5 Closeout Submittals

- .1 Refer to 25 50 00

1.6 Quality Assurance

- .1 Refer to 25 50 00

Part 2 Products

2.1 Not Used

- .1 Not Used.

Part 3 Execution

3.1 DSBN General

- .1 Systems to be in UNOCCUPIED MODE on weekends, holidays, statutory days and other days when students not at school.
- .2 All HVAC equipment to be in UNOCCUPIED MODE during Summer Months when students not at school.
- .3 Building Operator and/or timed override shall be able to switch systems to OCCUPIED MODE.

3.2 DSBN Scheduling

- .1 Primary heating (radiators and systems with Fan Powered VAV boxes running on 100% return) occupied schedule starting at 6am
- .2 Primary heating (radiators and systems with Fan Powered VAV boxes running on 100% return) unoccupied schedule starting at 6 pm
- .3 Primary ventilation (AHUs, univents, exhaust fans) full occupancy schedule staged on starting at 7am, and continuing 1-minute intervals until all ventilation systems on
- .4 Primary ventilation (AHUs, univents, exhaust fans) unoccupied schedule starting at 6 pm
- .5 Exterior lighting schedule (if applicable) uses solar time and turns on 1/2hr before sunset
- .6 Exterior lighting schedule (if applicable) turns off at 11:15PM
- .7 Exterior lighting schedule (if applicable) turns on at 6AM
- .8 Exterior lighting schedule (if applicable) uses solar time and turns off 1/2hr after sunrise
- .9 Annual holidays added to exception schedule for all building systems (see below). All ventilation systems to remain unoccupied during holiday and primary heating to heat to unoccupied setpoints. Exterior lighting schedule to continue through holiday period.
 - .1 o Labour Day
 - .2 o Thanksgiving Day
 - .3 o Christmas Break
 - .4 o Family Day
 - .5 o Good Friday
 - .6 o Easter Monday
 - .7 o Victoria Day

3.3 Setpoints

- .1 All setpoint temperatures to be maintained within a 1.5degC deadband (+0.75 to -.75 off setpoint).
- .2 Heating setpoints (all to user adjustable) to match below:
 - .1 Occupied setpoints for Classrooms, Administrative areas, changerooms, washrooms, corridors, secondary school shops to equal 21C
 - .2 Occupied setpoints for gymnasiums to equal 19C
 - .3 Unoccupied setpoint for all zones to equal 16C
- .3 Cooling setpoints (all to be user adjustable) to match below:
 - .1 Occupied setpoints for Classrooms, Administrative areas, changerooms, washrooms, corridors, secondary school shops and gymnasiums to equal 23C
 - .2 Unoccupied setpoint for all zones to equal 28C

3.4 Alarms

- .1 Alarms for space temperatures to be reviewed with owner.
 - .1 Alarms for low temp on building spaces or systems to remain active
 - .2 Alarms for high temperatures in building zones should remain only for zones where mechanical cooling exists

- .2 Alarms for ventilation system components should be prioritized (AHU components, exhaust fans on balanced systems)
- .3 Alarm when fan status does not match command.
- .4 Alarm when pump status does not match command.
- .5 Alarmed systems and triggers document to be added to graphics main page

3.5 **Graphics**

- .1 See DSBN standard for graphics requirements

3.6 **DSBN Boiler Plant - Hot Water Heating System**

- .1 The Boiler Plant shall be started for the season and stopped for the season by the building operator by a manual physical operation BAS switchover selection.
- .2 Hot Water Primary Pump Control:
 - .1 Primary Pumps (Px, Px) are started, stopped and rotated weekly by the BAS.
 - .2 Monitor Pump status and display accumulated run time for operator. BAS to provide indication when lead pump is to be rotated.
 - .3 Adjust pump speed to maintain differential pressure setpoint.
 - .4 Integrate pump information via BACnet communication interface.
 - .5 Control pumps via hardwire connections.
- .3 Hot Water Heat Control:
 - .1 Integral Boiler controller at Lead boiler shall stage member boilers to maintain supply water temperature.
 - .2 BAS shall enable/disable boiler plant controls.
 - .3 BAS shall provide enable/disable to boiler control only. Integrated boiler controller (or techmar) to reset HWS supply temp curve based on outdoor air temperature. Boiler controller also to control lead and schedule changes in lead boiler.
 - .4 The boiler control sequence will begin when either one of the hot water pumps has a status of on.
 - .5 The boiler pump shall be interlocked with the respective boiler and shall delay off through integral boiler controller.
 - .6 The boilers safeties circuit will be monitored and the system will report a general alarm condition if a safety is tripped. A manual reset of the boiler safety will be required before the boiler will/can be restarted.
 - .7 Provide indication of:
 - .1 outdoor air temperature
 - .2 boiler loop supply temperature and return water temperature
 - .3 boiler alarm status
 - .4 Boiler firing status
 - .5 Burner firing %
 - .6 Speed of boiler pumps
 - .7 Boiler manufacturer provided installed modbus or bacnet connection may be required)
 - .1 Boiler firing status
 - .2 Burner firing %
 - .3 Speed of boiler pumps
 - .8 primary pumps status
 - .9 setpoints at the BAS
 - .10 See Appendix A for additional requirements of Graphics
- .4

3.7 DSBN Chiller Plant (CH1) – Chilled Water System (Air Cooled Chiller)

- .1 The Chiller Plant shall be started for the season and stopped for the season by the building operator by a manual physical operation. BAS Enable/disable to be provided.
- .2 Chilled Water Primary Pump Control:
 - .1 Primary Pumps (Px) is started, stopped manually by the Caretaker.
 - .2 Monitor Pump status and display accumulated run time for operator.
 - .3 Adjust pump speed to maintain pressure differential
 - .4 Measure pump water flow. Maintain Chiller minimum flow rate by modulating bypass valve open as required during low load conditions.
 - .5 Integrate pump information via BACnet communication interface.
 - .6 Control pumps via hardwire connections.
- .3 Chilled Water Control:
 - .1 Integral Chiller controller operates to maintain supply water temperature.
 - .2 BAS shall Enable/Disable Chiller.
 - .3 Reset chilled water temperature based on demand.
 - .4 Monitor operating status, alarms, chilled water supply and return temperatures, refrigerant pressures, compressor operations, run times.
 - .5 Integrate chiller information via BACnet communication interface.

3.8 AHU1, AHU2, AHU3: (SF, EF, ERV with bypass, HW, CW, coil pump)

- .1 Fans Start/Stop:
 - .1 The fans will be started/stopped at the same time according to the schedule.
 - .2 Modulate fans speeds via VFD to maintain supply/exhaust flow rates as wheel by-pass damper and other dampers modulate
 - .3 Modulate fan speeds to maintain system static pressure sensor as required.
- .2 Occupied Mode:
 - .1 Outdoor Air damper will be controlled to maintain minimum outdoor air flow setpoint.
 - .2 Exhaust air damper will be controlled to maintain minimum exhaust air flow of outdoor air flow setpoint minus 10%cfm..
 - .3 Outdoor air and mixed air damper flow rates are electronically linked and are proportional
- .3 Air flow measurement:
 - .1 Monitor, measure and indicate supply fan cfm, exhaust fan cfm, outdoor air cfm, and exhaust air cfm and display on graphics and use values in sequences.
- .4 Energy Recovery Wheel:
 - .1 Cooling Recovery
 - .1 When outdoor air temperature is above economizer enable setpoint and above return air temperature,
 - .2 energy wheel is on,
 - .3 outdoor air damper maintains minimum outdoor air flow setpoint,
 - .4 outdoor air recovery bypass damper and exhaust air recovery bypass dampers are closed.
 - .5 cooling coil is on.
 - .2 Cooling No Recovery
 - .1 When outdoor air temperature is above economizer enable setpoint and below return air temperature,
 - .2 energy wheel is off
 - .3 outdoor air damper maintains minimum outdoor air flow setpoint,
 - .4 outdoor air recovery bypass damper and exhaust air recovery bypass dampers are open,
 - .5 cooling coil is on.

- .3 Cooling Economizing
- .1 When outdoor air temperature is below economizer enable setpoint and below return air temperature,
 - .2 energy wheel is off,
 - .3 outdoor air damper and return air damper modulate to maintain supply air temperature setpoint,
 - .4 exhaust air recovery bypass damper and outdoor air recovery bypass dampers are 100% open,
 - .5 Cooling and heating coils are off.
- .4 Heating Recovery Mode
- .1 Part Load Heating Recovery Economizing (Free Heat):
 - .1 When outdoor air temperature is below economizer enable setpoint and below return air temperature and below supply air temperature setpoint,
 - .2 Energy recovery wheel is on,
 - .3 outdoor air damper maintains minimum outdoor air flow setpoint,
 - .4 exhaust air recovery bypass damper and outdoor air recovery bypass dampers are open.
 - .5 If supply air temperature is above supply air temperature setpoint, then exhaust air recovery bypass damper modulates to maintain supply air temperature setpoint, outdoor air recovery bypass damper is closed.
 - .6 heating coil is off.
 - .2 Full Load Heating Recovery (Free Heat):
 - .1 Outdoor air temperature is below economizer enable setpoint and below return air temperature and supply air temperature is less than setpoint,
 - .2 Energy recovery wheel is on,
 - .3 outdoor air damper maintains minimum outdoor air flow set point,
 - .4 return air damper at maximum position
 - .5 exhaust air recovery bypass damper and outdoor air recovery bypass dampers are closed,
 - .6 heating control valve modulates to maintain discharge air temperature set point.
- .5 Economizer enable set point:
- .1 Outdoor air temperature delta of 5C (9.0F) db below return air temperature.
- .6 Energy Recovery Wheel Frost Control:
- .1 When outdoor air temperature is below -6.7 degC (20°F) and return air relative humidity (RH) is above 25% enable energy recovery frost control.
 - .2 When in energy recovery frost control mode modulate the outdoor air bypass damper to maintain exhaust air temperature as per values below.

Return Air Humidity (RH%)	Exhaust Air Setpoint (°F/°C)
25%-27%	15°F (-9.4°)
27.1-30%	20°F (-6.6°C)
30.1%-40%	32°F (0°C)
40.1%-50%	43°F (6.1°C)
50.1-60%	52°F (11°C)

- .3 When frost control mode is not enabled outdoor air bypass damper returns to economizer control.
 - .7 Heat Recovery Wheel Frost Control:
 - .1 When exhaust air temperature drops below 2 degC (36°F) enable heat recovery frost control mode.
 - .2 When in heat recovery frost control mode calculate exhaust air dew point using return air humidity and exhaust air temperature.
 - .3 Reset exhaust air temperature setpoint to calculated exhaust air dew point plus a differential.
 - .4 Modulate heat recovery bypass damper to maintain exhaust air temperature set point.
 - .5 When frost control mode is not enabled outdoor air bypass damper returns to economizer control.
 - .8 Supply Air Control:
 - .1 Heating mode:
 - .1 The energy recovery wheel, energy recovery bypass damper, return damper and heating valve, will modulated in sequence to maintain the supply air temperature setpoint.
 - .2 Refer to Energy Recovery Wheel sequences above.
 - .3 Reset supply air temperature to maintain average zone temperature setpoint heating/summer) as sensed by the zone temperature sensors in each classroom as an average or as single point as applicable
 - .4 The supply air temperature is floating based on ERV off wheel temperature with minimum AHU setpoint of 19 degC (66F). If off wheel temperature is lower 19 degC (66F), AHU temperature is reset based on the following reset schedule (adjustable):
- | Outdoor Air Temperature (OA-T) | Supply Air Temperature (SA-T) Setpoint |
|--------------------------------|--|
| -18°C (0 F) | 19°C (66F) (adj.) |
| 20°C (68 F) | 19°C (66F) (adj.) |
| | |
- .2 Cooling / Summer mode:
 - .1 The energy recovery wheel, energy recovery bypass damper, return damper and cooling coil will modulated in sequence to maintain the supply air temperature setpoint.
 - .2 Refer to Energy Recovery Wheel Sequences above.
 - .3 The supply air temperature setpoint is reset to maintain average zone temperature set point (heating/summer) as sensed by zone
 - .9 Mixed Air Low Limit Override: The mixed air temperature will override the minimum position and close the outside air damper if a temperature is sensed below the setpoint of 2 degC (37F)
 - .10 Morning Warm Up
 - .1 Perimeter radiation shall be modulated followed by Fan Powered VAV boxes with heating coil will be modulated (if installed) and the AH unit will be off.
 - .2 When required, AH supply fan will run to maintain static pressure
 - .1 Outdoor air damper will remain closed
 - .2 Exhaust damper will be closed
 - .3 Return damper will be open
 - .4 Heating coil will modulate to maintain supply air temperature.
 - .11 Morning Cool Down:
 - .1 When required, AH supply fan will run to maintain static pressure
 - .2 Outdoor air damper will remain closed
 - .3 Exhaust damper will be closed

- .4 Return damper will be open
- .5 Economizer will operate
- .6 Mechanical cooling will operate.
- .7 If economizer cooling is available, utilize economizer sequences.
- .12 Night Setback/Night Setup:
 - .1 When in "unoccupied" heating mode, the perimeter radiation will be modulated to maintain setpoint and the unit will be off.
 - .2 If Fan Powered VAV boxes are present, reheat coils will cycle to maintain setpoint, and the unit will be off.
 - .3 When in "unoccupied" cooling mode, the AH unit will cycle as necessary to maintain the night setback zone temperature (either average or single point) as described earlier at setpoint via economizer cooling. If mechanical cooling is required to maintain setpoint, outdoor air damper shall be closed.
- .13 Safety:
 - .1 All of the safety devices are manual reset; the device that has tripped must be manually reset before restarting the air handling unit.
 - .2 If a temperature low limit switch senses a temperature below setpoint the supply fan and return fan will be shutdown. Unit will enter shutdown status. Refer to below.
 - .3 Fire alarm system activation will shutdown the fan system. Unit will enter shutdown status. Refer to below.
- .14 Shutdown:
 - .1 When the unit is shutdown by either a stop command or system safety the unit will be set as follows:
 - .1 Supply fan will be off
 - .2 Exhaust fan will be off
 - .3 Outside air damper will close
 - .4 Exhaust air damper will close
 - .5 Return damper will be open
 - .6 Energy Wheel will be off
 - .7 Heating – valve will close.
 - .8 If mixed air temperature is sensed below 4.5 degC (40F) then open heating coil valve to fill heating coil with hot water until mixed air temperature rises above 10 degC (50F).
- .15 Alarm Monitoring:
 - .1 An alarm is generated when the coil low temperature thermostat is triggered.

3.9 AHU4: Gymnasiums (SF, RF, HW, CW, Coil Pump):

- .1 Supply Fan Start/Stop: The supply fan will be started according to the schedule. If the supply fan status does not match the commanded value, an alarm will be generated. When the supply fan status indicates the fan started, the control sequence will be enabled.
- .2 Return Fan Start/Stop: When the supply fan is commanded, the return fan will start. If the return fan status does not match the commanded value, an alarm will be generated.
- .3 Monitor, measure and indicate supply fan cfm and return fan cfm.
- .4 Discharge Air Control:
 - .1 Cooling/Summer mode:
 - .1 The discharge air temperature setpoint will reset as necessary to maintain the zone temperature setpoints as sensed by the zone temperature sensors
 - .2 The mixed air dampers and cooling valve will modulate in sequence to maintain the discharge air temperature at setpoint.
 - .2 Heating mode:

- .1 The discharge air temperature setpoint will be 65F (adj) and zone reheat coils will add supplemental heat as required.
- .2 The heating valve will modulate in sequence to maintain the discharge air temperature at setpoint.
- .3 The coil pump shall be started when outdoor air temperature is below 1C. If the pump status does not match the commanded value, an alarm will be generated.
- .5 Mixed Air Low Limit Override: The mixed air temperature will override the minimum position and close the outside air damper if a temperature is sensed below the setpoint of 40F.
- .6 Economizer Dry Bulb Switchover: When the shared outside air temperature is below the switchover setpoint of 65F (18C) (Adj.), the economizer will be enabled. When the shared outside air temperature rises above the switchover setpoint plus a differential, the economizer will be disabled.
- .7 Economizer Override(IAQ): If the return air carbon dioxide level exceeds the indoor air quality setpoint of 1200 ppm, the mixed air damper minimum position setpoint will increase to allow more outside air in. An upper limit is set in order to keep the unit from failing to meet the cooling or heating requirements.
- .8 Night Setback/Night Setup: When in "unoccupied" mode, the unit will cycle as necessary to maintain the night setback zone temperature at setpoint. A differential prevents the unit from cycling excessively.
- .9 Safety:
 - .1 All of the safety devices are manual reset; the device that has tripped must be manually reset before restarting the air handling unit.
 - .2 If a temperature low limit switch senses a temperature below setpoint the supply fan and return fan will be shutdown. (low limit switch is complete with AH).
 - .3 Fire alarm system activation will shutdown the fan system.
- .10 Shutdown:
 - .1 When the unit is shutdown by either a stop command or system safety the unit will be set as follows:
 - .1 Supply fan will be off (electrically interlocked return fan will be off).
 - .2 Outside air damper will close.
 - .3 Return air damper will open.
 - .4 Exhaust air damper will close.
 - .5 Heating – valve will open.
 - .6 Cooling - valve will close
- .11 Alarm Monitoring:
 - .1 An alarm is generated whenever the supply fan or return fan fails to respond to supply fan start-stop command.
 - .2 An alarm is generated when the low temperature thermostat is trigger

3.10 **DSBN Unit Ventilators (HW, DX) and Integral Exhaust Fan**

- .1 Zone Temperature Control: A room temperature sensor will control the heating valve, cooling and outside air damper, wall fin radiation valve.
- .2 Exhaust Fan Start/Stop: If there is an integral exhaust fan it will be started according to the schedule.
- .3 Occupied
 - .1 The occupied cycle of the unit will be the schedule within the BAS control system.
 - .2 The supply fan will operate continuously at fixed speed.
 - .3 During the occupied cycle, the outdoor air damper will be open to minimum position. When directed so by an economizer signal, the outdoor air damper will continue to open together with the return air damper closing.
 - .4 Heating - when room space temperature falls below programmed occupied room temperature set point

- .1 modulate perimeter radiation valve and unit ventilator heating coil valve together to maintain space temperature setpoint.
- .2 when space temperature setpoint is met, perimeter radiation valve is closed and unit ventilator heating coil valve modulates to maintain fixed supply air temperature of 20C (68F) (adj) setpoint.
- .5 Economizer - during a call for cooling and when the outdoor to indoor air temperature delta (outdoor air at least 4C below return air temperature), the outdoor air damper will modulate open together with the return air damper modulating closed to achieve set point (discharge air temperature not to fall below 10 degC (50 F.)). If after fixed time (approximately 10 minutes) space temperature setpoint is not met, mechanical cooling shall be enabled.
- .6 Cooling - when room space temperature rises above programmed occupied room temperature set point, the mechanical cooling signal will be enabled until room space temperature is met.
- .4 Unoccupied
 - .1 Unoccupied cycles will be determined by the schedule within the BAS control system
 - .2 During the unoccupied cycle the return air damper will be fully open and the outdoor air bypass damper will only be enabled during an economizer cycle.
 - .3 The supply fan will only operate as required during a call for unit ventilator heating or cooling.
 - .4 Heating - when room space temperature falls below programmed unoccupied room temperature set point, modulate perimeter radiation as first stage of heat. If perimeter radiation is 100% open and space setpoint remains below setpoint, the unit will cycle on to until space temperature is met.
 - .5 Cooling - when room space temperature rises above programmed unoccupied room temperature set point, economizer or mechanical cooling signal will be enabled until room space temperature is met.
 - .6 Economizer - cycle will operate the same during the unoccupied cycle as when in the occupied cycle.
- .5 Preconditioning/Standby
 - .1 Unit operates at occupied set points with ventilation disabled. Outdoor air damper, relief fan and exhaust fan are all off.
- .6 Safety:
 - .1 All of the safety devices are manual reset; the device that has tripped must be manually reset before restarting the unit.
 - .2 If a temperature low limit switch senses a temperature below setpoint the supply fan will be shutdown and the outdoor air damper will be closed and the heating valve will open.
- .7 Schedule:
 - .1 A pushbutton on the space thermostat will allow temporary occupied mode to be activated for a 1 Hour period for after- hours use.
 - .2 During the temporary occupied mode, the unit will function according to the occupied mode of operation until the temporary occupancy time expires.
- .8 Shutdown:
 - .1 When the unit is shutdown by either a stop command or system safety the unit will be set as follows:
 - .1 Supply fan will be off
 - .2 Outside air damper will close
 - .3 Return air damper will open
 - .4 Cooling – condenser will be off
 - .5 Heating – valve will be off
 - .6 If mixed air temperature is sensed below 10degC (50F) then open heating coil valve to fill heating coil with hot water until supply air

temperature sensor measures above 10 degC (50F). (valve opens to maximum of 30%)

- .9 Alarm Monitoring
 - .1 An alarm is generated when the low temperature thermostat is triggered.

3.11 **Fan Powered Variable Air Volume Box (FBx-x):**

- .1 Monitor status and Mode and Supply air temperature of associated AHU Unit.
- .2 The Fan Powered VAV box (FBx-x), reheat coil and/or perimeter heating element provides cooling, heating and ventilation to the space.
- .3 The occupied and unoccupied modes are determined by a time of day schedule.
- .4 Occupied Mode
 - .1 Fan: the fan will run continuously at constant speed.
 - .2 Airflow Setpoint: Air flow will be adjusted at air valve to minimum value constant airflow setpoint. Refer to drawing Schedule for minimum values.
 - .3 Heating: Air handler ERV/HRV supply air temperature will reset higher/lower with energy recovery to maximum of 19C (66F) adjustable. Reheat coil shall modulate to maintain space setpoint. FBx-x shall be at minimum value. Refer also to Air Handler sequences. Refer to drawing Schedule for minimum and maximum values.
 - .4 Cooling: Monitor FBx-x airflow. When boiler plant is off modulate airflow between minimum and maximum values to maintain cooling setpoint. Refer to drawing Schedule for minimum and maximum values.
- .5 Unoccupied Mode
 - .1 Cooling mode:
 - .1 Fan: the fan will run at constant speed when cooling is required.
 - .2 Cooling mode air flow will be adjusted at air valve to maintain space setpoint
 - .2 Heating mode:
 - .1 First stage: shall be perimeter radiation when present
 - .2 Second Stage:
 - .1 Fan: the fan will run at constant speed when second stage heating is required.
 - .2 Reheat coil will provide heating to the space
 - .3 Air flow valve will be closed.
- .6 Reheat Coil Valve:
 - .1 If the zone is equipped with perimeter heating, perimeter heating shall modulate and be first stage of heat and the reheat coil valve will modulate to maintain 19C(66F) adjustable supply air temperature.
 - .2 If space temperature cannot be met with perimeter heating, reheat coil shall modulate open.
 - .3 Reheat coil and perimeter heating are not used in cooling mode.

3.12 **Variable Air Volume Box (VAVx, electric reheat):**

- .1 Monitor status and Mode and Supply air temperature of associated AHU Unit.
- .2 Occupied Mode
 - .1 Cooling / Ventilation: The VAV damper will adjust air flow between minimum and maximum values to maintain cooling setpoint and minimum ventilation. Refer to drawing Schedule for minimum and maximum values.
 - .2 Heating / Ventilation: The VAV damper will adjust air flow between minimum and maximum values to maintain heating setpoint and minimum ventilation and modulate reheat coil. Refer to drawing Schedule for minimum and maximum values.
- .3 Unoccupied Mode

- .1 Modulate perimeter radiation when present
 - .2 Modulate reheat coil when air handler is on.
 - .4 Reheat Coil Valve:
 - .1 If the zone is equipped with perimeter heating, perimeter heating shall modulate and be first stage of heat and the reheat coil valve will modulate to maintain 19C(66F) adjustable supply air temperature.
 - .2 If space temperature cannot be met with perimeter heating, reheat coil shall modulate open.
 - .3 Reheat coil and perimeter heating are not used in cooling mode.
 - .5 Monitor VAV airflow and modulate between minimum and maximum values. Refer to drawing Schedule for minimum and maximum values.
- 3.13 **Reheat Coil/Wallfin/Radiant Panel Radiation Control**
 - .1 Radiation control: Control valve will modulate to maintain zone temperature setpoint.
 - .2 A pushbutton on the space thermostat will allow temporary occupied mode to be activated for a 1 Hour period for after- hours use.
 - .3 During the temporary occupied mode, the unit will function according to the occupied mode of operation until the temporary occupancy timer expires.
- 3.14 **Unit Heaters UHx**
 - .1 Enable/Disable Unit Heaters when outdoor air temperature rises above 16C (61F) and when Boiler Plant is in Heating Mode.
 - .2 Heating: The fan and two-position control valve will be energized by standalone thermostat as needed to maintain zone heating temperature setpoint.
- 3.15 **DSBN Vestibule Cabinet Heaters (CHx, ECH, FFH, Electric Fan Force Heater – tagging and naming may vary):**
 - .1 Enable/Disable Cabinet Heaters when outdoor air temperature rises above 7C (45F) and when Boiler Plant is in Heating Mode.
 - .2 Heaters fans operate by integral thermostat and self-contained control to maintain 16C (61F).
- 3.16 **DSBN Exhaust Fans: EF1, 2, 3, 12, 15, 20, 21, 22, 23**
 - .1 Exhaust Fan Start/Stop/Status:
 - .1 The exhaust fan will be started according to the operation mode and operation of associated ventilation zone and schedule.
 - .2 Single use washroom fans not to be connected to BAS but tied into the occupancy sensor of the lighting
- 3.17 **DSBN Gym Circ Fans: CF1, CF2**
 - .1 Exhaust Fan Start/Stop/Status:
 - .1 The exhaust fan will be started according to the operation mode and operation of associated ventilation zone and schedule.
- 3.18 **DSBN Domestic Water Service Meter Monitoring**
 - .1 Monitor incoming water service consumption.
 - .2 Provide Ultrasonic flow meter if City provided Meter is not compatible.

3.19 DSBN Domestic Hot Water Recirc Pump

- .1 Provide enable/disable and status.
- .2 Pump is to circulate for 15 minutes every two hours.
- .3 Provide on/off schedule for pump, to be owner set.

3.20 Electrical Power Monitoring

- .1 Monitor incoming power service and 6 separate breakers via BACnet or Modbus protocol. (total of 7).

3.21 Natural Gas Meter Monitoring

- .1 Monitor incoming gas service consumption.
- .2 BAS to provide Intrinsically Safe Zenner barrier and coordinate compatibility with Romet.
- .3 Power circuit provided by Electrical. Refer to Electrical Room and Electrical Drawings

3.22 DSBN Exterior Lights

- .1 Enable/disable exterior lighting. Contactor(s) located in electrical room. Allow for four (4) zones of control. Confirm exact number of Zones with Electrical drawings).
- .2 Provide override switch at each circuit for maintenance testing override of off time. Reset light status to off at start of next off schedule regardless of switch position.
- .3 Solar time to be determined by Astronomical Clock.
- .4 See Scheduling above for on/off timing details

3.23 DSBN Security System - Low Temperature Alarm by BAS

- .1 Alarm low temperature output to security monitoring system if:
 - .1 a space temperature is more than 8C below setpoint,
 - .2 or Boiler Hot water supply temperature is below 18C (65F),
 - .3 and outdoor air temperature is below 15C (59F),
 - .4 and Boiler Plant is enabled for the season.

3.24 DSBN Security System – Armed Status to BAS

- .1 When security system is placed into Armed Mode:
 - .1 When security system has been Armed for more than 30 minutes, BAS shall change status of HVAC systems to Unoccupied.
- .2 Security hardware by Intrusion Alarm company. Intrusion Alarm company to provide wiring from Intrusion Alarm panel to Boiler Room BAS panel. Coordinate wire type and panel location prior to start

END OF SECTION

Part 1

1.1 General

- .1 Section 260000 shall describe the general requirements and the responsibilities of the Electrical Contractor with respect to the electrical work on this project.
- .2 Where the word "Contractor" is used in these specifications it shall mean the Electrical Contractor unless specifically noted differently.
- .3 Electrical drawings and specifications are to be read in conjunction with the architectural, structural and mechanical drawings and specifications.
- .4 These conditions shall apply to all aspects of the electrical work as shown on the drawings and described in these specifications.
- .5 Electrical work shall also be in conformance with the "Instructions to Bidders" and the "Tender Form".

1.2 Codes and Regulations

- .1 Materials and labour provided under this contract shall be of the highest quality and shall be in compliance with the Canadian Standards Association, Ontario Electrical Safety Code, 29th edition and the Ontario Building Code.
- .2 Where there is a conflict between Code jurisdictions, the most stringent regulation shall apply.
- .3 The Electrical Contactor shall be responsible to make application for permits and for payment of fees associated with the installation and inspection of the electrical work.
- .4 Work shall be performed in a neat, safe and workman like fashion in accordance with procedures set down by the Ministry of Labour, Electrical Safety Authority, Construction Safety Association of Ontario, and where applicable by Electric Utilities Safety Association and the District School Board of Niagara safety policy.
- .5 Carry out changes required without delay.

1.3 Scope of Work

- .1 The intent of these drawings and specifications is to provide a complete and operational system to the Owner.
- .2 Supply and install all material and labour to complete the work as shown on the drawings, described in the specifications or required by regulatory agencies.
- .3 Supply all items, articles and materials, using methods, operations or techniques mentioned, shown, scheduled or reasonably implied by the drawings and specifications. This shall include all labour, equipment, tools, apparatus and incidentals required to provide a complete and operable electrical system or systems.
- .4 The plans and specifications are intended to complement one another. Materials and operations shown or implied on one and not the other shall be deemed to be required and must be included in the contract.
- .5 Prior to submitting a tender price, visit the site to become familiar with existing equipment systems and conditions. No additional payments will be considered for items arising from this Contractor's failure to conduct a field review of the existing building.
- .6 Where electrical systems are being demolished, all conduit, wiring, devices and boxes are to be removed. This Contractor shall trace and identify all wiring systems uncovered during demolition and remove redundant conduit, boxes and wiring.

- .7 The specifications shall be comprised of the following sections:

26 00 00 – General Requirements
26 00 70 – Seismic Restraint Systems
26 01 00 – Materials and Installation
26 02 00 – Main Electrical Service
26 04 00 – Switchboards and Panelboards
26 05 00 – Lighting Equipment
26 05 15 – Exit Signs and Emergency Lighting
26 06 10 – Cable Tray
27 51 20 – Public Address and Intercom
27 53 13 – Program Clock System
27 60 02 – Data & Telephone Wiring (CAT 6A)
28 31 00 – Fire Alarm System

1.4 Contradictions and Discrepancies

- .1 Prior to the closing of tenders, report any contradiction or discrepancies found in the drawings to the Engineer for clarification.
- .2 The Engineer will interpret the intent of the article in question and may issue an addendum to clarify the intent.
- .3 Failure by the Contractor to report contradictions or discrepancies until after the tenders close will give the Engineer the right to interpret the intent of the article in question and render a binding decision.

1.5 Contemplated Changes

- .1 When a change to the work is contemplated, the Engineer will issue a "Site Instruction" outlining the proposed variation in the works. The Electrical Contractor shall, as promptly as possible, estimate the cost implications of the proposed change (extra or credit) and submit a detailed (item by item) cost break down for materials, labour and incidentals, overhead and profit to the Engineer for review. Upon approval by the Engineer a "Change Order" will be issued and the change in price will be added to or deducted from the contract price.
- .2 The detailed cost breakdown shall be in the form of an item by item material and labour take off and shall list all materials used or credited and the labour hours associated with the installation of the materials.

1.6 Allowances

- .1 Electrical contractor costs, including coordination, management, supervision, installation, mark-up and overhead and other burdens associated with electrical cash allowances are to be included in the Electrical Contractor bid amount.

1.7 Shop Drawings

- .1 No material shall be installed prior to shop drawing review. The Contractor will be responsible for all costs which result from installing materials prior to approval of the shop drawing.
- .2 Failure to submit shop drawings in a timely fashion will not be considered a reason for extending the contract.

- .3 Prior to submitting shop drawings, submit a list which shall summarize the items for which shop drawings will be submitted. This list may be expanded by the Engineer if all items are not listed. This list will also serve to track the review of shop drawings.
- .4 Submit all shop drawings at the same time. Partial submissions will be held until all items have been received.
- .5 Submit shop drawings to the Engineer for review and comment in electronic pdf format.
- .6 Submit shop drawings for major components of all electrical systems as shown on the drawings or in the specifications.
- .7 Shop drawings shall bear the stamp of the Electrical Contractor indicating that he has examined the shop drawings and is confident that the material represented in them is in strict conformance with the specifications and that the material can be installed as required. Shop drawings not bearing the Contractor's stamp will be returned without review. The Contractor will be deemed to be delaying the project until shop drawings bearing the Contractor's stamp are submitted.
- .8 The Contractor's responsibility for errors, omissions or deviations in the shop drawings is not relieved by the Engineer's review of the shop drawings.
- .9 Upon review by the Engineer, if no errors or omissions are discovered or if only minor corrections are made to the shop drawings, the drawings will be returned, and fabrication may proceed. Should the shop drawings be rejected, they will be returned so noted and a resubmission of the corrected shop drawings will be required, following the procedures outlined above. No fabrication shall be commenced until the resubmitted drawings have been reviewed.
- .10 Keep one copy of reviewed shop drawings on site.
- .11 The Contractor is to provide the engineer with updated schedules depicting the status of all shop drawings.

1.8 Record Drawings

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$100.00 CDN plus HST, per drawing, up to first 10 drawings, and \$50.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawing.
- .2 Drawings for this project have been prepared on a CAD system using Building Information Modelling (BIM) - Autodesk Revit Architecture (Revit) software of release version confirmed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$100.00 CDN plus HST, per drawing, up to first 10 drawings, and \$50.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.
- .3 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:
 - .1 dimensioned location of inaccessible concealed work;
 - .2 locations of control devices with identification for each;

- .4 Use final reviewed "as-built" drawing set to provide CAD files and Revit models of drawings thus forming true "as-built" set of Contract Drawings and to create PDF drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of PDF "as-built" drawings on separate USBs. Submit "as-built" sets on USBs to Consultant.
- .5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files and Revit models are to be compatible with software release version confirmed with Consultant.
- .6 For projects with phased turnover of project (refer to Division 01), review with Consultant completeness of as-built drawings prior to turn over of an area. Copies of hand drawn interim as-built drawings to be made available to Owner's maintenance personnel.
- .7 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

1.9 Maintenance Data and Operating Instructions

- .1 This Contractor shall assemble two copies of all equipment literature, shop drawings, operating instructions, maintenance data, inspection certificates, verification and commissioning reports, copies of all "as installed" panel schedules and other information pertaining to the electrical installation and shall submit two copies to the General Contractor.
- .2 Each copy shall be logically arranged in a hard covered, three ring binder, with a suitable title affixed to the spine, a table of contents and tabs to identify each section.
- .3 After delivery of the manuals to the Owner, the Contractor shall arrange with the Owner and the system and equipment manufactures to conduct a series of tours with the Owners staff to familiarize them with the new equipment.
- .4 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as reviewed with Consultant and enhanced with bookmarks and internal document links.
- .5 The submittal of the Maintenance Manuals is a condition of the contract and final payment will not be considered due until this provision has been fulfilled.

1.10 Qualifications

- .1 Electrical work shall be performed by qualified electricians holding valid "Construction and Maintenance 309A Certificates of Qualification" issued by The Ontario Provincial Ministry of Training, Colleges and Universities.
- .2 The journeyman/apprentice ratio shall not exceed 3:1 (Three journeymen to one apprentice).

1.11 Installation

- .1 Final layout of the work is the responsibility of the Electrical Contractor. The Contractor shall make every effort to provide a neat and workman like installation. Any work deemed unacceptable to the Owner or the Engineer will be removed and re-installed by the Electrical Contractor at no cost to the Owner.
- .2 Concealed conduits, boxes, fittings, wiring and cables shall be installed as close to the building structure as possible to ensure proper concealment and avoid the necessity for furring.

- .3 Verify that dimensioned equipment locations as shown on the drawings can be retained and that proper clearances to adjacent work can be maintained.
- .4 The Engineer retains the right to relocate devices, without charge to the Owner, up to ten feet from locations shown on the drawings, provided the change is made prior to installation and does not require additional material or labour.
- .5 All exposed interior raceways, junction boxes, wiring and equipment shall be installed neatly, parallel to building lines and as close together as is possible.
- .6 Clearly mark and identify all raceways, junction boxes, feeder cables and other equipment. Identification shall be by means of a Lamacoid tag (white face, black core to provide black letters) lettering shall be 3/8" high. Fasten tags to junction boxes, disconnect switches, motor starters and other flat surfaces with double sided tape. Fasten tags to conduits and cables with ty-wraps.
- .7 All terminal strips shall be labeled with the wire numbers corresponding to those of the equipment manufacturer or according to a master list compiled by the Contractor and included in the Maintenance Manuals.
- .8 Junction and pull boxes shall be identified on the cover using permanent black marker as to the wiring they contain. Use the following code to identify systems:
 - NP – Normal Power
 - EP – Emergency Power
 - EL – Emergency Lighting & Exit Lighting
 - L – Lighting
 - DA – Computer Data
 - T – Telephone
 - FA – Fire Alarm
 - CA – Cable Television
 - S – Security and Door Access
 - CC – Closed Circuit TV
 - PA – Public Address

1.12 Layout and Planning

- .1 The Contractor shall be responsible for laying out, planning, and locating all systems, equipment, cable tray and conduit based on accurate field measurements and shop drawings or certified prints as required to properly install, maintain, repair and operate all systems and equipment. Drawings shall not be scaled to locate equipment, ductwork or piping. The drawings are diagrammatic and indicate the general arrangement and routing only. The Contractor shall plan the work to avoid interferences, minimize offsets, and to provide for a neat and proper installation.

1.13 Project Coordination

- .1 Coordinate progress of the work, progress schedules, submittals, use of site temporary utilities and construction facilities.
- .2 The work of the various sections shall be properly coordinated to assure the best arrangement of electrical equipment in the available space. Under no circumstances will any extra cost be allowed due to the failure by the Contractor to coordinate the work with the other trades. If required, in critical locations, interference, and/or installation drawings shall be prepared showing the work of the various sections and/or existing installations and shall be submitted to the Engineer for review before the commencement of work.

1.14 Commissioning and Testing

- .1 Prior to the start up of any system, check all devices and verify the manufacturer's start-up instructions.
- .2 Verify that all equipment is connected to the proper voltage and phase wire size and over current protection.
- .3 Meggar all panel feeders, Motor feeders and all major equipment feeders, record the readings and include them in the maintenance manuals.
- .4 Check rotation on all motors.
- .5 Check main service voltage, phasing, ground conditions and ground resistance. Record and include in the maintenance manuals.
- .6 Ensure that all equipment is grounded in accordance with the Ontario Electrical Safety Code and that the ground electrode resistance meets the requirements of the code.

1.15 Mechanical Equipment Connections

- .1 The responsibilities of the Electrical Contractor in the connection of mechanical equipment are as follows:
 - .1 This Contractor shall provide power wiring carrying full line current of motor or other mechanical systems equipment including wiring of speed controllers, variable speed drives, motor starters, and disconnect switches connected in line between the power source and the motor or other equipment.
 - .2 Motor starters, motor control centers and speed controllers will be provided and installed by the Electrical Contractor unless noted otherwise in the mechanical equipment schedule on the drawings. (Some unitized mechanical equipment may be supplied complete with these devices.)
 - .3 Where mechanical equipment is supplied with integral starters only power feeds and local isolation switches will be provided by the Electrical Contractor.
 - .4 Low voltage mechanical systems wiring (under nominal 120 volts), including Building Management System (BMS) wiring, but excluding fire alarm, PA, data & telephone wiring, will be supplied and installed by the Mechanical Contractor.
 - .5 Multi-speed motors are to be consequent pole.
 - .6 Electric heaters will be supplied installed and wired by the Electrical Contractor including low (under 120 volt) and line voltage thermostats, excluding BMS wiring.
 - .7 The Electrical Contractor shall verify on site the exact location and characteristics of mechanical equipment prior to proceeding with the mechanical wiring.

1.16 Underground Installations

- .1 Excavating and backfilling for electrical work, bases, pads, trenches etc., inside and outside of the building which is required for the installation of electrical equipment or wiring will be provided by the Electrical Contractor.
- .2 Excavate to alignment and grade required for placing of the underground services. Brace and dewater trench so that the electrical plant can be safely and correctly installed in accordance with the Ontario Construction Safety Association and Ministry of Labour standards.
- .3 Unless noted otherwise, all electrical trenches shall provide for a minimum of 1 meter of cover over all electrical and communications conduits.

1.17 On Site Storage and Operating Facilities

- .1 The Electrical Contractor shall provide a trailer or similar structure at the site to store all materials, tools and to serve as a workshop and office. Power from the building will be made available but connection will be the responsibility of the Contractor.

1.18 Cutting Patching and Fire Stopping

- .1 Cutting and patching of the building structure required due to the demolition of existing electrical equipment or for the installation of new electrical apparatus is the responsibility of the Electrical Contractor. Cutting and patching shall be provided by the trade skilled in the installation of the media to be patched at the expense of the Electrical Contractor.
- .2 Provide and install sleeves for conduits and cables and openings for raceways and equipment. Sleeves in concrete shall be schedule 40 steel pipes sized to allow free passage of the equipment. Sleeves shall extend 6" on either side of the structure on each side and be packed with resilient fire stop material. All penetrations caused by the electrical work shall be sealed using an approved fire sealing material in accordance with the Ontario Building Code.
- .3 All cutting and patching shall be laid out for review by the Engineer prior to proceeding and patching shall be completed to a "paint ready" state.
- .4 No cutting of structural members shall be permitted without the approval of the Structural Engineer.
- .5 Provide and pay for metal goose neck flashing installed by the roofing Contractor where electrical wiring must penetrate the roof. Wherever possible run electrical wiring through mechanical piping doghouses.

1.19 Supports and Concrete Work

- .1 Provide and erect all special structural steel or concrete work required solely for the installation of electrical equipment or wiring and not shown on Architectural, Structural or Mechanical drawings. Supply and install all anchor bolts and other fastenings. Where apparatus is required to be mounted on concrete pads, locate the pads accurately and install with neatly chamfered edges.
- .2 Where electrical equipment is mounted on housekeeping pads, this Contractor shall provide cast in place pads, constructed by the appropriate trade and paid for by the Contractor. Pads shall be 30kPa concrete, minimum 100 mm thick and reinforced with #6 150mm x 150mm steel mesh and shall extend 50mm beyond the electrical equipment.

1.20 Final Completion and Guarantee Certificates

- .1 At the completion of the work this Contractor shall participate in the procedures for establishing substantial completion as laid out in OAA/OGCA document No.100 or as required by the contract. As required by OAA/OGCA #100 the process shall commence with the Contractor submitting a detailed list of work he has yet to complete.
- .2 Upon completion of the contract, submit to the Owner the Electrical Safety Authority, Certificate of Approval.
- .3 Submit to the Owner, a certificate of Fire Alarm Verification along with the verifying technician's work notes.

- .4 Submit a letter to the local "Fire Authority Having Jurisdiction" and the Owner, a letter indicating that the fire alarm installation and modification has been completed by tradesmen certified to carry out this type of work and that the work has been completed in accordance with CAN/ULC S524 and verified in accordance with CAN/ULC S537.
- .5 Affirm in writing that all materials and workmanship used in the project are in strict conformance with the drawings and specifications and will give proper and efficient operation and are free from mechanical and electrical defects. Guarantee to repair and/or replace any defects which may appear in any of the work within one year after substantial completion (except due to normal wear) without expense to the Owner.

END OF SECTION

1 General

- .1 Section 260000 forms part of this Section as though written out in full and is to be read in conjunction with this section.
- .2 The work to be done under this section shall include the furnishing of labour, materials, tools and equipment required to complete the installation of the Seismic Restraint System as shown on the drawings, specified and in accordance with the Ontario Building Code.
- .3 Definitions
SRS: acronym for Seismic Restraint System
SCS: Slack Cable Systems
- .4 Limitations
 - a. One trade to be responsible for the design, supply and installation of all seismic restraint systems for all electrical systems and equipment installed under the Electrical Contractors Contract.
- .5 General Description
 - a. This section covers design, supply and installation of complete SRS for all electrical systems, equipment specified for installation on this project. This includes both static and dynamic components.
 - b. It is the responsibility of the Electrical Contractor to engage the services of an experienced SRS Engineer who is an active member of the Professional Engineers of Ontario, and the costs for these services shall be included in the Contract amount.
 - c. The SRS Engineer shall design restraining systems, provide shop drawings for review, and provide inspection services during and after construction.
 - d. SRS to be fully integrated into, and compatible with the noise and vibration controls.
- .6 Electrical equipment and associated services requiring seismic restraints shall include but not necessarily be limited to the following items. Compare with the drawings and add to the list as applicable:
 - a. Equipment:
 - i. All floor mounted, static electrical equipment including but not necessarily limited to the following, shall be suitable anchored and braced to ensure that it does not topple over:
 - Switchboards
 - Motor Control Centre's
 - Control Panels
 - Transformers
 - ii. All floor mounted electrical equipment with moving parts, such as diesel generator, shall be anchored and provided with vibration isolator and snubber assemblies.
 - b. Life safety related systems:
 - i. The SRS Engineer shall decide whether the following systems may be considered to remain operational to provide an appropriate level of safety in evacuating the building:
 - Fire Alarm System
 - Emergency power
 - Egress lighting

- ii. For these systems, the following requirements apply:
 - Equipment must be installed in accordance with the criteria indicated above.
 - Conduit installations for these systems will generally be installed securely on the slab, with expansion couplings to cross building joints and where these are terminated into equipment that is likely to vibrate or move, the connection is to be in flexible conduit.
 - Lighting fixtures in T-Bar ceilings are to be supported by vertical chains. In the egress routes, these fixtures shall be further secured by cross bracing.
 - To maintain the continuity of Emergency Power System, suitable materials and methods to provide fire rating as well as seismic restraint are required.
 - To maintain the continuity of Fire Alarm systems, suitable materials and methods to provide fire rating as well as seismic restraint are required.
- .7 Escape route requirements: To maintain accessibility in escape routes, the pertinent electrical installations must be seismically restrained. These shall include but not necessarily be limited to:
 - a. Conduit
 - b. Light fixtures
 - c. Cable tray
 - d. Treatment of conduit and light fixtures is to be as already described above.
 - e. Cable trays are to be securely supported and cross braced to ensure that it stays in place.
- .8 References
 - a. CAN/CSA-G40.21- latest edition, Structural Quality Steels.

2 Submittals

- .1 Submit shop drawings and product data in accordance with Section 260000.
- .2 Submittals to include:
 - a. Full details of design criteria.
 - b. Working drawings (prepared to same standard of quality and size as documents forming these tender documents), materials lists, and schematics full specifications for all components of each SRS to be provided.
 - c. Design calculations (including restraint loads resulting from seismic forces in accordance with Ontario Building Code (OBC), detailed work sheets, tables).
 - d. Separate shop drawings for each SRS and devices for each system, equipment.
 - e. Identification of location of each device.
 - f. Schedules of types of SRS equipment and devices.
 - g. Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
 - h. Installation procedures and instructions.
 - i. Design calculations including restraint loads to be to NBCC, OBC and Supplement.
 - j. Detailed work sheets, tables.
 - k. Detailed design of SRS including complete working drawings prepared to same standard of quality and size as Contract Documents, materials lists, design calculations, schematics, specifications.

- .3 Submit one additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.
- .4 The SRS are to be inspected and certified by the Seismic Engineer upon completion of the installation, and a written report with certification of compliance submitted to the Engineer.

3 Maintenance Data

- .1 Provide maintenance data including monitoring requirements for incorporation into manual specified in Section 260000.

4 Products

- .1 SRS Manufacturer
 - a. SRS to be provided by one manufacturer regularly engaged in the production of SRS.
 - b. Acceptable manufacturers:
 - i. Korfund.
 - ii. Mason.
 - iii. Vibro-Acoustics.
 - iv. Vibron.
- .2 General
 - a. SRS to provide gentle and steady cushioning action and avoid high impact loads.
 - b. SRS to restrain seismic forces in all directions.
 - c. Fasteners and attachment points to resist same load as seismic restraints.
 - d. SRS of Piping systems to be compatible with expansion, anchoring and guiding requirements and equipment vibration isolation and equipment SRS.
 - e. SRS utilizing cast iron, threaded pipe and other brittle materials not permitted.
 - f. Use high strength mechanical expansion anchors for attachment to concrete structure. Drilled or power driven anchors not permitted.
 - g. Seismic control measures are not to interfere with integrity of firestopping.
- .3 SRS for Static Equipment, Systems
 - a. Floor-mounted equipment, systems:
 - i. Anchor equipment to equipment supports.
 - ii. Anchor equipment supports to structure.
 - iii. Use size of bolts as indicated in approved shop drawings.
 - b. Suspended equipment, systems:
 - i. Use one or combination of following methods:
 - 1) Install tight to structure.
 - 2) Cross-brace in all directions.
 - 3) Brace back to structure.
 - 4) Slack cable restraint system.
 - ii. SCS to prevent sway in horizontal plane, "rocking" in vertical plane, and sliding and buckling in axial direction.
 - iii. Hanger rods to withstand compressive loading and buckling.
- .4 SRS for Vibration Isolated Equipment
 - a. Floor-mounted equipment, systems:
 - i. Use one or combination of following methods:

- 1) Vibration isolators with built-in snubbers.
 - 2) Vibration isolators and separate snubbers.
 - 3) Built-up snubber system approved by Engineer, consisting of structural elements and elastomeric layer.
 - ii. SRS to resist complete isolator unloading.
 - iii. SRS not to jeopardize noise and vibration isolation systems. Provide clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
 - iv. Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.
 - b. Suspended equipment and systems:
 - i. Use one or combination of following methods:
 - 1) Slack cable restraint system.
 - 2) Brace back to structure via vibration isolators and snubbers.
- .5 Slack Cable Restraint System (SCS)
- a. Use elastomer materials or similar to avoid high impact loads and provide gentle and steady cushioning action.
 - b. SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
 - c. Hanger rods to withstand compressive loading and buckling.
- .6 Service Utilities Entrance into Buildings
- a. Provide sufficient flexibility to prevent breakage in the event of an earthquake.

5 Execution

- .1 Installation
- a. Provide attachment points and fasteners to withstand the maximum load that the seismic restraint is to resist in all directions.
 - b. Slack Cable Systems (SCS):
 - i. Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
 - ii. Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points.
 - iii. Provide transverse SCS at 10 m spacing maximum on piping systems, with longitudinal SCS at 20 m maximum or as limited by anchor/slack cable performance.
 - iv. Small pipes may be rigidly secured to larger pipes for restraint purposes, but not the reverse.
 - v. Arrange restraint wires on ceiling hung equipment at approximately 90° to each other (in plan), tie back to structure at maximum angle of 45° to structure.
 - vi. Adjust restraint cables so that they are not visibly slack, but permit vibration isolation system to function normally.
 - vii. Tighten cable to reduce slack to 1½" (40 mm) under thumb pressure. Cables shall not support weight during normal operation.
 - c. Install SRS at least 1" (25 mm) from all other equipment, systems, and services.
 - d. Bolt miscellaneous equipment that is not vibration-isolated, through house-keeping pad to structure.
 - e. Co-ordinate connections with all disciplines.

- f. Anchor vertical tanks through house-keeping pad to structure and provide steel bands above centre of gravity.
 - g. Provide at least two (2) straps with anchor bolts fastened to structure for horizontal tanks:
- .2 Inspection and Certification
 - a. SRS to be inspected and certified by Seismic Engineer upon completion of installation.
 - b. Provide written report to Engineer with certificate of compliance.
- .3 Commissioning Documentation
 - a. Upon completion and acceptance of certification, hand one (1) complete set of construction documents to Engineer revised to show "as-built" conditions.

End of Section

1. General

- 1.1. Section 260000, forms part of this section as if it were written here in full and is to be read in conjunction with this section.
- 1.2. This section covers the materials and installation methods used in the project.
- 1.3. Material supplied shall be new and be approved by the Canadian Standards Association, Underwriter's Laboratory Canada and/or Ontario Electrical Safety Code.
- 1.4. Competent and qualified supervision shall be supplied to oversee the electrical installation on a continuous basis.
- 1.5. The workforce shall consist of at least one foreman and qualified electricians employed in sufficient numbers to ensure the completion of the work in accordance with the project, with the highest quality control. This contractor shall assure at all times that his work is completed to such an extent so as to avoid substantial delays to other divisions.
- 1.6. Obtain DSBN electrical standards prior to ordering any materials.

2. Wire and Cable

- 2.1. Power Conductors
 - a. Secondary conductors shall be CSA approved type for 600 volt and be ULC listed.
 - b. Conductors shall be copper.
 - c. Minimum conductor size shall be 12 AWG stranded, with flame retardant R90 insulation.
 - d. Underground installations shall be wired with 600 Volt RWU type insulation, unless otherwise noted.
 - e. Neutral conductors shall not be used for more than one branch circuit, for more than one multiwire branch circuit, or for more than one set of un-grounded feeder conductors.
 - f. Conductors shall be installed in a neat and orderly fashion. The utmost care shall be taken to avoid damage to conductor insulation when cables are installed. Conductors shall be installed in conduit.
 - g. Conductors shall be identified with the proper numbers and at all termination and junction points. Brady and Pilgrim type markers are acceptable.
 - h. All power conductors shall be colour coded at each termination as follows:
 - i. Phase "A" – Red
 - ii. Phase "B" – Black
 - iii. Phase "C" – Blue
 - iv. Neutral – White
 - v. Ground – Green
 - vi. Isolated ground – Green, Black stripe.
- 2.2. Control Conductors
 - a. Conductors shall be OHEC approved type for 600 volt and be ULC listed, unless otherwise noted.
 - b. Conductors shall be copper.
 - c. Minimum conductor size shall be 14 AWG stranded, with flame retardant TW insulation for 75 degrees Celsius.
 - d. Control conductor insulation shall be yellow in colour.
 - e. Conductors shall be installed in a neat and orderly fashion. The utmost care shall be taken to avoid damage to conductor insulation when cables are installed. All conductors shall be installed in conduit.
 - f. Conductors shall be identified with the proper numbers and at all termination and junction points. Brady and Pilgrim type markers are acceptable.

2.3. Cable jackets for other systems shall be coloured as follows:

- | | |
|------------|-----------------------------|
| a. White: | CAT 6A for Data |
| b. Orange: | Cat 6 for Security |
| c. Purple: | Intrusion Alarm |
| d. Yellow: | BAS Digital Controls |
| e. Green: | Public Address/Clock System |

2.4. Metallic and Non-Metallic Sheath Cable

- a. The limitations on the use of non-metallic sheath cable (NMD, NMW) and metallic sheath cable (BX) will be strictly enforced.
- b. When BX cable installation is not in conformance with this specification it shall be removed and replaced with conduit and wire at no expense to the Owner.
- c. The use of metallic sheath cable shall be limited to the inside of metal stud and drywall partitions and to a maximum of 1.5 meters drop from lighting junction box to light fixture. All other wiring shall be in conduit.
- d. Notwithstanding item c above, metal stud walls shall not be used as main distribution means for bundles of BX cables.
- e. Do not "daisy chain" light fixtures with BX. Provide individual BX drops from junction boxes which are part of a lighting conduit and wire system.
- f. BX cables shall not be used to wire equipment power or controls for mechanical systems.
- g. AC90 wiring shall only be permitted for fire alarm system wiring drops from accessible ceiling junction boxes to ceiling heat/smoke detectors. All other fire alarm initiating/signal wiring shall be installed in conduit.
- h. BX cables shall not be surface mounted unless specifically called for.
- i. Non-metallic sheath cable type NMD, (Romex) and type NMW (Farmex) shall not be used.

3. Conduit and Fittings

- 3.1. Conduit types shall be;
 - a. Hot dipped galvanized heavy wall rigid schedule 40 conduit (Rigid steel)
 - b. Aluminium heavy wall schedule 40 conduit (Rigid Aluminium)
 - c. Electrical metallic tubing (EMT)
 - d. Rigid heavy wall polyvinyl chloride PVC (Sceptre)
 - e. Underground PVC duct (DB2)
- 3.2. Minimum size conduit shall be 19 mm (3/4") unless noted otherwise.
- 3.3. Raceways carrying wiring 120 volts and higher shall be equipped with a green ground conductor sized the same as the wiring in the race way up to #8 AWG and sized as shown in Table 18 of the Ontario Electrical Safety Code for wiring with ampacities over 40 amps.
- 3.4. EMT shall be used in all installations except for the following or on approval by the Engineer.
 - a. Rigid steel conduit shall be used where subject to severe mechanical injury.
 - b. Rigid PVC conduit shall be used underground or embedded in concrete.
- 3.5. Conduit fittings for EMT shall be steel set screw type indoors and compression type rain tight outdoors.
- 3.6. Where non-metallic conduit is used a suitable sized green grounding conductor shall be installed.
- 3.7. Conceal conduits as far as practicable in the floor, wall and ceiling construction. Conduits may be run exposed in crawl spaces, fan rooms, penthouses, electrical and mechanical rooms, unless specified or noted otherwise. Approval shall be obtained from the Engineer prior to the installation of any surface conduits in any location other than the above specified areas.

- 3.8. Install conduit neatly in appearance, running parallel to or at right angles to building lines, parallel and equally spaced in groups, not bent over sharp objects.
- 3.9. Clean and seal conduit until wiring is installed.
- 3.10. Install grounding bushings, jumpers and ground straps as required to maintain continuity of grounding for the complete system.
- 3.11. Terminate empty conduit for future use with a cap and nylon pull cord in each empty conduit. Tie off pull cord at each end of run and tag each end with location of the opposite end.
- 3.12. Conduit shall be fastened securely in place with approved straps and hangers in sufficient number to prevent movement of any part of the conduit. This includes conduit installed in forms before concrete is poured. No tie wires will be permitted.
- 3.13. Expansion fittings shall be provided at points where conduit crosses building expansion joints.
- 3.14. Connections to motorized equipment shall be made with sealtite flexible conduit, to minimize vibration.
- 3.15. Liquid-tight fittings shall be used where sealtite conduit is specified.
- 3.16. Conduits shall be installed a minimum of 75mm from any hot water pipes.
- 3.17. Conduit for the fire alarm system shall be factory tinted Red in colour.
- 3.18. Conduit for other systems shall be identified with spray paint at not more than 10 feet intervals. Colours shall be matched to the system for which they are used, as follows:

a. Blue:	Emergency Low voltage wiring
b. Green:	Security/Access control
c. White:	High Voltage Power Supply (250 to 600 volts)
d. Yellow:	Emergency Lighting line voltage
e. Silver (no paint)	Standard Wiring systems 120 to 250 volts
f. Red	Fire Alarm wiring
- 3.19. All interior electrical conduits shall be run above grade including feeders from switchboard, distribution panelboards, branch circuit wiring, PA / Intercom, Data / Telephone cabling and Fire alarm system wiring.
- 3.20. Provide conduit / junction box network with 12 awg or larger conductors from each electrical panelboard to each room served by the electrical panelboard.

4. Underground Ducts

- 4.1. Unless otherwise specified all underground wiring shall be in PVC conduit. Approved types of conduit shall be used for concrete or direct burial.
- 4.2. All ducts shall be properly sloped to ensure drainage away from building.
- 4.3. Proper protection and identification of all duct runs shall be made as required.
- 4.4. Duct installation of more than one duct shall include factory duct spacer system. Spacers to be installed at 3 meter intervals.
- 4.5. All duct joints and connections shall be made using approved bonding adhesive (glue), installed according with manufacturer's instructions.

5. Junction, Pull and Outlet Boxes

- 5.1. EEMAC 1 enclosures shall be furnished for dry and clean locations. In wet or outdoor locations EEMAC 3R enclosures shall be used.
- 5.2. Install all boxes to be accessible after the building is complete, set to come flush with the finished lines of the wall where recessed and level where surface mounted.
- 5.3. Install junction boxes on all conduit work where necessary to permit easy installation of conductors.
- 5.4. Where boxes must be surface mounted, they shall be cast alloy type or multi-gang aluminum type FS/FD with appropriate covers. No pressed steel boxes shall be surface mounted. When larger than 6"x6"x4" is required type D boxes may be used.

6. Wiring Devices

- 6.1. Wiring devices shall be as specified on the drawings
- 6.2. Cover Plates shall be stainless steel for all interior wiring devices. Weatherproof cover plates shall be used for devices mounted exterior applications.
- 6.3. Duplex receptacle plates and light switch plates shall have the panel and circuit number of the outlet on clear adhesive tape with black letters produced by a digital labeling device permanently affixed to them.
- 6.4. Receptacles wired to a receptacle controller shall be labelled as a "controlled" receptacle as per ASHRAE 90.1 section 8.4.2. Refer to panel schedules for list of receptacle circuits wired to receptacle controller.
- 6.5. Alternate acceptable manufacturers shall be Hubbell, Pass & Seymour, Wattstopper and Arrow Hart.
- 6.6. Except as noted on the drawings, electrical device shall be mounted as follows;

Light switches:	1050mm AFF
Duplex receptacles:	450mm AFF
Over counter receptacles:	150mm over counter height
Thermostats:	1050mm AFF
CATV outlets:	450mm AFF
Data outlets:	450mm AFF
Telephone outlets:	450mm AFF
Wall mounted light fixtures:	2200mm AFF
Fire alarm, pull Stations:	1150mm AFF
Fire alarm, signal devices:	2450mm AFF (or 150mm below low ceilings)
Emergency lighting fixtures:	2450mm AFF (or 150mm below low ceilings)
Over mirror fixtures:	150mm over mirror

7. Occupancy Sensors

- 7.1. Supply and install lighting controls as shown on the drawings.
- 7.2. Lighting relay/dimming controllers shall be mounted above ceiling, located above primary wall mounted/recessed toggle switches.
- 7.3. Sensing technologies shall be completely passive meaning that they will not emit any radiation that is known to interfere with certain types of hearing aides, or electronic devices such as electronic white board readers. Acceptable programmable shall be Passive Infrared (PIR), and/or PIR/Ultrasonic Passive Dual Technology (PDT)
- 7.4. Sensors shall operate on a class 2, three-conductor system. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 milliamps so that up to 14 sensors may be connected to a single power pack.
- 7.5. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.
- 7.6. Substitutions must be submitted no less than 5 days prior to bid date. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception. If substitution is approved, the contractor shall bear the responsibility of a fully functional system to the owner's and Architect's satisfaction.

8. Disconnects

- 8.1. Disconnect switches, fused and un-fused, shall be provided as shown on the drawings and shall be EEMAC 2 for interior use and EEMAC 3R for exterior use.
- 8.2. All disconnect switches shall be complete with exterior mounted operating handle mechanically interlocked with the front cover to prevent opening when the switch is in the "on" position and capable of being locked in the "off" position. All switches shall be equipped for multiple locks.
- 8.3. All disconnect switches shall be of the heavy-duty type.

- 8.4. Fused disconnects shall have fuse clips installed for HRCI Class J or Class L fuses.
- 8.5. Install lamacoid nameplates identifying the load served by each switch and where applicable the location of the feeder source.
- 8.6. Acceptable manufactures of disconnects shall be Schneider, Cutler Hammer or Siemens.
- 8.7. Local disconnecting means for boiler pumps shall be 20A twistlock plug and receptacle.

9. Fuses

- 9.1. Low voltage HRC fuses, types as specified, shall be CSA certified in accordance with standard C22.2 No. 106-M 1985.
- 9.2. HRCI-JY fuses and fuses to Standard C22.2 No. 106-1953 are not acceptable.
- 9.3. Fuses shall be HRCI-J for ratings 1 to 600 amperes or HRCI-L for ratings 601 to 6000 amperes except where otherwise specified.
- 9.4. Where a time delay characteristic is required, fuses shall carry 500% of their ampere rating for not less than 10 seconds and shall be clearly labeled "Time Delay". A shorter delay is not acceptable.
- 9.5. Supply and install a junction box with a hinged door in the electrical room for the storage of spare fuses. Provide six spare fuses of each size for sizes 400A and under and three spare fuses for sizes greater than 400A.
- 9.6. All fuses for the distribution system shall be of the same manufacturer to ensure selective co-ordination.
- 9.7. Fuses shall be as manufactured by Gould Shawmut, Sefco, English Electric, Bussman.

10. Motor Starters

- 10.1. Verify location and characteristics of mechanical equipment requiring starters supplied by this contractor prior to placing orders for starters.
- 10.2. Each starter shall have a lamacoid nameplate identifying the load served by the starter and where applicable the location of the feeder source.
- 10.3. Provide and install separately mounted magnetic (Sq D class 8536) and/or combination magnetic starters, (Sq D class 8538) of fusible disconnect switch type, with ratings, sizes, enclosure types and accessories as shown on the drawings. Unless specified otherwise magnetic and combination magnetic starters for HVAC equipment shall be complete with;
 - a. Control transformer (secondary voltage as specified)
 - b. 3 overload relays
 - c. Time delay fuses
 - d. Amber push to test "Run" pilot light
 - e. Screw terminal wiring strip for connection to external control devices
 - f. Two N.O. and two N.C. auxiliary contacts
 - g. Hand-Off-Auto selector switch. (Starters with start/stop or run/stop push buttons in place of the HOA selector switch shall be supplied as indicated on the drawings).
- 10.4. Only NEMA rated magnetic starters shall be acceptable.
- 10.5. On starters for motors over 15 HP provide for connection of motor winding thermistors and relaying to trip the motor "off" under excess winding temperatures. Thermistor reset shall be manual. Approved manufacturers are Square D, Allen Bradley, Westinghouse or Siemens equivalent.
- 10.6. Provide where shown on the drawings, starters with the above features in a Motor Control Centre with bus work of the voltage and capacity as indicated. Approved manufactures of MCC's shall be Square D Class 8998 class 1, type B or Allen Bradley, Westinghouse or Siemens equivalent.
- 10.7. Provide and install manual starters with overload relays and toggle type operators, of ratings, sizes and enclosure types as shown on the drawings or as required by the applicable code. Starter shall contain properly coordinated overload elements to provide overload and complete phase failure protection and indicator lamp to show energized condition. Approved manufacturers are Square D Class 2510, Allen Bradley, or Siemens equivalent.

11. Contactors

- 11.1. Provide Contactors with voltage and current ratings, contact arrangements, and enclosure types as indicated on the drawings. Contactors shall be rated for the use for which they are shown. Contactors are to be electrically held. Acceptable Contactors manufactures are Schneider, Siemens, Allen Bradley, and Westinghouse.
- 11.2. Install lamacoid nameplates identifying the load served by each contactor and where applicable the location of the feeder source.

12. Time Switches

- 12.1. Provide and install electronic programmable astronomic time switches.
- 12.2. The Time Switch shall be 120 VAC, 60 Hz with field replaceable back- up power device.
- 12.3. Time switches shall be capable of being programmed to control up to 96 operations per 24-hour period and shall automatically adjust on-off operations based on Astronomical data (latitude and time of year).
- 12.4. Time switch shall be equipped with 2 sets of SPST contacts capable of switching 20 A per pole at 277 VAC.
- 12.5. Provision shall be made for positive padlocking and/or sealing.
- 12.6. Time switches shall be INTERMATIC # ET2825C or equal.

13. Photo Controls

- 13.1. Provide and install photo-electric control switches to provide automatic on/off switching of outdoor lighting.
- 13.2. Photo electric control switches shall be weather tight, completely self-contained, not affected by moisture, vibration or temperature changes and with die cast housing.
- 13.3. On-off adjustment shall be made by moving a light level selector to any desired light level in a range from 2 fc to 50 fc.
- 13.4. The photocell shall be rated at 120V, 2000W SPST contact, TORK #2101, Intermatic #K4121 or Precision #T-15.

14. Surge Protection

- 14.1. Supply and install surge protection devices as shown or specified on the drawings.
- 14.2. Surge protector to provide discrete all mode protection (L-N, L-L, L-G & N-G).
- 14.3. Surge protector shall conform to the following:
 - a. UL Type 2 designation
 - b. 200kAIC rated
 - c. Thermally Protected MOVs
 - d. Form C dry relay contacts and audible alarm with silence button
 - e. UL 1449 5th Edition standards
- 14.4. Mount surge protector as close as possible to breaker / fuse feeding surge protector. Length of wiring between breaker / fuse and surge protector to be as short as possible.
- 14.5. Include for a pre and post install inspection from surge protector manufacturer to ensure surge protectors and wiring are installed as per manufacturer recommendations.

15. Access Doors

- 15.1. Provide access doors at locations where electrical equipment requiring inspection, service, maintenance or adjustment is installed in such a manner as to be hidden behind building structure or finishes.
- 15.2. Verify ceiling/wall/floor construction for proper assessment for the quality and type of door required.
- 15.3. Minimum construction shall be 2.5mm (12ga) steel, prime coated steel with 180 degree opening hinged door with rounded safety corners, concealed hinges, screwdriver latches plaster locks and anchor straps.
- 15.4. Where access doors are located in tile or marble finishes they shall be constructed of #304 stainless steel.

16. Painting

- 16.1. Electrical equipment which becomes defaced due to construction and installation is to be cleaned and painted to restore original finish.
- 16.2. Equipment which fails to regain original finish after repainting will be replaced by this contractor at no cost to the owner.

END OF SECTION

1. General

- 1.1. Section 260000, forms part of this section as though written here in full and is to be read in conjunction with this section.
- 1.2. This section provides for the supply and installation of the new main electrical service from a pad mounted transformer provided by Welland Hydro.
- 1.3. The Electrical Contractor shall be responsible for making arrangements with Welland Hydro for the provision of the new main electrical service.
- 1.4. Coordinate installation of transformer with Welland Hydro. Welland Hydro costs including, transformer, metering as well as primary and secondary cable termination costs will be paid from Hydro Allowance.
- 1.5. Electrical Contractor is to coordinate the entire installation of the new service with Welland Hydro.
- 1.6. The Electrical Contractor shall provide all other material and labour including secondary lugs, inspection fees, etc. required to complete the service installation.

2. Electrical Service

- 2.1. Provide primary underground duct bank from Welland Hydro connection point (switchgear SG27) on Varsity Drive to new precast transformer base.
- 2.2. The metering equipment will be located in the main electrical room or at the transformer in accordance with Welland Hydro drawing standards.
- 2.3. Supply and install the secondary duct bank in accordance with the Ontario Electrical Safety Code, from the transformer pad to a main switchboard as shown on the drawings in accordance with O.E.S.C. rule # 12-012.
- 2.4. Supply and install all cabling as shown on the drawings.
- 2.5. Secondary switchboard terminations by Electrical Contractor using compression type lugs.
- 2.6. Work shall comply with the rules and regulations of the Ontario Electrical Safety Authority and Welland Hydro standards.
- 2.7. Concrete for duct banks and other concrete work required for the electrical installation shall be provided by the electrical contractor.
- 2.8. Include in the tender price all the costs of the inspection authority for this service including labour, material, testing and inspection costs.

3. Grounding

- 3.1. Electrical Contractor shall provide grounding to establish a path to ground not to exceed 6 ohms resistance.
- 3.2. The entire conduit network shall be electrically continuous throughout.
- 3.3. Panel boxes, motor frames and other electrically operated equipment shall be grounded per the Ontario Electrical Safety Code (OESC) and the equipment manufacturer's instructions.
- 3.4. Install a green grounding conductor inside all flexible conduit connections to mechanical equipment.
- 3.5. All convenience receptacles shall be of the grounding type, grounded to the conduit network and the green ground conductor.
- 3.6. All lighting fixtures shall be grounded as per the OESC and the manufacturer's instructions.
- 3.7. Grounding conductors shall be sized per the OESC.
- 3.8. Provide a separate ground for Telephone Supply Authority and for telephone equipment.

END OF SECTION

1. General

- 1.1. Section 260000, forms part of this section as if it were written out here in full and is to be read in conjunction with this section.
- 1.2. This section provides for the supply and installation of Service Entrance Switchboards, Distribution Panelboards and Lighting and Receptacle Panelboards.
- 1.3. Load centers shall not be used.
- 1.4. All distribution equipment shall be the product of one manufacturer.
- 1.5. This Contractor shall provide and pay for a protection coordination study produced by a third-party testing company of the distribution scheme to determine the proper settings for distribution breakers in the system.
- 1.6. This Contractor shall provide and pay for a short circuit and arc flash study produced by a third-party testing company of the distribution scheme.
- 1.7. Do not use over current protective devices and equipment which are series rated breaker/panel combinations.
- 1.8. Protective devices shall be supplied with factory set trips in accordance with the settings calculated in the coordination study.
- 1.9. Provide cast in place concrete housekeeping pads under floor mounted equipment. Pads shall be a minimum of 4" thick and extend 2" beyond the footprint dimensions of the equipment to be placed.

2. Submittals for Review

- 2.1. Shop drawings for each panel as indicated on the drawings showing, panel designation, EEMAC rating of the panel enclosure, phase, wire, bus ampacity, bus material, interrupting rating, quantity, size, and frame type of each breaker supplied with the panelboard.
- 2.2. Submit a preliminary short circuit, protection coordination and arc flash study for review with equipment shop drawings. Contractor shall liaise with the local hydro utility to obtain the available fault current for use in the report and include copies of correspondence in the study. Changes will be implemented based on the results of the study to ensure proper coordination of distribution breakers. Submit all data for review sufficiently in advance of equipment assembly.
- 2.3. Submit an updated short circuit, protection coordination and arc flash study for review based on the available fault current obtained from Welland Hydro utility. The new study shall capture all changes implemented by section 2.2. All panels included within the scope of the protection coordination are to be included within the scope of the arc flash study and are to be furnished with arc flash labels upon completion of project. Arc flash labels are to identify the following:
 - a. Flash Hazard Boundary
 - b. Cal/cm² Flash Hazard at 18 inches for low voltage panels
 - c. Protective clothing category
 - d. Shock hazard when cover is removed
 - e. Limited Approach
 - f. Restricted Approach
 - g. Prohibited Approach
 - h. Protective device supplying panel

3. Submittals for Project Closeout

- 3.1. At the completion of the project the Electrical Contractor will submit record drawings as specified in Section 260000.
- 3.2. Provide a complete set of shop drawings in the maintenance manual as well as maintenance instructions and a complete set of neatly typed panel schedules indicating size and location of breakers as well as the load each breaker serves.
- 3.3. Include a copy of the short circuit, protection coordination and arc flash study with the maintenance manuals.

- 3.4. Supply and install a full-sized plaque mounted single line diagram within the electrical room.
- 3.5. Turn over to the Owner ten (10) panel keys.

4. Circuit Breaker Service Entrance Switchboards

- 4.1. Service entrance switchboards shall be comprised of multiple totally enclosed, dead front, free standing, front aligned sections built on a formed steel framework and secured together to support code gauge steel enclosure panels. Enclosure panels are to be single tool screw removable utilizing captive screw devices. The interior and exterior of the switchboard shall be painted with two coats of epoxy-based paint. The exterior shall be ANSI #61 Grey.
- 4.2. Internal components shall be front accessible for service or removal. Enclosures shall be EEMAC 2 sprinkler proof and consist of one section containing a full height cable pull box with bussed terminal block for phase neutral and ground connections. A second section containing the main disconnecting and over current device. This section shall also include the utility metering as well as customer metering described below.
- 4.3. Additional sections shall provide space for distribution system disconnecting and over current devices. See drawings for details.
- 4.4. Service entrance switchboards shall contain:
 1. Main disconnection and over current device consisting of an electronic trip molded case full function circuit breaker rated for 100% of the continuous current rating, and with the short circuit capacity shown on the drawings. The main breaker electronic trip system shall be microprocessor based, true RMS sensing design and use digital programming techniques for installation of protection settings and shall provide the following time/current curve adjustments to allow customizing and coordination:
 - a. Adjustable long time Ampere rating and delay.
 - b. Adjustable short time Ampere rating and delay.
 - c. Adjustable instantaneous pickup
 - d. Adjustable ground fault pickup and delay
 - e. High level selective override
 2. Switchboard bus work shall be silver plated copper rated as shown on the drawings. Provision shall be made for future extension of the horizontal bus into additional distribution sections. Bolts used to connect bus bars shall be a minimum of type 5 bolts and shall be used with "Bellville" type locking washers.
 3. Provide customer's metering equipment at main disconnecting and overcurrent device. This system shall provide true RMS metered values to the 31st harmonic and be accurate to 0.25% of reading for voltage and current measurements and 0.5% of reading power and energy measurements. The power meter shall be rated for operating temperatures from -20 to 60 degrees centigrade and shall accept metering inputs of up to 600 Vac direct connection or industry standard instrument transformers. The power meter shall communicate through BACnet protocol to the Building Automated System (BAS). The unit shall also have an optically isolated back-lit LCD display and KYZ pulse initiator for communication of kWh, kVARh, or kVAh information. The information provided by the power meter shall be:
 - a. Current, per phase
 - b. Voltage phase to phase & phase to neutral
 - c. Real power (kW) per phase and 3 phase total
 - d. Reactive power (kVAR) per phase & three phase total
 - e. Apparent power (kVA) per phase & three phase total
 - f. Power factor (true) per phase & three phase total
 - g. Frequency
 - h. Real energy (kWh) three phase total

- i. Reactive energy (kVARh) three phase total
 - j. Apparent energy (kVAh) three phase total
 - k. Energy accumulation modes, signed, absolute, energy in, energy out
 - l. Neutral current measurements
 - m. Demand current, per phase & neutral, present & peak
 - n. Real power demand (kWd) readings three phase total, present & peak
 - o. Reactive power demand (kVARd) three phase total, present and peak
 - p. Apparent power demand (kVAd) three phase total, present & peak
 - q. Total harmonic distortion (THD) voltage & current per phase
 - r. Date and Time Stamping, peak demands, power up/restart and resets
4. Provide customer's power monitoring equipment on the feeder section(s) of the switchboard. The system shall provide true RMS metered values and be accurate to 0.5% of reading for voltage and current measurements and 1% of reading power and energy measurements. The power meter shall be rated for operating temperatures from -20 to 60 degrees centigrade and shall accept metering inputs of up to 600VAC direct connection or industry standard instrument transformers. The power meter shall communicate through BACnet protocol to the Building Automated System (BAS). The information provided by the power monitor shall be:
- a. Voltage phase to phase & phase to neutral
 - b. Real energy (kWh) 3-phase total received/delivered
 - c. Reactive energy (kVARh) 3-phase total received/delivered
 - d. Apparent energy (kVA) 3-phase total
5. The power monitoring equipment described in section 4.4.4 can be used for each feeder on the main switchboard. Alternately, the power monitoring equipment can be used for multiple feeders. The manufacturer shall choose the best solution to satisfy the system requirements described above as well as the requirements of ASHRAE 90.1-2016.
6. The switchboard shall provide adequate space for future installation of additional power monitoring equipment to satisfy the needs for all spares and spaces provided.
7. The power monitoring system shall facilitate daisy-chaining of the devices to provide one BACnet communications link to the BAS. All internal wiring shall be provided by the manufacturer with a single point of connection for the external communications wiring.
8. The distribution section shall contain thermal magnetic molded case circuit breakers for all breakers under 400 amperes. Breakers shall provide a means of disconnecting distribution circuits and shall provide over current & short circuit protection with inverse-time and instantaneous tripping characteristics. Molded case circuit breakers shall be operated by a toggle handle and have a quick-make, quick-break over center switching mechanism that is mechanically trip free. Contacts to be non-welding silver alloy. A push-to-trip button on the front of the breaker shall provide a local means to exercise the trip mechanism for testing purposes. Molded case distribution circuit breakers shall be equipped with the following:
- a. Rated for 80% continuous current
 - b. Breaker current range from 15 to 399 amperes, one, two or three poles.
 - c. Circuit breakers shall have interrupting capacities equal to the rating of the switchboard as shown on the drawings.
 - d. Provide breakers with, shunt trips, bell alarms, auxiliary contacts, under voltage release, handle block, handle lock, or motor operators as called for on the drawings.

9. For breakers 400 amperes and above the distribution section shall contain breakers with the same electronic trip system as described under main breaker in 4.4.1 above to allow adjustments required for coordination with the tripping scheme.

5. Circuit Breaker Distribution Panelboards

- 5.1. Circuit breaker distribution panelboards shall be equipped with:
 1. EEMAC 2 sprinkler proof enclosure complete with hinged lockable door mounted to a hinged bolted trim. The hinged trim shall allow authorized persons access to the panel interior without the necessity of removing the panel trim. Enclosure shall be sized to accept the number and size of breaker shown on the drawings. All panel locks are to be keyed alike.
 2. Gutter space in accordance with the requirements of the Canadian Standards association (CSA) and the Ontario Electrical Safety Authority (ESA).
 3. A directory card with plastic cover.
 4. Interiors which allow switching and protective devices to be replaced without disturbing adjacent devices and without removing bus connectors.
 5. Tinplated copper bus with sufficient cross section area to meet CSA C22.2 No.29 standard for temperature rise.
 6. Molded case bolt on circuit breakers (15 to 399 amperes) shall provide over current and short circuit protection with adjustable inverse-time and instantaneous tripping characteristics shall be operated by a toggle handle utilizing a quick-make, quick-break over center mechanism that is mechanically trip free. Contacts shall be non-welding silver alloy. A push-to-trip pushbutton on the front of the breaker shall provide a means of testing the breaker trip mechanism.
 7. Circuit breakers shall be rated for 80% continuous current and shall have a minimum interrupting capacity of 22 kAIC at 240 volts. Breakers shall be equipped with a mechanism to allow padlocking in the off position. Series rated breakers are not acceptable.
 8. For circuit breakers 400 amperes and above, the distribution section shall contain breakers with electronic trip system as described in 4.4 above to allow adjustments required for coordination with the tripping scheme.
 9. Manufacturer's nameplate showing, manufacturer's name, system voltage, phase, wire, Ampacity, panelboard type, manufacturer's work order and date and CSA listing number.

6. Branch Circuit Panelboards

- 6.1. Circuit breaker branch circuit panelboards shall be equipped with:
 1. EEMAC 2 sprinkler proof enclosure complete with hinged lockable door mounted to a hinged bolted trim. The hinged trim shall allow authorized persons access to the panel interior without the necessity of removing the panel trim. Enclosure shall be sized to accept the number and size of breaker shown on the drawings. All panel locks are to be keyed alike.
 2. Tinplated copper bus with sufficient cross section area to meet CSA C22.2 No.29 standard for temperature rise.
 3. Isolated ground bar where indicated.
 4. Molded case bolt on circuit breakers shall provide over current and short circuit protection with inverse-time and instantaneous tripping characteristics, shall be operated by a toggle handle utilizing a quick-make, quick-break over center mechanism that is mechanically trip free. Automatic tripping shall be clearly indicated by centering of the handle. Contacts shall be non-welding silver alloy.
 5. Circuit breakers shall be rated for 80% continuous current and shall have a minimum interrupting capacity as shown on the drawings.

6. Manufacturer's nameplate showing, manufacturer's name, system voltage, phase, wire, Ampacity, panelboard type, manufacturer's work order and date and CSA listing number.
7. Where panelboards are recessed into walls, provide two spare 1-1/4" EMT conduits from each panel to two 6"x6"x6" junction boxes in the adjacent corridor ceiling space and mark as "Spare".

7. Distribution and Branch Circuit Identification

- 7.1. All switchboards and panelboards shall have Contractor installed identification in the form of lamacoid name plates (white background, black letters) which conform to the following:
 - a. Lettering shall be a minimum of 1/2" high and the nameplate shall be attached to the top center of the panel trim with two #8 machine screws drilled and tapped into the trim.
 - b. Minimum information show on name plates shall include panel designation as supplied by the Owner to meet the existing naming convention, voltage, phase and wires, name of the source the panel is fed from and its location.
- 7.2. Circuit identification for Distribution panelboards shall be comprised of Contractor installed identification in the form of lamacoid name plates (white background, black letters 1/2" high) which are fastened to the panel trim with two #8 machine screws next to the branch circuit breaker being identified
- 7.3. Circuit identification for Branch Circuit panelboards shall consist of a neatly type panel directory card under a plastic cover affixed to the inside of the panel door, listing all the circuit numbers and the loads connected to them.

8. Installation

- 8.1. All wall mounted panels shall be installed with the top of the tub no higher than 7'-0" above finished floor level.
- 8.2. Install panels level and plumb and recessed or surface mounted as shown on the drawings.
- 8.3. Verify factory trip settings with the values calculated in the coordination study.

9. Manufactures

- 9.1. Service Entrance Switchboards shall be Schnieder – Square "D" Service Line 800 or QED series as required.
- 9.2. Distribution Panels shall be Schneider- Square "D" I- Line series Distribution panelboards.
- 9.3. Branch circuit panels shall be Schneider-Square "D" NQOD series.
- 9.4. Similar equipment by Siemens and Cutler Hammer may be considered equal.

END OF SECTION

1. General

- 1.1. Section 260000, forms part of this section, as though written here in full, and is to be read in conjunction with this section.
- 1.2. At the completion of the project pay a third-party testing company to certify that the lighting system and associated controls are in compliance the Ontario Building Code. The report shall be in conformance with ASHRAE 90.1-2013 section 9.4.3. Lighting control devices shall be tested to ensure that control hardware is calibrated, adjusted and in proper working condition. Provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria. Set occupancy / vacancy sensors to maximum 20min time delay.
- 1.3. This section provides for supply and installation of the lighting system, including luminaires, lamps and all associated equipment.
- 1.4. The fixture schedule as shown on the drawings includes luminaire designation, voltage, lamp data, mounting arrangement, special features required, manufactures' name and catalogue number.
- 1.5. Lighting Fixture Schedule indicates a manufacturer and a catalogue number establishing a minimum standard.
- 1.6. Drawings name several alternate acceptable manufacturers whose product will be accepted as an alternate product however the Contractor will within one week of notification supply to the Engineer a complete plan of the school indicating point by point calculated lighting intensity and corresponding watt densities for each and every area where the proposed luminaire(s) would be located.
- 1.7. Lighting fixtures shall be supplied complete with the proper lamp(s) and all required accessory items such as IC housings, yokes, plaster rings, bar hangers, chains and other mounting materials.
- 1.8. Fixtures shall be provided with hangers to adequately support the complete weight of the luminaire. In no case shall luminaires be supported solely by the ceiling assembly. Where recessed fixtures are installed in a suspended ceiling assembly, the ceiling assembly shall be reinforced with extra ceiling supports (one in each corner) and be equipped with safety chains to support the fixture should the ceiling assembly collapse.
- 1.9. Hangers and method of fastening which differ from the manufacturer's standard mounting arrangement shall be submitted to the Engineer for review.
- 1.10. Do not support luminaires from metal roof deck. Provide supplemental rigid structural members (Uni-strut or steel angles) sized to support fixtures from the buildings structure. Do not use wood to support fixtures.
- 1.11. Fixtures mounted on outlet boxes shall be rigidly secured to a fixture stud in the box and the box shall be rigidly fastened to the building structure.
- 1.12. Install fixtures inline and level and avoid light leaks. Remove and reinstall luminaires which are not installed to the satisfaction of the Owner, architect or Engineer.
- 1.13. Do not "daisy-chain" light fixtures with BX. Provide individual BX drops from junction boxes which are part of a lighting conduit and wire system.
- 1.14. Exterior lighting controls to be controlled by BAS relay and photocell. Provide override switch to bypass BAS relay and photocell.

2. Submittals for Review

- 2.1. Submit electronic copies of shop drawings for each fixture type specified.
- 2.2. Shop drawings shall be clearly marked as to fixture type, operating voltage, ballast or transformer information, number, type and wattage of lamps require, special information regarding housings, rating for insulated ceilings or special mounting instructions.
- 2.3. Luminaire shop drawings shall bear the Electrical Contractor's stamp indicating that the Contractor has reviewed the shop drawings and is satisfied that the product represented meets all the criteria of the specification and is of the type, size and fit suited for the ceiling and insulation system in which it is to be installed. Any discrepancies shall be noted on the shop drawings.

3. Submittals for Project Closeout

- 3.1. At the completion of the project the Electrical Contractor will submit record drawings as specified in Section 260000.
- 3.2. Include a copy of all luminaire shop drawings, manufactures special installation instructions, lamp data and maintenance instructions in the maintenance manuals.

4. Lamps

- 4.1. All lamps shall have the following characteristics unless otherwise specified;
 1. LED – LED lamps shall have a colour temperature of 4000 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 60,000 hours minimum.

5. LED Drivers

- 5.1. LED Drivers:
 1. LED drivers shall be electronic type, 120V and with a minimum efficiency of 85%.
 2. Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across the full dimming range.

6. Pole Bases for Lighting Fixtures

- 6.1. Provide and install cast in place steel reinforced concrete pole bases and poles as required to complete the installation as shown on the drawings.
- 6.2. Coordinate the size of pole bases with specified pole, bolt circle diameter to ensure that there is a minimum of 100mm (4") of concrete cover over the outside of anchor bolts and/or reinforcing steel. Unless shown otherwise the minimum reinforcing steel in any cast in place concrete pole bases shall be five 15M vertical bars, spaced equally around the circumference, held in place by six 10M hoops place equidistance along the length of the vertical bars.
- 6.3. Concrete for pole bases shall have a minimum strength of 25 kPa at 28 days and contain 5% to 8% entrained air.
- 6.4. Align anchor bolts to allow fixtures and fixture optical assemblies to be installed on the pole aimed as required to provide the proper lighting pattern.
- 6.5. When pole is set plumb and true, Grout the space between the top of the base and the base plate.
- 6.6. All pole bases are to be inspected by the Engineer prior to concrete pour. Notify the Engineer 3 days before scheduled concrete pour.

7. Lighting Controls

- 7.1. Interior lighting fixtures shall be controlled as shown on the drawings using switches, dimmers, contactors, photocell controls and occupancy sensors as specified elsewhere in this specification.
- 7.2. Low voltage FT6 rated lighting control cables may be run free air through accessible ceiling spaces in classrooms and offices from local room controllers to local control devices. Cables shall be run parallel to building lines and supported at minimum 5ft (1.5m) increments. Lighting control wiring in gymnasiums, shop classrooms, mechanical / electrical rooms, etc. shall be run in conduit.

8. Coordination

- 8.1. Check the area where fixtures are to be installed for any interference with piping duct work equipment or building structure. Coordinate and adjust layout with other trades to avoid conflicts. No extra arising from the failure of the Contractor to coordinate his work will be allowed.
- 8.2. Verify that the specified fixture is compatible with the ceiling type and insulation in the area where the fixture is to be installed. Report any discrepancies to the Engineer.

END OF SECTION

1. General

- 1.1. Section 260000, forms part of this section as though written here in full and is to be read in conjunction with this section.
- 1.2. This section provides for supply and installation of exit lights and emergency lighting equipment.
- 1.3. Contractor shall refer to manufacturer installation manual for proper wire gauge as determined by remote head distance.
- 1.4. At the completion of the project pay a third-party testing company to certify that the emergency lighting system is in compliance with the Ontario Building Code. The report shall include voltage drop readings measured at the last remote head on each branch circuit from each battery with the system fully functional.
- 1.5. All units located in gymnasium, shop classrooms and unsupervised areas (including corridors) shall be protected by wire guards.

2. Submittals for Review

- 2.1. Submit shop drawings for each type of exit sign, emergency light and battery unit.

3. Submittals for Project Closeout

- 3.1. At the completion of the project the Electrical Contractor will submit record drawings as specified in Section 260000.
- 3.2. Include a complete set of shop drawings for exit signs, emergency lighting and battery unit equipment along with the maintenance and operating instructions in the maintenance manuals.
- 3.3. Include a copy of the Certification Certificate and the testing technician's work sheets.

4. Exit Signs

- 4.1. Exit signs shall be single or double face as shown on the drawings and shall be wired to accept 120 Volt AC power.
- 4.2. Exit signs shall comply with the requirements of the Ontario Building code.
- 4.3. Exit signs shall utilize green LED(s) as a light source, shall consume less than 2 Watts of power and comply with NBC2010, CSA C22.2 No. 141 and CSA C860.
- 4.4. Fixture body shall be rigid steel housing, gasketed to eliminate light leaks, have field selectable direction chevrons and universal mounting.
- 4.5. Where required, provide and install wire guards manufactured by the emergency lighting manufacturer specifically for the exit sign(s) being supplied.
- 4.6. Supply and install signs as shown on the drawings.

5. Emergency Lights

- 5.1. Remote heads shall be 12 V DC, LED bulbs in MR16 head, wattage as specified on drawings, fully adjustable for maximum spacing, injection molded, impact resistant, flame retardant thermoplastic. The LED's, lens and circuit boards shall be fully integrated in the molded shell to ensure extended life and maximum performance. Fixture shall be supplied with a canopy for installation on any four-inch octagon box.
- 5.2. Remote fixtures shall be certified to CSA 22.2 No.141-15 and be ICES005 compliant.
- 5.3. Supply and install emergency remote heads as shown on the drawings

6. Battery Units

- 6.1. Emergency battery units shall be rated 120 V, 60 Hz, be constructed of durable 18 gauge steel and be CSA listed to C22.2 141-15 and be ICES 005 compliant.
- 6.2. Supply and install emergency battery units as shown on the drawings. Refer to drawings for battery unit wattage and number of LED remote heads. Battery unit(s) to be complete with cord set and NEMA L5-15P twist lock plug.
- 6.3. The charge voltage factory set to $\pm 1\%$ tolerance. High efficiency, rapid recovery, precision control charging system shall be employed to promote long battery life and reduce the potential for grid corrosion. The charger shall provide a continuous high

charge to recharge the battery, when the battery is at full capacity, the charger will shut-off. Periodically the charger shall provide a pulse of energy to keep the battery at full voltage. The pulse charger shall be precisely regulated and shall charge the battery in relation to its temperature, state of charge and input voltage fluctuations. The charger shall be current limited, temperature compensated, short-circuit proof and reverse polarity protected.

- 6.4. The unit shall be furnished with an electronic lockout circuit, which will connect the battery when the AC circuit is activated, and an electronic brownout circuit, which will activate the emergency lights when utility power dips below 75% of nominal voltage. A low voltage battery protection circuit shall be provided and will disconnect the load when the battery reaches the end of discharge.
- 6.5. The battery unit shall come complete with an auto diagnostic micro-controller board and shall supply the rated load for a minimum of a 1/2 hour to 87.5% of the rated battery voltage.
- 6.6. Battery unit(s) shall come complete with the Auto Test function. The automated testing system shall be designed to comply with all of the requirements of the local Fire Code. Every month a 5 minute discharge and diagnostic test checks the operational status of the unit. Every 12 months, this test is extended to the full 30 minute, code required duration. This ensures that the battery charger is recharging the battery in accordance with code requirements.

7. Warranty

- 7.1. Warranty in writing the exit signs, emergency lighting and battery unit equipment is free from defects in material and workmanship for a period of five years after final acceptance.

END OF SECTION

General

- 1.1. Section 260000, forms part of this section as though it were written here in full and is to be read in conjunction with this section.
- 1.2. This section includes cable trays and accessories.
- 1.3. Provide cable tray for CATV, Intercom, telephone, security, building access and data wiring.
- 1.4. Provide support systems and fasteners for new trays to align trays plum and level.
- 1.5. Horizontal runs shall be supported by trapeze type hangers utilizing steel "UNI-Strut" extending 3 inches beyond the tray sides and suspended by ½ inch threaded rods each side fastened to a horizontal building structure not the steel deck. Space hangers every 10 feet.
- 1.6. As an alternate to trapeze hangers for horizontal support the contractor may use loop end #4 GRIPPLE fittings installed to minimize tray lateral sway. Install in pairs at not more than 5 feet apart.
- 1.7. Vertical runs shall be fastened to steel "UNI-strut" extending 3 inches beyond the sides of the tray and fastened to a vertical building surface using ½ inch bolts in suitable expansion anchors.
- 1.8. Verify all field measurements prior to ordering cable trays.
- 1.9. Cable trays shall be CSA approved and rated for the load they must carry.
- 1.10. Trays shall be grounded in accordance with the requirements of the Electrical Safety Authority.

2. Submittals for Review

- 2.1. Product data; provide information for fittings, accessories and support systems.
- 2.2. Shop drawings for all types and sizes of tray. Indicate tray type, material, dimensions, support points and finish.
- 2.3. Produce and submit interference drawings to demonstrate clearances from building components and systems of other trades.

3. Submittals for Project Closeout

- 3.1. At the completion of the project the Electrical Contractor will submit record drawings as specified in Section 260000.
- 3.2. Include a copy of the approved shop drawings with the maintenance manuals.

4. Wire Basket Tray

- 4.1. Provide wire basket cable tray of types and sizes indicated with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.
- 4.2. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
- 4.3. Wire basket cable tray shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
- 4.4. Cable trays shall be minimum 2 inch deep and 12 inch wide.
- 4.5. Cable trays by Cooper, Cablofil, Hubbell, Chalfant or Cope shall be considered equal.

5. Installation

- 5.1. Install cable trays as recommended by manufacturer's installation instructions.
- 5.2. Provide warning signs reading: WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER OR SUPPORT. USE ONLY AS SUPPORT FOR CABLES."
- 5.3. Use expansion connectors where required.

- 5.4. Provide fire stopping to maintain fire and smoke ratings where cables, conduit sleeves and cable trays pass through fire rated building elements.
- 5.5. Provide Teflon sleeves on all conduits for data and telephone wiring.

END OF SECTION

1. General

- 1.1. Section 260000 forms part of this section, as though written here in full, and is to be read in conjunction with this section.
- 1.2. This section includes for the supply, installation and commissioning of a public address, classroom intercommunications system (PA/Intercom) and Program signal system.
- 1.3. The electrical contractor will provide and install EMT conduit from each outlet to the cable tray as required to facilitate installation of the system.
- 1.4. Coordinate installation of wiring with Hamilton Video and Sound.
- 1.5. The PA/Intercom Contractor will make all connections and provide commissioning of the system.
- 1.6. The system shall be based on a Carehawk CH1000 Life Safety Communication System, microprocessor based, single master intercom and sound distribution system.
- 1.7. This contractor shall engage the services of Hamilton Video and Sound Ltd. (905) 522-1200 (Andrew Braun ext. 114) to provide, program and commission the system as shown on the drawings.

2. Submittals for Review

- 2.1. Shop drawings for the PA/Intercom control console showing physical dimensions, mounting arrangement as well as size and location of internal components and terminal strips and wiring numbers.
- 2.2. Complete wiring diagrams showing all termination points. Show details of all components with wiring and terminal numbers.
- 2.3. Shop drawings for each type of device including main console with amplifier, inter com stations, speakers, matching transformers, horns, microphone inputs and auxiliary device inputs.
- 2.4. Shop drawings shall be prepared by the manufacturer and comprise only originals of project specific drawings and data sheets. Photo copied catalogue sheets are not acceptable.
- 2.5. Include a block diagram illustrating the manner in which the contractor intends to layout the system. Show wiring type, gauge and number as well as terminal numbers.

3. Submittals for Project Closeout

- 3.1. At the completion of the project the Electrical Contractor will submit record drawings as specified in Section 260000.
- 3.2. Provide three copies of PA/Intercom installation, operation, maintenance and repair information as well as a complete set of shop drawings, bound into the maintenance manuals along with all system testing procedures and test results.

4. Operation

- 4.1. System operation shall be dictated by the function priority as follows;
 1. Emergency paging
 2. Emergency tone distribution
 3. Time tone distribution
 4. All call
 5. Intercom
- 4.2. The system shall be capable of providing selective voice paging independently to all parts of the system or to selected individual devices.
- 4.3. Two-way voice communications shall be available independently from any DSBN classroom intercom station and the main DSBN console location. These conversations shall be private and shall not be overheard by any other station.
- 4.4. The system shall also sound timed program signal via an input from a program signal controller.
- 4.5. Two channel operation shall allow separation of outdoor speakers from the all call and paging function to allow, timed two different signal tones to be transmitted separately to DSBN outdoors horns.

5. **Equipment**

- 5.1. Control and amplification shall be provided by a wall mounted Carehawk CH1000 microprocessor based control cabinet microphone inputs and three auxiliary inputs for compact disc player, tape player or other standalone device. Microphone inputs shall be low impedance with 300uV nominal balanced sensitivity and a noise level at least 60dB below rated output. Auxiliary inputs shall be high impedance 300uV nominal, greater than 10k ohms and a noise level 60dB below rated output. System frequency response is to be 50 to 15000 Hz, plus or minus 2dB. Distortion shall be less than 2.0% at rated power. Control cabinet shall be mounted in the Main Office.
- 5.2. The console shall contain all power supplies to run the system and all switches required for all call, selective zone calling and individual two-way communications. System output to be not less than 250 watts at 70 volts.
- 5.3. System shall include a remote wall mounted wiring termination panel located in Hub room.
- 5.4. The Administration PA control console Carehawk #AP1 shall include a handset, microphone, speaker, LCD display, and menu system to control all system functions. The console shall be a completely self-contained desk mount unit.
- 5.5. Provide interface to allow remote access via telephone.
- 5.6. Provide interface with new program clock system.
- 5.7. Speaker/Microphone intercom units shall be recessed mounted with appropriate finished steel wall box not larger than 12 inches by 12 inches by 3 inches deep. Master selector switch shall connect station directly to Master Station. A momentary manual switch selects talk or listen mode. Other controls shall include volume control, and privacy switch. Incoming calls actuate an annunciator lamp and momentary buzzer. Steel wall box to be McBride #MC20E.
- 5.8. Speakers shall be complete with back boxes insulated with sound deadening material and uniformly perforated painted metal face plates.
- 5.9. Input cables shall be 22 AWG solid copper, 300 Volt insulation, 90 degree C rated, twisted shielded pairs with a PVC jacket. Speaker wire is to be installed in conduit as shown on the drawings and shall be CAT 5e, green jacketed, unshielded.
- 5.10. All equipment must be CSA/CUL approved.
- 5.11. Provide interfacing to telephone system as required in other section.
- 5.12. Control Panel:
 - a. The microprocessor control panel shall be of modular design, wall mountable, utilize RJ45 connections between all modules. The system shall be equipped with self-diagnostics.
 - b. The Intercom Talk/Listen and Emergency Push to Talk All Call switches shall be a heavy-duty type designed for 1,500,000 service free operations
 - c. The administration PA control console can be used to select up to two program sources.
 - d. Program Volume Level shall be controlled by the program source.
 - e. Monitor Volume Level shall be controlled by the Administration PA control console.
- 5.13. Two Channels
 - a. The system shall provide two channels of communication with a built-in Intercom amplifier and a Program/Page amplifier. The system shall provide for connection of external program paging amplifiers as required.
- 5.14. Priority Control: The console's microprocessor shall provide priority control such that a higher priority function shall always interrupt a lower priority function. The lower priority function shall be resumed once the higher priority function has completed. Functions of equal priority within shall not be able to interrupt one another. "ALL MODE" priorities shall have a higher priority than either ZONE or INTERCOM MODE functions. ZONE and INTERCOM MODES shall be able to occur simultaneously.

- a. ALL MODE Functions in order of priority
 - i. Emergency Page from the Console, Telephone, Page Phone.
 - ii. Emergency Tone from Console, Telephone or External Contact.
 - iii. Time Tone from Console, Telephone or External Contact.
 - iv. Door Tome from External Contact.
 - v. All Call Page from Console, Telephone, Page Phone, Mic 1 or Mic 2.
 - vi. Program All Distribution from Console.
 - b. ZONE MODE Functions in order of priority
 - i. Time Tone Zone from Console.
 - ii. Panel Mic Zone Page from Console.
 - iii. Mic 1 Zone Page from Console.
 - iv. Program Zone Distribution from Console.
 - v. Telephone Zone Page from Telephone.
 - c. INTERCOM MODE Functions in order of priority
 - i. Console Intercom
 - ii. Console – Telephone Intercom
 - iii. Telephone Intercom
- 5.15. Emergency All Call Announcements
- a. Emergency All Call Announcements shall be initiated by depressing the Emergency switch which will sound an emergency preannounce tone, followed by the announcement using the built-in panel microphone that is distributed at a preset level to all speakers overriding any existing program material.
- 5.16. Two-Way Communication: The console shall provide two-way communication between the control panel and any one speaker. The console shall automatically go into the intercom mode when a room speaker is selected on the speaker selector panel and the room speaker station shall receive a one second tone to announce the intercom call. The direction of speech shall be controlled by the control panel using adjustable VOX sensing. In the intercom mode, the program monitor function shall become inoperative.
- 5.17. Remote All Call: The system shall provide for the connection of paging telephone that can be programmed as a normal all call or an emergency all call page. The Emergency All Call page shall be preceded by a preannounce tone.
- 5.18. Annunciator Speaker Call-In: Personnel at a suitably equipped remote speaker location shall be capable of placing a call to the console by pressing the call-in switch at the speaker location. At a console, an intermittent tone shall sound, the intercom LED will flash and a red LED on control console shall light.
- 5.19. Outdoor Horns: TOA SC-630T horn complete with HC-1 cage with back box and stainless-steel grill complete for weatherproof installation. Provide relay and connection to PA control console. Provide programming for outdoor horn schedule.
- 5.20. Loudspeaker and Associated Equipment:
- a. Type 1 – Located in Classroom. Flush mounted wall speaker in MC20E back box shall consist of McBride model #8LS821-19 speaker, complete with a matching transformer McBride model #MCT7025, a square speaker baffle McBride model #MC255SQ and a call-in switch McBride model #MCSW-1.
 - b. Type 2 – Located in Corridors. Flush ceiling speakers shall be a McBride model #8LS821-19 speaker complete with a matching transformer McBride model #MCT7025, flush round back box McBride model #MC10E, one pair of support rails McBride model #MC100 and a round speaker baffle McBride model #MC11.
 - c. Type 3 – Located in the Gym. Surface speakers shall be McBride model #8LS821-19 speaker complete with a matching transformer McBride model #MCT7025, surface square back box McBride model #SMC20# and a square baffle McBride model #MC25 and Carehawk handset HS-120 in flush mounted Hammond box.

- d. Type 4 – Located in mechanical rooms, storage rooms and service rooms. Surface speakers shall be a McBride model #8LS821-19 speaker complete with a matching transformer McBride model #MCT7025, a square speaker baffle McBride model #MC25SQ, a call-in switch McBride model #MCSW-1 and a surface square back box McBride model #SMC20E.
- e. Type 5 – Located in the boiler room and mechanical rooms. Indoor horn speaker (mount close to ceiling on wall) shall be TOA type SC-615T.

6. Program Distribution

- 6.1. The console shall provide for distribution of the program selected panel to selected speakers or all speakers. Distribution to selector speakers shall be by the control console using predefined speaker zones.

7. Program Sources

- 7.1. The console shall provide for the selection of three different program sources; two (2) line level sources and one mic input. The microphone input shall have its own preamplifier. Separate service level controls for all program input shall be provided to balance program sources.

8. AM-FM Tuner/CD/MP3 Player

- 8.1. The consoles, one each for DSBN, shall be provided with a built in AM-FM Digital Tuner/CD/MP3 Player.

9. Monitoring and Premonitoring Program Material

- 9.1. The console shall provide for audible monitoring of all selected programming by the console speaker. The console speaker level shall be adjustable without affecting the outgoing program level. The console shall provide for selective premonitoring of programming selected at the control panel before it is distributed to remote speakers.

10. Pre-Alert Tone Activation and Distribution

- 10.1. The console shall provide for the generation and distribution of a pre-alert tone to be sent to all or selected speakers. The tone shall be activated by depressing a push button on the control panel. Distribution of the tone shall be to all or selected speakers in the same manner as distribution of a program selected at the control panel.

11. Built In Tone Generator

- 11.1. The system shall provide a built-in tone generator with five distinct tones; Emergency, Time Tone, All Call preannounce, Privacy and Intercom preannounce.

12. Custom User Tone Generator

- 12.1. Provide the capability for custom user tones to be programmed and actuated upon an external signal.

13. Door Tone Signal

- 13.1. The system shall provide for tone signaling through all remote speaker stations when an external contract is closed. This function shall be used for after hours signaling for door access and/or telephone ringing.

14. Battery Back up

- 14.1. The system operation shall have provision for operation from DC battery system or UPS upon failure of the AC power system.

15. Modular Wire Connections

- 15.1. All field wiring terminations at console shall be made with quick connect insulation displacement connectors.

16. Desktop or Rack Configuration

- 16.1. System control equipment shall be Underwriters Laboratory pending under Commercial Audio Systems and Accessories U.L. 813 and installed in an enclosure for systems up to 256 stations and located where shown on the plans.

17. Testing

- 17.1. All lines shall be tested for continuity, ground and shorts. An impedance test shall be done on each and every speaker and a report shall be submitted to the Engineer.
- 17.2. The Supplier shall test the system to ensure proper operation and make any changes or corrections to the system if any defects occur at no cost to the Owner.
- 17.3. The Contractor shall include in his Tender price, all costs required for the Suppliers Technician's visit and testing.
- 17.4. All junctions shall be documented and shown.

18. Installation

- 18.1. Installation shall be in accordance with manufacturer's instructions and recommended practices.
- 18.2. Wiring shall be of sufficient size and number of conductors to provide a complete and functioning system as described herein.
- 18.3. Conductors shall be FT6 rated and shall be run in the cable tray provided. Wiring from the tray to PA devices shall be in ¾" EMT.
- 18.4. Coordinate locations and mounting heights with the installation of other devices.
- 18.5. Splice cables only in accessible junction boxes and only using terminal strips. Make cable shields continuous at splices and connect shields to ground only at the amplifier end.
- 18.6. Install input circuits in separate cables and install in separate raceways from output circuits. Leave 2 feet of excess cable at each outlet device and 6 feet of excess cable at the control console. Use armoured cable for outdoor speaker circuits.
- 18.7. All PA/Intercom wiring is to be installed in conduit or cable tray as shown on the drawings. Use suitable cable fittings and connectors.
- 18.8. Ground and bond equipment and circuits.

19. Commissioning

- 19.1. This contractor will pay a manufacturer's factory trained representative to inspect the installation and perform field tests to ensure installation is correct and meets the manufacturer's performance standards. This contractor will repair or replace any portion of the system which fails to meet the manufacturer's performance criteria.
- 19.2. The manufacturer's representative will prepare and start the system and measure and record sound power levels in each room served by the system.
- 19.3. Together the contractor and the manufacturer's representative will make final adjustments to transformer taps for the appropriate sound levels.
- 19.4. The Manufacturer will then issue to the contractor for inclusion in the maintenance manuals a certificate indicating that the system is complete and operates in accordance with design requirements.
- 19.5. The contractor and the factory representative will provide detailed operation and maintenance instruction to the owner's teaching staff and maintenance personnel.
- 19.6. Guarantee the system free from defects for a period of one year after acceptance by the Owner.

END OF SECTION

1. General

- .1 Section 260000, forms part of this section, as though written here in full and is to be read in conjunction with this section.
- .2 This section provides for the supply and installation of a fully operational Master Clock System, controlled by PA/Intercom control cabinet.
- .3 This contractor shall wire the program time signal to control programmed class change and other signal requirements over the Public Address (PA) system.
- .4 The electrical contractor will provide and install EMT conduit from each digital clock to the cable tray as required to facilitate installation of the system. Coordinate with Hamilton Video and Sound for installation of cabling.
- .5 This contractor shall engage the services of Hamilton Video and Sound Ltd. (905) 522 - 1200 (Andrew Braun Ext. 114) to provide, program and commission the system as shown on the drawings.

2. Submittals for Review

- .1 Provide design layout, product data sheets and specifications for all system components.
- .2 Submit a complete list of materials referenced to the specification section numbers.
- .3 Provide a complete proposed layout of the system and identifying all components.
- .4 Tone Generator.
- .5 Clock Controller data sheet.
- .6 Digital clock data sheets.

3. Submittals for Project Closeout

- .1 Refer to Section 26 00 00 for record drawing and maintenance manual requirements

4. Equipment

- .1 Digital clock Carehawk 24ZB20 / 24ZB40 series complete with backboxes, cover plates, etc. as specified on the drawings.
- .2 Provide power supplies for digital clock system as specified on the drawings.
- .3 There shall be no local means of adjusting the slave clocks.

5. System Installation

- .1 This contractor will install clocks as shown on the drawings.
- .2 Provide power and control wiring as shown on the drawings and as required by manufacturer.

6. Start up and Commissioning

- .1 After installation is complete this contractor shall program, test and commission equipment and wiring necessary to verify the proper operation of the program system and the clock system.
- .2 This contractor will pay a manufacture's factory trained representative to inspect the installation and perform field tests to ensure installation is correct and meets the manufactures performance standards. This contractor will repair or replace any portion of the system which fails to meet the manufacturer's performance criteria.
- .3 This contractor shall with aid of a manufacturer's technical representative provide DSBN maintenance staff with hands on training in the operation and maintenance of the program clock system.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Section 260000 forms part of this section as though written here in full and is to be read in conjunction with this section.
- .2 This contractor shall sub-contract this work to one of the District School Board of Niagara (DSBN) approved contractors for Data and Telephone cabling
- .3 What follows are the approved specifications for installation of network cabling systems in DSBN schools and buildings. These cabling requirements serve both data and voice-over-ip (VOIP telephony) applications. These specifications do not apply to existing buildings that require cabling additions.

1.2 Submittals for Review

- .1 Provide design layout, product data sheets and specifications for all system components including 19 inch floor and wall racks, patch panels and face plates for Cat 6A RJ45 jacks.

1.3 Submittals for Project Closeout

- .1 At the completion of the project the Electrical Contractor will submit record drawings as specified in Section 260000.
- .2 Supply a copy of the system Cat 6A certification report for each cable installed, with the system equipment shop drawings and system maintenance instructions in the maintenance manuals.
- .3 Include a copy of the shop drawings in the maintenance manuals.

1.4 Requirements of Regulatory Agencies

- .1 The installation shall conform to regulations and procedures set forth by the Electrical Safety Authority, Canadian Electrical Code and the Ontario Electrical Code.

1.5 Installation Guidelines

- .1 The design, installation and testing of the system in section 1.4 shall be in accordance with the following standards:

ANSI/NECA/BICSI-568 -- Standard for Installing Commercial Building Telecommunications Cabling

a. ANSI/TIA/EIA Standards

- 1) ANSI/TIA/EIA-568-C.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements
- 2) ANSI/TIA/EIA-568-C.2 -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
- 3) ANSI/TIA/EIA-568-C.3 -- Optical Fiber Cabling Components Standard
- 4) ANSI/TIA/EIA-569-B -- Commercial Building Standard for Telecommunications Pathways and Spaces
- 5) ANSI/TIA/EIA-606(B) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- 6) ANSI/TIA/EIA-607(B) -- Commercial Building Grounding and Bonding Requirements for Telecommunications
- 7) ANSI/TIA/EIA-526-14B -- Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant

- 8) ANSI/TIA/EIA-758(B) -- Customer-Owned Outside Plant Telecommunications Cabling Standard
- 9) ANSI/TIA/EIA-862 -- Building Automation Systems Cabling Standard for Commercial Buildings
- b. Install cabling in accordance with the most recent edition of BICSI® publications:
 - 1) BICSI -- Telecommunications Distribution Methods Manual
 - 2) BICSI -- Cabling Installation Manual
 - 3) BICSI -- LAN Design Manual
 - 4) BICSI -- Customer-Owned Outside Plant Design Manual

1.6 Description and Scope of Work

- .1 Supply and install a telecommunications cabling system consisting of voice/data station cable of the following type: Solid copper, 23AWG, 100 ohm balanced Category 6A UTP (enhanced, unshielded twisted pair) cable to specified computer locations as indicated on architectural drawings. This cable must meet or exceed the mechanical and transmission performance specifications in ANSI/TIA-568-C.1/568-C.2 Category 6A standards.
- .2 Supply and install conduits, raceways and cable management systems to computer locations as shown on drawings. Conduits must be ¾" minimum size, and shall run from wall and floor locations to a point above the ceiling. Larger 1' conduits (or larger) can be used for higher fill rates. Consult with DSBN Facilities Dept. or Supervisor of Network Services (Information Technology Services Dept.) for clarification.
- .3 For each computer wiring location, supply and install wiring consisting of the specified number of UTP cables indicated on drawings.
- .4 All cables shall terminate in flush mount faceplates at the computer location, where applicable and labelled accordingly. Otherwise surface mount boxes are acceptable as specified in the "Products section 2.2" of this specification.
- .5 All cables shall terminate their home runs to the 19" rack location as specified on drawings by DSBN Information Technology Services or Facilities Departments.
- .6 If architectural drawings specify wireless (**Wi-Fi**) **drop locations**, consult with the Supervisor of Network Services in (ITS Dept) **before pulling these runs**. DSBN uses an enterprise wide Wi-Fi solution managed centrally at our Education Centre.
- .7 Wherever drawings specify a voice outlet, **terminate a cable to this location as specified in Section 1.4.1**. DSBN uses enterprise Voice-over-IP (VOIP) telephone technology. Traditional analog type phones are no longer used. All phones are VOIP digital sets that use data network cabling for power and communication. **Do not install traditional 2-pair RJ-11 cabling and jacks.**

PART 2 – PRODUCTS

2.1 General

- .1 All indoor conduits shall be EMT. Type LB conduit fittings are unacceptable. All 90 degree bends shall be made with junction boxes or long radius pipe bends. Minimum bend radius for UTP cabling is 1 inch.
- .2 Where drawings indicate 2 computer jacks to be installed, provide a 4-position faceplate with 2 blank spaces for future use.
- .3 Where drawings indicate 1 computer jack to be installed, provide a 2-position faceplate with 1 blank space for future use.

- .4 Where drawings indicate more than 4 jacks to be installed, provide a 6-position faceplate and appropriate size box as required
- .5 Computer jacks shall use RJ-45 connectors terminated using the EIA/TIA-568C wiring scheme.
- .6 Wire management products such as conduits, raceways, vertical and horizontal cable managers, J-hooks, beam clamps and support rings must be used where appropriate, according to accepted installation practices as set forth according to standards in section 1.3.
- .7 **Plenum rated UTP CMP cable (NFPA 262 Flame rating) is to be used exclusively in all ceiling spaces** above tile, whether or not those areas are designed as plenum areas or not.
- .8 Backbone cabling runs between equipment room closet rack locations must use a 6-strand 50/125um OM3 (10gig) multi-mode fiber optic cable (plenum rated), and shall be run, terminated and labelled accordingly.
(Note: No copper backbone runs permitted, even if closet locations are within 100m distances or less). Consult with the Supervisor of Network Services, Information Technology Services Dept. with questions.
- .9 Network racks must be standard 19" wide, 44U - 83" tall floor standing models with vertical cable management on both sides. A rack mounted vertical power strip is required. Clearance around racks should be a minimum 36" in front of rack and minimum 30" in rear of rack. If physical space is limited, consult with the Supervisor of Network Services, Information Technology Services Dept. on acceptable wall-mount rack solutions.\
- .10 UPS battery backup/surge protection required for all network rack locations. See Section 2.2 Parts List for details.
- .11 For each network rack, install 1-15amp NEMA 5-15R receptacle electrical circuit (Elementary schools). Secondary schools may require 1-20amp electrical circuit (NEMA 5-20R receptacle). Consult with the Supervisor of Network Services, Information Technology Services Dept on Secondary school requirements before installation.

2.2 Parts List

- .1 Voice/Computer Data Cabling

For all ceiling spaces:

Category 6A Cabling

Panduit #PUP6AM04WH-UG (**white**)

Panduit Advanced MaTriX, Cat6A UTP, CMP, NFPA 262, plenum cable

For network rack device activation:

Category 6A Patch Cord

Panduit #UTP6ASD7 (**Off white**)

Panduit Advanced MaTriX, Cat6A (SD-small diameter) UTP, CM, 7' patch cord

Note: Consult with the Supervisor of Network Services, Information Technology Services Dept. for additional patch cord color requirements

- .2 Voice/Computer Data RJ-45 Jacks

Category 6A Jack

Panduit # CJ6X88TGWH (**white**)

.3 Voice/Computer Data RJ-45 Faceplates

Panduit #CFPSL4IW off-white single gang 4 port angled port faceplate

Panduit #CFPSL6IW off-white single gang (Note: requires two gang deep box and a two gang to single gang reducing plate Panduit #MIWBAlW)

.4 Voice/Computer Data 19" Patch Panel

Panduit Mini-Com 24 port Modular Patch Panel #CP24BLY

.5 Box acceptable for Surface Mount Installation on Rack Poles

Panduit #CBXJ2IW-A (IW = off-white) (IG = grey) - 2 position box

Panduit #CBX4IW-A (IW = off-white) (IG = grey) - 4 position box

Panduit #CBXF6IW-A (IW = off-white) (IG = grey) - 6 position box

.6 Box acceptable for Surface Mount installation with 3/4" & 1" conduit

Model: T&B #TD14-2 (3/4" box)

Single gang deep cast box, gray, with 3/4" threaded hubs. (4 cables = 44.6% conduit fill rate
3 cables = 33.5% conduit fill rate)

Model: T&B 2IHD5-3 (1" box)

Two gang deep cast box, grey, with 1" threaded hubs. (6 cables = 41.1% conduit fill rate
5 cables = 34.5% conduit fill rate)

Note: requires a two gang to single gang reducing plate Panduit #MIWBAlW

.7 Part acceptable for Flush Mount Wall Installations

Cooper B-Line #BB15 Single Gang Cover Plate Mounting Bracket (where applicable)

Cooper B-Line #BB10 Single Gang Cover Plate Mounting Bracket (where applicable)

.8 Fiber Optic Cable parts and specifications

6-strand 50/125um OM3, indoor PLENUM rated, multimode fiber optic cable

(Panduit, Superior Essex, Corning, or Optical Cable Corp are acceptable, please specify if other is to be used)

Panduit #FRME1 1U Rack Mount Fiber Interconnect Drawer

Panduit #FAPB Blank Filler Plate for Fiber Panels

Panduit #FAP6WAQDLCZ 6 Position LC Coupler Plate

Panduit #FLCSMCXAQY Opticam LC Multimode Fiber Optic Connector

2 meter 50/125um OM3 LC-LC fiber optic patch cables, quantity per rack as required

.9 Network Rack parts and specifications

19" standard rack, 44U-83" tall floor standing rack

R.F. Mote RFM-1944-RB

Vertical Rack Cable managers, 44U size, both sides with doors

R.F. Mote RFM-RVCM-B

Vertical Power Bar – 15A, 12 plug minimum, black, with breaker,

UL, cUL approved, must be vertically mounted

Note: If space is limited, consult with the Supervisor of Network Services, Information Technology Services Dept. for alternative wall-mount solutions.

.10 UPS Battery backup/surge protection specifications

DSBN has standardized on Tripplite UPS systems for use in network rack locations. Consult with Information Technology Services Dept. for network power requirements before ordering UPS equipment.

PART 3 - INSTALLATION & EXECUTION

3.1 General

- .1 Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, provincial, and local authorities having jurisdiction as expressed in section 1.2 and 1.3 of this specification, and according to manufacturer's printed instructions.
- .2 It is expected that the contractor completes the work in this specification in a professional manner while performing in an educational type setting, keeping in mind their actions affect students, teachers and parents alike. The craftsmanship of work is expected to be of the highest quality.
- .3 Install floor mounted racks plumb and secure to building structure
- .4 Train all cabling neatly into wire ways and ty-wrap neatly in bundles.

3.2 Safety

- .1 The vendor shall take the necessary precautions and bear the sole responsibility for the safety of the methods employed in performing the work. The vendor shall at all times comply with the regulations set forth by federal, provincial, and local laws, rules, and regulations concerning "OSHA" and all applicable provincial labor laws, regulations, and standards. The vendor shall indemnify and hold harmless the DSBN from and against all liabilities, suits, damages, costs, and expenses (including attorney's fees and court costs) which may be imposed on the DSBN because of the vendor, subcontractor, or supplier's failure to comply with the regulations stated herein.

3.3 Warranty

- .1 Unless otherwise specified, unconditionally guarantee in writing the materials and workmanship for a period of not less than twenty-five (25) years from date of acceptance by the DSBN.

3.4 Labelling & Identification

- .1 All cabling, faceplates and terminations must be labelled according to ANSI/EIA/TIA-606(B) Standards as specified in Section 1.3 "Installation Guidelines" of this document. Labels that are machine-printed will only be accepted. Hand written labels are unacceptable.

3.5 Testing

- .1 All testing shall comply with ANSI/EIA/TIA-568-C.1/C.2 specifications for the cabling specified in section 2.2 of this specification. Testing must be performed using Level IIe or higher field testing equipment approved for use with standard industry practices.
- .2 Testing of optical fiber must be done at 850nm and 1300nm as per ANSI/TIA-568-C.3 standards.
- .3 Test results for all terminations may be submitted to the DSBN in electronic format via email.
- .4 If cabling runs exceed industry standards for distance and fail performance testing, the contractor must contact the Supervisor of Network Services, Information Technology Services Department and Facility Departments to explore alternatives in resolving these issues.

PART 4 - APPROVED CONTRACTORS & QUALIFICATIONS

4.1 Approved Contractor List

- .1 Contact DSBN Purchasing Dept. for information.

4.2 Contractor/Vendor Qualifications

- .1 The successful contractor/vendor awarded to perform the scope of work described herein, must have a minimum of (5) years of experience.
- .2 The vendor must have an **RCDD®** (*Registered Communications Distribution Designer*) assigned to DSBN projects or equivalent BICSI industry standard certification. These may include RITP (Registered Information Technology Professional), Registered Telecommunication Project Manager (RTPMi), Data Center Design Consultant (DCDC) or Network Technology Systems Designer (NTS). The RCDD/equivalent must have a minimum of (3) years experience in this type of project design, as to adequately support the installers during installation, during the warranty/extended warranty period, and during support maintenance periods. A resume of the responsible RCDD/equivalent must be attached to the vendor's response for evaluation by the DSBN. Should the RCDD/equivalent assigned to this project change during the installation, the new RCDD/equivalent assigned must also submit a resume for review by the DSBN.
- .3 If in the opinion of the DSBN, the RCDD/equivalent does not possess adequate qualifications to support the project, the DSBN reserves the right to require the vendor to assign an RCDD/equivalent who, in the DSBN's opinion, possesses the necessary skills and experience required of this project.
- .4 The vendor must have manufacturer /industry (BICSI) certified installers and technicians on staff assigned to this project. Substitute personnel will not be accepted. The project shall be staffed at all times by installers and technicians who have a minimum of (2) years' experience.

END OF SECTION

PART 1 – GENERAL

1. Summary

- .1 This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- .2 Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- .3 The Fire Detection and Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 1. Fire alarm and detection operations
 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.

2. Acceptable Manufacturers

- .1 Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell and represent the base bid for the equipment.
 1. Subject to compliance with requirements, provide alternate products by one of the following:
 - a) SimplexGrinnell / AutoCall
 - b) Chubb-Edwards
 - c) Troy Life and Fire Safety

3. System Description

- .1 General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- .2 History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm, supervisory and trouble logs shall be provided.
- .3 Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.
- .4 Wiring/Signal Transmission:
 1. Transmission shall be addressable signal transmission, dedicated to fire alarm service only.
 2. System connections for initiating (signaling) circuits and notification appliance circuits
 3. shall be Class A.
- .5 Required Functions: The following are required system functions and operating features:
 1. Priority of Signals: Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second-, and third-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
 2. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
 3. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and any required remote annunciators, indicating the location and type of device.

4. General Alarm: A system general alarm shall include:
 - a) Indication of alarm condition at the FACP and any required remote annunciator(s).
 - b) Identification of the device that is the source of the alarm at the FACP and any required remote annunciator(s).
 - c) Operation of audible and visible notification appliances throughout the building until silenced at FACP. Audible Alarm Notification shall operate Temporal Code.
 - d) Closing doors normally held open by magnetic door holders.
 - e) Shutting down supply and return fans serving zone where alarm is initiated.
 - f) Notifying the local fire department.
 - g) Initiation of elevator recall when specified sensors are activated.
5. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
 - a) Activate the system supervisory service audible signal and illuminate the LED at the FACP and the graphic annunciator.
 - b) Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
 - c) Transmission of supervisory signal to remote central station.
6. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.
7. System Reset
 - a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b) Should an alarm condition continue, the system will remain in an alarmed state.
- .6 Analog Smoke Sensors:
 1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The FACP shall determine the condition of each sensor by comparing the sensor value to the stored values.
 2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
 3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 8 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
 4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet CAN/ULC-S537 and CAN/ULC-S536 calibrated test method requirements. The reports shall be viewed on a Maintenance Terminal CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
 5. Peak Value Logging: The FACP shall log the Peak Value of smoke obscuration or degree of temperature for each individual sensor to allow system calibration for maximum response time performance without nuisance alarms based on "actual ambient conditions".
 6. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP.. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall

- not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control panel.
7. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
- .7 Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
 3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- .8 Audible Alarm Notification: By horns in areas as indicated on drawings.
- .9 Power Requirements
1. The control panel shall receive AC power via a dedicated fused disconnect circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 30 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
 3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control panel.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control panel. A green "power on" LED shall be displayed continuously while incoming power is present.
 5. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
 6. The system shall support 100% of addressable devices in alarm operated at the same time, under both primary (AC) and secondary (battery) power conditions.
 7. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

4. Submittals

- .1 General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
 2. Wiring diagrams from manufacturer.
 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
 4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per all applicable standards.
 5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of SLC, NAC, RAC, Sensor, and auxiliary control circuits.
 6. Operating instructions for FACP.
 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual.

- Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
 9. Record of field tests of system.
 - .2 Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

5. Quality Assurance

- .1 Installer Qualifications: A factory-authorized installer is to perform the work of this section.
- .2 Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories of Canada, Inc. (ULC), and shall bear the "ULC" label.

PART 2 – PRODUCTS

1. Fire Alarm Control Panel Simplex 4100ES (FACP)

- .1 General: Comply with ULC-S527, "Control Panels for Fire Alarm Systems."
- .2 The following FACP hardware shall be provided:
 1. Base panel with beige cabinet and door, 120 VAC, 60 HZ input power.
 2. 250 Addressable point capacity inclusive of inputs and outputs in any combination.
 3. Four (4) Class B/Style Y Notification Appliance Circuits (NAC; rated 2A @ 24VDC, resistive);
 4. Two form "C" Auxiliary Output Circuits (rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory or other selective control operations. Provide capability for switching up to ½ A @ 120VAC, inductive loads.
- .3 Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single panel is required to form a complete control panel, provide exactly matching modular panel enclosures.
- .4 Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

2. Passive Graphic Annunciator

- .1 Provide a passive graphic annunciator panel.

3. Emergency Power Supply

- .1 General: Components include battery, charger, and an automatic transfer switch.
- .2 Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all notification appliances in alarm or supervisory mode for a period of 30 minutes.

4. Addressable Manual Pull Stations

- .1 Description: Addressable single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
- .2 Protective Shield: All manual pull stations shall be provided with a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

5. Smoke Sensors

- .1 General: Comply with CAN/ULC-S529, "Smoke Detectors for Fire Alarm Systems." Include the following features:
 1. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
 2. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 3. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 4. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 5. Removal of the sensor head for cleaning shall not require the setting of addresses.
- .2 Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.
- .3 Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
- .4 Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
 1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
9. A NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

6. Heat Sensors

- .1 Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- .2 Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- .3 Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- .4 Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

7. Addressable Circuit Interface Modules

- .1 Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of water flow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.
- .2 Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
- .3 There shall be the following types of modules:
 1. Type 1: Monitor Circuit Interface Module:
 - a) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 2. Type 4: Line Powered Control Circuit Interface Module
 - a) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

8. Standard Alarm Notification Appliances

- .1 Horn: Piezoelectric type horn shall be listed to ULC -S525. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.
- .2 Visible/Only: Strobe shall be listed to ULC-S526. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

- .3 Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to ULC-S526 and ULC-S525. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.

PART 3 – EXECUTION

1. Installation, General

- .1 Install system components and all associated devices in accordance with applicable CAN/ULC Standards and manufacturer's recommendations.
- .2 Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Canadian Fire Alarm Association (CFAA) fire alarm certified personnel.

2. Equipment Installation

- .1 Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- .2 Existing Fire Alarm Equipment shall be maintained fully operational until the new equipment has been tested and accepted.
- .3 Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material.
- .4 Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- .5 Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

3. Wiring Installation

- .1 System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the National Electric Code (NEC).
- .2 Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- .3 Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

4. Field Quality Control

- .1 Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

- .2 Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 1. Factory trained and certified.
 2. Canadian Fire Alarm Association (CFAA) fire alarm certified.
 3. Certified by a provincial or local authority.
 4. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- .3 Pre-testing: Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- .4 Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
- .5 Minimum System Tests: Test the system according to the procedures outlined in CAN/ULC-S536 and/or -S537).
- .6 Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- .7 Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.
- .8 Final Test, Certificate of Completion, and Certificate of Occupancy:
 1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

5. Training

- .1 Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
 2. Schedule training with the Owner at least seven days in advance.

END OF SECTION

1 General

1.1 **RELATED SECTIONS**

- .1 Section 32 92 23 Sodding
- .2 Section 32 93 10 Trees, Shrubs and Ground Covers

1.2 **MATERIALS**

- .1 Contract will use native topsoil, amended as directed. Fertilizer is to be delivered to the job site with manufacturer's labels intact. All material to be approved by the project co-ordinator.

1.3 **SCHEDULE OF WORK**

- .1 Schedule placing of topsoil and finish grading to permit sodding or seeding operations under optimum soil moisture and weather conditions.

1.4 **MEASUREMENT FOR PAYMENT**

- .1 Payment for rough grading will be paid by lump sum based on estimated volumes. Payment for fine grading and amendments will be paid on a per square meter basis included into the cost of other items, including sodding.

2 Products

2.1 **MATERIALS**

- .1 Topsoil shall be: friable, neither heavy clay nor of very light sandy nature containing minimum of 4% organic matter to a maximum of 20% by volume. Free from subsoil, roots, grass, weeds, toxic materials, stones, foreign objects and with an acidity range (pH) of 5.5 to 7.5.
- .2 Planting soil for planting trees and shrubs: mix 9 parts topsoil with 1 part peatmoss. Incorporate bonemeal into planting soil at rate of 3 kg/m³ of soil mixture.
- .3 Peatmoss:
 - .1 Derived from partially decomposed fibrous or cellular stems and leaves of species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5mm.
- .4 Fertilizer:
 - .1 Complete commercial synthetic slow release fertilizer with minimum 35% water soluble nitrogen.
 - .2 Formulation ratio: 6-14-14 at 10lbs per 1000 sq feet incorporated into the rootzone.
- .5 Bonemeal:
Raw, steamed bonemeal, finely ground with a minimum analysis of 3% nitrogen and 20% phosphoric acid.

3 Execution

3.1 **SPREADING OF NATIVE/IMPORTED TOPSOIL/PLANTING SOIL**

- .1 Spread topsoil after Landscape Architect has inspected and approved subgrade.

- .2 Spread topsoil with adequate moisture in uniform layers over approved, unfrozen subgrade, where sodding and planting is indicated.
- .3 Apply topsoil to following depths:
 - 150 mm of topsoil for sodded areas
 - 600 mm of topsoil for planting beds
- .4 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.2 **APPLICATION OF FERTILIZER**

- .1 Mix fertilizer thoroughly to full depth of topsoil.

3.3 **FINISH GRADING**

- .1 Fine grade and loosen top soil. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose friable bed for sodding and planting areas, by means of cultivation and subsequent raking.
- .2 Roll with 50 kg roller, minimum 900 mm wide, to consolidate leaving surface smooth, uniform, firm against deep foot printing, and with a fine loose texture to approval of Landscape Architect.

3.4 **RESOTRATION OF STOCKPILE SITES**

- .1 Restoration of stockpile sites to include grading, seeding and sodding where required to match proposed surface treatment.

3.5 **SURPLUS MATERIAL**

- .1 Dispose of materials not required off site.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

- .1 Provision of all labour, materials, equipment and incidental services necessary to supply and install site furnishings.

1.2 **PROTECTION OF EXISTING FEATURES**

- .1 Building and surface features.
 - .1 Protect surface features which may be affected by work from damage while work is in progress. In the event of damage, immediately make repair to the approval of the landscape architect.

1.3 **MEASUREMENT FOR PAYMENT**

- .1 Items will be paid for as per the Unit Schedule. Payment includes installation, excavation (as required) and all materials, labour and incidentals required to complete the work.

2 Products

2.1 **MATERIALS**

- .1 Bike racks supplied by Maglin 1-800-716-5506 OR Approved equal
Model No. MBR-0400-00015
Finish: Black Powder Coat
Surface Mount
Install as per manufacturer's Specifications.
- .2 Bench by Maglin 1-800-716-5506 OR Approved equal
Model: MBE-0510-00010
Finish: Black powder coat metal
Installation: Surface mount as per manufacturer Specifications
- .3 Black Vinyl Chain Link Fence and gates
Install as per detail on L2.
- .4 Galvanized Chain Link Fence
Install as per detail on L2.
- .5 Picnic table by Maglin 1-800-716-5506 OR Approved equal
Model No.: MTB-0210-00003
Material: Wood Grain Texture (Grey) High Density Polyethylene
Table top and Backless bench
Options: Direct Burial, Wheelchair accessible
Install as per manufacturer's Specifications.
- .6 Timber Raised Planter
Install as per detail on L3.
- .7 Permeable pavers by Techo-Bloc 1-877-832-4625 or approved equal
Paver: Aquastorm Paver
Colour: Grey
Texture: Smooth
Laying Patter: Linear Laying Pattern 02

Cavities and joints to be filled with topsoil and seeded with eco-lawn seed mix.
Installation as per manufacturer's instructions.

- .8 Outdoor Chalk Board by Nature's Instruments (1-877-733-7456) or Approved Equal
Model: NI-PG-301-01
Installed as per manufacturer's instructions.

3 Execution

3.1 **INSTALLATION**

- .1 Install as per the details identified on drawings L2, L3 and L4.
- .2 Prior to installation provide layout to the approval of the landscape architect.

END OF SECTION

- 1 General
 - 1.1 **RELATED WORK**
 - .1 Section 31 22 19.13 Topsoil & Finish Grading
 - 1.2 **SOURCE QUALITY CONTROL**
 - .1 Obtain approval from Landscape Architect of sod at source.
 - .2 When proposed source of sod is approved, use no other source without written authorization.
 - 1.3 **SCHEDULING**
 - .1 Schedule sod laying to coincide with topsoil operations.
 - 1.4 **MEASUREMENT FOR PAYMENT**
 - .1 Nursery sod will be measured in square metres and paid for under item "Sod".
 - .2 Access areas and work zones with high erosion potential will require protection in the form of pegged sod.
- 2 Products
 - 2.1 **MATERIALS**
 - .1 Nursery sod: Quality and source to comply with standards outlined in "Guide Specification for Nursery Stock", Section 17, 9th edition, published by Canadian Nursery Trades Association.
 - .2 Number one Kentucky Bluegrass/Fescue Sod: sod grown from maximum 40% Kentucky Bluegrass, 30% creeping Red Fescue, supplied by Greenhorizons, 519-653-7494 or approved equivalent.
 - .3 Broken, dry, discoloured pieces will be rejected by Landscape Architect.
 - .4 Wooden pegs 17 x 17 x 200 x 200 mm.
 - .5 Water: potable.
 - .6 Fertilizer: complete synthetic slow release fertilizer with maximum 35% water Soluble nitrogen. Formulation ratio: 21-7-7 with slow release nitrogen at 3lbs per 1000 sq feet.
- 3 Execution
 - 3.1 **LAYING OF SOD**
 - .1 Prior to sodding, obtain approval from Landscape Architect that finished grade and depth of topsoil are satisfactory.
 - .2 Lay sod within 24 hr. of being lifted.
 - .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 overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
 - .5 Provide close contact between sod and soil with light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
 - .6 Water sod immediately after laying to obtain moisture penetration to top 100 mm of topsoil.
 - 3.3 **MAINTENANCE**
 - .1 Maintain sodded area from start of installation until final acceptance is awarded from the Landscape Architect for all landscape project items unless otherwise directed by the Landscape Architect.

- .2 Water sodded areas in sufficient quantities and at frequency required to maintain soil under sod continuously moist to depth of 75 mm to 100 mm. This is assumed, at a minimum, to be twice a week for the 4 weeks following installation, and once every two weeks thereafter from June through to September.
- .3 Maintain sodded areas weed free.
- .4 Fertilize sodded areas two weeks after sodding with .2.11 ratio fertilizer. Spread evenly at rate of 1 kg. of nitrogen/100m² and water in well.

3.4

ACCEPTANCE

- 1. Sodded areas will be accepted at final inspection by Landscape Architect provided that:
 - .1 Sodded areas are properly established.
 - .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 2 times.
 - .5 Sodded areas have been fertilized.
(Landscape Architect is to be notified 24 hrs in advance by the contractor of when the fertilizer application is to be applied.)

END OF SECTION

-
- 1 General
- 1.1 **RELATED WORK**
- .1 Section 31 22 19.13 Topsoil & Finish Grading
- 1.2 **SOURCE QUALITY CONTROL**
- .1 Obtain approval from Landscape Architect of sod at source.
- .2 Notify Landscape Architect of source of material at least 7 days in advance of shipment.
No work under this Section is to proceed without approval.
- .3 Acceptance of plant material at its source does not prevent rejection on site prior to or after planting operations.
- 1.3 **MEASUREMENT FOR PAYMENT**
- .1 Payment will be unit price for supply and installation of trees and shrubs. Installation includes:
- .1 Excavations for planting.
- .2 Supply of peat moss and fertilizer for planting.
- .3 Tree and shrub placement as shown on planting details.
- .4 Staking and guying as per specification.
- .5 Mulching.
- 1.4 **SHIPMENT AND PRE-PLANTING CARE**
- .1 Coordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting.
- .2 Tie branches of trees and shrubs securely and protect plant material against abrasion, exposure and extreme temperature change during transit. Avoid binding of plant stock with rope or wire which would damage bark, break branches or destroy natural shape of plant. Give full support to root ball of large trees during lifting.
- .3 Cover plant foliage with tarpaulin, and protect roots by means of dampened straw, peatmoss, sawdust, or other acceptable material to prevent loss of moisture during transit and storage.
- .4 Remove broken and damaged roots with sharp pruning shears.
- .5 Keep roots moist and protected from sun and wind. Heel in trees and shrubs, which cannot be planted immediately, in shaded areas and water well. Heeled in trees and shrubs are to be kept to a minimum on-site. Landscape Architect must be notified prior to any on-site storage of materials.
- 1.5 **GUARANTEE**
- .1 Provide a written guarantee, signed and issued to the owner stating that the plant material as itemized on the plant list is guaranteed against defects for a period of twelve (12) months from the date of Acceptance.
- .2 End-of-warranty inspection will be conducted by the Landscape Architect.
- .3 Landscape Architect reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth on trees and shrubs is not sufficient to ensure future survival.

1.6

REPLACEMENTS

- .1 If any plant material is found either dead or not in satisfactory health as determined by the Landscape Architect, it will, upon request, be immediately removed from the site and replace as soon as conditions permit during the normal planting season.
- .2 Replace dead plant material immediately.
- .3 Extend warranty on replacement plant material for a period equal to the original warranty period.
- .4 Continue such replacement and warranty until plant material is accepted by the Landscape Architect.

2

Products

2.1

MATERIALS

- .1 Water: potable and free of minerals which may be detrimental to plant growth.
use appropriate treegator watering bag as specified in tree planting details.
- .2 Stakes: Wood stakes 40 x 40 x 5 x 2440 mm.
- .3 Guy Wires: steel wire strand at following size.
 - .1 Shrubs and trees under 75 mm caliper use No. 12 galvanized wire (not on podium deck)
- .4 Tree Rings: fabricated from 3 mm galvanized wire encased in two ply reinforced 12 mm diameter rubber garden hose or equivalent.
- .5 Tree Wrapping Material:
Not Applicable
- .6 Mulch: Submit sample prior to shipping to site for approval by Landscape Architect:
 - .1 Shredded bark mulch: free of small branches, leaves and varying in size with no pieces thicker than 12 mm.
- .7 Anti-desiccant: Wax-like emulsion to provide film over plant surfaces reducing evaporation but permeable enough to permit transpiration.
- .8 Fertilizer: 6-24-24 at 12lbs per 1000sq ft incorporated to half rootball depth, and to the dripline of trees.
- .9 Peatmoss:
 - .1 Derived from partially decomposed fibrous or cellular stems and leaves of species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.

2.2

PLANT MATERIAL

- .1 Quality and Source:
Comply with Guide Specification for Nursery Stock, latest edition of Canadian Nursery Trades Association referring to size and development of plant material and root ball.

Measure plants when branches are in their natural position. Height and spread dimensions refer to main body of plant and not from branch tip to branch tip. Use trees and shrubs of No. 1 grade.

.2 Additional plant material qualifications:

- .1 Plant material obtained from areas with milder climatic conditions from those of site acceptable only when moved to site prior to the breaking of buds in their original location and heeled-in, in a protected area until conditions suitable for planting.
- .2 Use trees and shrubs with strong fibrous root system free of disease, insects, defects or injuries and structurally sound. Use trees with straight trunks, well and characteristically branched for species. Plants must have been root pruned regularly, but not later than one growing season prior to arrival on site.
- .3 Large trees must have been half root pruned during each of two successive growing seasons, the latter at least one growing season prior to arrival on site.
- .4 Plant material that has come out of dormant stage and is too far advanced will not be accepted unless prior approval obtained.

.3 Cold Storage:

Approval required by Landscape Architect for plant material which has been held in cold storage.

.4 Container Grown Stock:

- .1 Acceptable if containers large enough for root development. Trees and shrubs must have grown in container for a minimum of one growing season but not longer than two. Root system must be able to "hold" soil when removed from container. Plants that have been root bound are not acceptable. Container stock must be fertilized with slow releasing fertilizer.

.5 Balled and Burlapped:

Coniferous and broad-leaved evergreens over 500 mm tall must be dug with soil ball.

Deciduous trees in excess of 3 m height must have been dug with large firm ball. Root balls must include 75% of fibrous and feeder root system. This excludes use of native trees grown in light sandy or rocky soil. Secure root balls with burlap, heavy twine and rope.

For large trees: wrap ball in double layer of burlap and drum lace with minimum 10 mm dia. rope. Protect root balls against sudden changes in temperature and exposure to heavy rainfall.

.6 Substitutions:

Substitutions to plant material as indicated on planting plan are not permitted unless written approval has been obtained from Landscape Architect as to type, variety and size. Plant substitutions must be of similar species and of equal size as those originally specified.

- 3 Execution
 - 3.1 **WORKMANSHIP**
 - .1 Obtain approval prior to excavating.
 - .2 Apply anti-desiccant in accordance with material manufacturer's instructions.
 - .3 Coordinate operations. Keep site clean and planting holes drained. Immediately remove soil or debris spilled onto pavement.
 - 3.2 **PLANTING TIME**
 - .1 Plant deciduous plant material during dormant period before buds have broken. Plant material noted for spring planting must be planted in dormant period.
 - .2 Plant material imported from region with warmer climatic conditions may only be planted in early spring.
 - .3 When permission has been obtained to plant deciduous plant material after buds have broken, spray plants with anti-desiccant to slow down transpiration prior to transplanting.
 - .4 Plant evergreens in spring before bud break.
 - .5 When permission has been obtained, trees and shrubs, and ground covers growing in containers may be planted throughout growing season.
 - .6 Plant only under conditions that are conducive to health and physical conditions of plants.
 - .7 Provide planting schedule:
Extended planting operations over long period using limited crew will not be accepted.
 - 3.3 **EXCAVATION**
 - .1 Individual shrubs:
excavate planting holes 250 mm deep and at least 250 mm wide.
 - .2 Small trees (up to .30 m):
excavate holes 450 mm deep with diameter of 300 mm greater than root spread or root ball.
 - .3 Large trees:
excavate to depth of 500 mm with width of 750 mm greater than diameter of root ball.
In heavy soils, increasing planting holes by 50 mm for each 100 mm of root ball diameter.
 - 3.4 **PLANTING**
 - .1 Plant trees and shrubs vertically with roots placed straight out in hole. Orient plant material to give best appearance.
 - .2 Place plant material to depth equal to depth they were originally growing in nursery.

- .3 With balled and burlapped root balls, loosen burlap and cut away minimum top 1/3 without disturbing root ball. Do not pull burlap or rope from under root ball. With container stock, remove entire container without disturbing root ball. Non-biodegradable wrappings must be removed.
- .4 Tamp planting soil around root system in layers of 150 mm eliminating air voids. Frozen or saturated planting soil is unacceptable. When 1/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling with mixture of planting soil, peatmoss and 1:4:2 slow release fertilizer.
- .5 Build 100 mm deep saucer around outer edge of hole to assist with maintenance watering.
- .6 When planting is completed, give surface of planting saucer dressing of 1:2:2 fertilizer at rate of 12 kg/100 m². Mix fertilizer thoroughly with top layer of planting soil and water in well.

3.5 **TREE SUPPORT**

- .1 Tree support is shown on planting details.

3.6 **PRUNING**

- .1 Prune trees and shrubs after planting where damage has occurred during shipping or planting. Postpone pruning, of those trees where heavy bleeding may occur, until in full leaf. Employ clean sharp tools and make cuts flush with main branch, smooth and sloping as to prevent accumulation of water. Remove projecting stubs on trunks or main branches. Remove dead and injured branches and branches that rub causing damage to bark, without changing the plants natural shape. Do not damage lead branches or remove smaller twigs along main branches.

3.7 **MULCHING**

- .1 Obtain approval of planting material installations before mulch is applied. Loosen soil in planting beds and pits and remove debris and weeds. Spread mulch to a minimum thickness of 100 mm. Mulch material susceptible to blowing must be moistened down and mixed with topsoil before applying or will not be acceptable.
- .2 Mulch material sample must be provided to the landscape consultant for approval prior to the successful contractor shipping the material to the site.

3.8 **MAINTENANCE**

- .1 Water twice a week for first 4 weeks and then sufficiently thereafter to maintain optimum growing conditions (assumed to be once every two weeks thereafter from June through to September). Ensure adequate moisture in root zone at freeze-up.
- .2 Spray plants to combat pests and diseases, as required. Do not use DDT or sprays prohibited by Agriculture Canada.
- .3 Keep stakes and guy wires in proper repair.

- .4 Provide adequate protection against winter damage including damage caused by rodents.
- .5 Maintain plant material from date of planting up to end of warranty period.
- .6 Remove trunk wrapping, guy wires and tree stakes at end of warranty period.

3.9

ACCEPTANCE

- .1 Trees, shrubs and ground covers must be healthy and in a vigorous growing condition at the time the final inspection review for the landscape components of the project is requested.
- .2 Trees, shrubs and ground covers planted in the fall will be evaluated for final acceptance in the following spring one month after start of growing season.

END OF SECTION