Heydon Park Secondary School Renovations

Location: 70 D'Arcy Street, Toronto, Ontario
Client: Toronto District School Board

Specifications

Project No.: hp2604
Issued for Tender
November 17, 2026

BORTOLOTTO
Bortolotto Design Architect Inc.
174 Spadina Avenue, Suite 200
Toronto, Ontario M5T 2C2

Contents

Section 00 01 03 Project Directory 2
Section 00 01 15 List of Drawings 3
Section 01 00 00 General Instructions 3
Section 01 21 00 Cash Allowances - TDSB 4
Section 01 23 00 Alternatives 1
Section 01 29 00 Payment procedures 2
Section 01 31 00 Project Coordination 2
Section 01 31 19 Progress Meetings 2
Section 01 32 00 Project progress documentation 3
Section 01 33 00 Submittal Procedures 4
Section 01 35 13 Site Safety Protocol for Occupied Buildings 7
Section 01 41 00 Regulatory Requirements and Construction Safety 8
Section 01 43 00 Quality Control 3
Section 01 51 00 Temporary Utilities 3
Section 01 52 00 Construction Facilities 2
Section 01 53 00 Temporary Construction 3
Section 01 61 00 Common Product Requirements 4
Section 01 71 00 Examination and Preparation 3
Section 01 73 00 Execution 2
Section 01 74 10 Cleaning 3
Section 01 78 00 Closeout Submittals 5
Section 06 10 53 Miscellaneous Rough Carpentry 4
Section 06 40 00 Architectural Woodwork 10
Section 07 52 00 Modified Bituminous Membrane Roofing 12
Section 07 84 00 Firestopping 5
Section 07 92 00 Joint Sealants 6
Section 08 11 13 Hollow Metal Doors and Frames 5
Section 08 14 16 Flush Wood Doors 5
Section 08 71 00 Door Hardware 4
Section 08 80 00 Glazing 6
Section 09 21 16 Gypsum Board Assemblies 6
Section 09 22 16 Non-Structural Metal Framing 4
Section 09 30 00 Tiling 10
Section 09 51 13 Acoustical Panel Ceilings 5

Section 09 51 14 Acoustical Fabric-Faced Panels 2
Section 09 65 00 Resilient Flooring.....5
Section 09 68 13 Tile Carpeting 4
Section 09 91 00 Painting 10
Section 10 10 00 Miscellaneous Specialties.....3
Section 20 00 00 Mechanical Specifications (Issued under separate cover) 277
Section 26 00 00 Electrical Specifications (Issued under separate cover) 85
Section 32 00 00 Landscape Specifications (Issued under separate cover).....51
Section Appendix A Exterior Signage - Signage & Wayfinding Program; November 16, 2026 17
Section Appendix B Heydon Park Secondary School - TDSB - Arborist Report; November 17, 2026 25

Section 00 01 03
Project Directory

Part 1 General

1.1 PROJECT DIRECTORY

.1 **OWNER REPRESENTATIVE**
Toronto District School Board
Jason Varandas, B.Arch.Sc., Architectural Coordinator
M: 647-444-9156
jason.varandas@tdsb.on.ca
15 Oakburn Crescent
Toronto, Ontario, M2N 2T5

.2 **ARCHITECT & PRIME CONSULTANT**
Notify for issues regarding drawings, consultants and construction
Bortolotto Design Architect Inc.
Alex Horber, OAA, Project Architect
M: 647-309-8080
T: 416-324-9951 x2
alex@bortolotto.com
174 Spadina Avenue, Suite 200
Toronto, Ontario, M5T 2C2

.3 **LANDSCAPE ARCHITECT**
Notify Prime Consultant
HKLA Landscape Architects
Kyle Foch BLA, OALA, APALA, CSLA, SLA
M: 905-251-5489
T: 905-839-5599
kfoch@hkla.ca
220 Westney Road South, Suite 308
Ajax, Ontario, L1S 7P9

.4 **STRUCTURAL ENGINEER**
Notify Prime Consultant
LEA Consulting Ltd.
Igli Bregasi, P.Eng, M.Eng.
M: 647-964-9444
T: 905-470-0015
ibregasi@lea.ca
40 University Avenue, Suite 503
Toronto, Ontario, M5J 1T1

.5 **MECHANICAL & ELECTRICAL ENGINEERS**
Notify Prime Consultant
Suri & Associates Ltd.
Rohin Suri, CEM, CEA, CBCP
M: 647-981-7621
rsuri@suriassoc.com

321 Lakeshore Road West, PO Box 59522
Mississauga, Ontario, L5H 4L1

END OF SECTION

Section 00 01 15
List of Drawings

Part 1 General

1.1 LIST OF DRAWINGS

.1 List of drawings as follows:

A000	Cover
	ARCHITECTURAL
A011	General Notes, OBC Data & Legends
A020	Room Schedules & Assemblies
A021	Door and Frame Schedules
A022	Signage Schedule
A101	Site Plan
A201	Life Safety Plans
A301	Ground Floor Demolition Plan
A302	Second Floor Demolition Plan
A303	Third Floor Demolition Plan
A304	Roof Demolition Plan
A401	Ground Floor Plan
A402	Second Floor Plan
A403	Third Floor Plan
A404	Roof Plan
A405	Enlarged Plans
A501	Ground Floor Reflected Ceiling Plan
A502	Second Floor Reflected Ceiling Plan
A503	Third Floor reflected Ceiling Plan
A601	-reserved-
A701	Interior Elevations
A702	Interior Elevations
A703	Interior Elevations
A704	Interior Elevations
A705	Interior Elevations
A706	Exterior Elevations
A707	Building Sections
A708	Building Sections
A709	-reserved-
A710	-reserved-
A711	Millwork Details
A712	Millwork Details
A713	Millwork Details
A801	-reserved-
	LANDSCAPE

L-TP1	Tree Preservation Plan
L-TP2	Tree Preservation Plan
L-L1	Landscape Plan - Back Yard
L-L2	Landscape Plan - Front Yard
L-D1	Details
L-D2	Details
L-D3	Details
L-N1	Notes
	STRUCTURAL ENGINEERING
S100	General Notes
S110	Typical Details
S200	Existing Ground Floor Part Plan
S201	Existing Roof Framing Plan
S202	Existing Roof Framing Plan
	MECHANICAL ENGINEERING
M1	Mechanical Legend and Notes
M2	First Floor - Existing HVAC Plan
M3	Second Floor - Existing HVAC Plan
M4	Third Floor - Existing HVAC Plan
M5	Roof - Existing HVAC Plan
M6	First Floor - Existing Plumbing & Drainage Plan
M7	Second Floor - Existing Plumbing & Drainage Plan
M8	Third Floor - Existing Plumbing & Drainage Plan
M9	First Floor - New HVAC Plan
M10	Second Floor - New HVAC Plan
M11	Third Floor - New HVAC Plan
M12	Roof - New HVAC Plan
M13	First Floor - New Plumbing & Drainage Plan
M14	Second Floor - New Plumbing & Drainage Plan
M15	Third Floor - New Plumbing & Drainage Plan
M16	Boiler Room - Existing Mechanical Plans
M17	Boiler Room - New Mechanical Plans
M18	Schedules
M19	Schedules
M20	BAS Controls Sequences & Schematics
M21	BAS Controls Sequences & Schematics
M22	BAS Controls Sequences & Schematics
M23	Schematics & Details
M24	Schematics & Details
	ELECTRICAL ENGINEERING
E1	Electrical Legend and Notes
E2	First Floor - Existing Power & Systems Plan
E3	Second Floor - Existing Power & Systems Plan
E4	Third Floor - Existing Power & Systems Plan

E5	Roof - Existing Power & Systems Plan
E6	First Floor - Existing Lighting Plan
E7	Second Floor - Existing Lighting Plan
E8	Third Floor - Existing Lighting Plan
E9	First Floor - New Power & Systems Plan
E10	Second Floor - New Power & Systems Plan
E11	Third Floor - New Power & Systems Plan
E12	Roof - New Power & Systems Plan
E13	First Floor - New Power & Systems Plan
E14	Second Floor - New Power & Systems Plan
E15	Third Floor - New Power & Systems Plan
E16	Boiler Room - Existing & new Electrical Plans
E17	Schedules & Schematics
E18	Schedules & Schematics

END OF SECTION

Section 01 00 00
General Instructions

Part 1 General

1.1 SECTION INCLUDES

.1 General instructions and definitions.

1.2 WORK UNDER THIS CONTRACT

.1 It is intended that Work supplied under this Specification shall be complete in every detail for the purpose required. This Contract shall include by Contractor, materials not herein mentioned, but which may be found necessary to complete or perfect any portion of Work in accordance with requirements of this Specification.

.2 The General Contractor shall be aware that building is an occupied multi-unit residential building and that all work will be undertaken in close proximity to residents.

.3 The General Contractor shall ensure that work in the corridors and lobbies is undertaken after 8am and before 5pm in order to minimize disruption to the residents.

.4 The General Contractor shall maintain, at all times during active construction, two paths of egress to the exterior. One of these temporary exits shall be equipped with a temporary non-slip curb ramp (sloped at max. 1:12) and be clearly signed inside and outside.

1.3 SPECIFICATIONS

.1 Each Section of Division 1 is complementary to all other Sections of Division 1 and shall be read together with all other Sections.

.2 This Section co-ordinates, relates and governs Work of all other Sections of the Specification.

.3 The Specifications are apportioned into Divisions and Sections for convenience but shall be read as a whole and neither such apportionment nor anything else contained in the Contract Documents places responsibility upon the Consultant to settle disputes among Sub-contractors in respect thereof.

1.4 QUANTITY OF ITEMS

.1 Where a component, device, item or part of materials or equipment is referred to in the singular number, such reference shall require the provision of as many components, devices, items or parts of material or equipment necessary to complete the Work.

1.5 STANDARDS AND CODES

.1 Contract forms, codes, specifications, standards, manuals and installation, application and maintenance instructions referred to in these Specifications, unless otherwise specified, amended or date suffixed, shall be the latest published editions.

1.6 DISCREPANCIES

.1 Advise Prime Consultant of any contradictions, discrepancies or errors that are found or noted.

.2 Advise Prime Consultant if there is any doubt as to the meaning or intent thereof in the Contract Documents.

.3 Do not proceed until instructions/clarifications have been confirmed by Prime Consultant.

.4 Failure to notify Prime Consultant shall result in the Contractor incurring responsibility for any resulting circumstances, conditions, expenses or cost.

1.7 DEFINITIONS

.1 Wherever words “approved”, “review”, “acceptance”, “acceptable”, “satisfactory”, “selected”, “directed”, “required”, “submit”, or similar words or phrases are used in standards of elsewhere in Contract Documents, it shall be understood, that words “by (to) the Consultant” follow, unless context provides otherwise.

.2 “Others” Defined: Others in contract Documents refers to other trades within framework of this Contract. Any Work or material executed outside Contract is designated “NIC’ (Not in Contract), “By Owner”, or “By Other Contractors”.

.3 “Provide” Defined: means the furnishing of all labour, materials equipment, transportation and all other services required, including costs in connection therewith, to complete the Work.

1.8 OVERLOADING

.1 Take precautions and preclude overloading of any part of structure, false-work, formwork of scaffolding during progress of the Work, and make good damage resulting from such overloading.

1.9 INSERTS, ANCHORS AND FASTENERS

.1 Use only factory made, threaded or toggle type inserts as required for supports and anchors, properly sized for load to be carried. Place inserts only in members of main structure and not in any finishing material.

.2 Where inserts cannot be placed, use factory made expansion shields for light weights only.

.3 Supply and locate all inserts, holes, anchor bolts and sleeves in time when walls, floors and roofs are erected.

.4 Fasteners stressed in withdrawal are not acceptable, except where otherwise specifically shown.

.5 Ensure that metal fastenings are of same materials as metal components being anchored or of a metal which will not set up a galvanic action causing damage to the fastening or metal component under moist conditions.

.6 Fastenings for pre-finished materials shall be of concealed type unless otherwise indicated.

.7 Ensure that metal fastenings and accessories are of same texture, colour and finish as material on which they occur.

1.10 TRADEMARKS AND LABELS

.1 Trademarks and labels, including applied labels, shall not be visible in finished Work in finished areas.

.2 The exceptions to this requirement are trademarks and labels which are essential to obtain identification of mechanical, electrical or other equipment for maintenance and replacement purposes and for mandatory fire ratings.

1.11 POWDER-ACTUATED FASTENERS

.1 Use powder actuated devices only after receipt of written permission from Owner.

.2 Do not use powder actuated fasteners which are stressed in withdrawal in finished Work.

.3 Do not use powder actuated fasteners within 100 mm of the edge of concrete.

.4 Powder actuated fasteners shall comply with PATM (Powder Actuated Tools Manufacturers Institute) and ANSI A10.3.

1.12 INTERFERENCES

.1 Coordinate placement of equipment to ensure that components will be properly accommodated within the spaces provided prior to commencement of work.

.2 Take complete responsibility for any remedial work that results from failure to coordinate any aspect of the Work prior to its fabrication/installation.

.3 Ensure that accesses and clearance required by jurisdictional authorities and/or for easy maintenance of equipment are provided in the layout of equipment and services.

END OF SECTION

Section 01 21 00
Cash Allowances - TDSB

Part 1 General

1.1 SECTION INCLUDES

.1 Cash Allowances

1.2 RELATED SECTIONS

.1 Section 01 00 00 - General Instructions

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 CASH ALLOWANCES

.1 Refer to GC 4.1–CASH ALLOWANCES.

.2 The Contractor shall include in the Contract Price, cash allowances stated herein.

.3 Cash allowances, unless otherwise specified, shall cover the following costs:

.1 Supply only cash allowances shall include:

.1 Net cost of Products.

.2 Delivery to site.

.3 Applicable taxes and duties, excluding Value Added Taxes (HST).

.2 Supply and installation cash allowances shall include:

.1 Net cost of Products and Services.

.2 Delivery to site.

.3 Applicable taxes and duties, excluding Value Added Taxes (HST).

.4 Unloading, storing, and handling of Products on site.

.5 Labour, installation, finishing, and commissioning of Products.

.6 Construction Equipment required for installation of Products.

.7 Subcontractors' and sub-Subcontractors' overheads and profits related to the cash allowance.

.3 Cash allowances for services shall include:

.1 Net cost of inspection and testing services.

.2 Applicable taxes, excluding Value Added Taxes (HST).

.3 Subcontractors' and sub-Subcontractors' overheads and profits related to the cash allowance.

.4 Other costs related to work covered by cash allowances shall be included in the Contract Price:

.1 For supply only cash allowances, the Contract Price shall include:

.1 Handling at site, including unloading, un-crating, storage and hoisting;

.2 Protection from weather and physical damage;

.3 Labour, installation, finishing, and commissioning of Products;

.4 Construction Equipment required for installation of Products;

.5 Other expenses with respect to cash allowance work such as contract coordination;

.6 Overheads and profits related to the cash allowance.

.2 For supply and installation cash allowances, the Contract Price shall include:

.1 Protection from weather and physical damage;

.2 Other expenses with respect to cash allowance work such as Contract coordination;

.3 Contractor's overhead and profit related to the cash allowance.

.3 For services cash allowances, the Contract Price shall include:

.1 Contractor's overhead and profit related to the cash allowance;

.2 Supply of material to be tested;

.3 Other testing and re-testing specified work.

.5 Costs not included in inspection and testing Cash Allowances, but included in the Contract Price:

.1 Costs of incidental labour and facilities required to assist inspecting or testing agency.

.2 Costs of testing services used by Contractor separate from Contract Document requirements.

.3 Costs of testing services mandated by regulation as a requirement to complete a scope of work.

.4 Costs of retesting upon failure of previous tests as determined by Consultant.

.5 Tests and inspections noted in the Contract Documents which are not specifically noted as being payable by Cash Allowances.

.6 The Owner, through the Consultant, will provide the Contractor with documentation required to permit pricing of a cash allowance item.

.7 The Owner, through the Consultant, may request the Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.8 The Owner, through the Consultant, may request the Contractor to disclose originals of all bids, quotations, and other price-related information received from potential Suppliers or Subcontractors.

.9 The Owner, through the Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain the Owner's prior written approval in the form of a Change Order before entering a Subcontract, amending an existing Subcontract, or performing own forces work included in a cash allowance. Upon issuance of the Change Order, the Contractor's responsibilities for a cash allowance item shall be the same as for other work of the Contract.

.10 The total cash allowance amount will be adjusted in whole by way of Change Order prior to the issuance of the final Certificate of Payment.

.11 Where total costs under cash allowances exceed the total cash allowance amount, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.

.12 Progress payments on accounts of work authorized under cash allowances shall be included in the Consultant's monthly certificate for payment.

.13 A schedule shall be prepared jointly by the Consultant and Contractor to show when items called for under cash allowances must be authorized by the Consultant for ordering purposes so that the progress of the Work will not be delayed.

.14 Supply only Cash Allowance Scope:

.1 Door hardware.

.15 Supply and Installation Cash Allowance Scope:

.1 Unforeseen site conditions.

.2 Disposal of contaminated soils not identified in geotechnical investigation report.

.3 Abatement of unforeseen material not otherwise noted in the Designated Substances Survey provided by the Owner.

.4 Unforeseen electrical work in existing building.

.16 Services Cash Allowances Scope:

.1 Inspection of designated substances and hazardous building materials abatement.

.2 Asphalt paving inspection and testing.

.3 Masonry and mortar testing.

.4 Structural steel, steel joists, and steel deck inspection.

.5 Waterproofing membrane inspection and testing.

.6 Roofing inspection and testing.

.7 Fireproofing inspection and testing.

.8 Fire stopping and smoke seal inspection and testing.

.9 Steel doors, frames, and screens inspection and testing.

.10 Arboricultural Consultant supervision and on-site direction.

.11 Video inspection of drainage piping beyond scope identified in Bid Documents.

.12 Excess soil management tracking and inspection.

.17 Refer to TDSB Tender Pricing Form for Cash Allowance value.

END OF SECTION

Section 01 23 00
Alternatives

Part 1 General

1.1 SECTION INCLUDES

.1 Alternative systems, materials and products.

1.2 RELATED REQUIREMENTS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 ALTERNATIVES

.1 Alternatives for all disciplines shall be submitted to the Prime Consultant.

.2 Alternatives will ***only*** be accepted during the Tender period, and shall be submitted a minimum of five (5) business days prior to bid closing.

.3 Alternatives will ***not*** be accepted during construction unless specifically allowed in individual Sections.

.4 Alternatives shall meet or exceed the performance and physical characteristics of the material or system specified in each Section.

.5 The contractor shall provide a written comparison summarizing the performance and physical characteristics of the proposed alternative and indicating that the alternative meets or exceeds the requirements of the specifications. Alternatives submitted without this analysis will be rejected.

.6 The Contractor shall submit samples of alternative materials for review by Prime Consultant. Samples shall match the specified colours and/or textures of the specified basis of design. Alternatives submitted without samples or samples which do not match the specified colours and/or textures will be rejected.

.7 Coordinate related work and modify surrounding work to integrate the Work of each alternative.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

.1 Schedule of values.
.2 Cash flow projection.
.3 Workers' compensation clearance.
.4 Statutory declarations.
.5 Payment for Products stored off site.

1.02 SCHEDULE OF VALUES

.1 Prior to the first application for payment, submit for Consultant's review an initial schedule of values. Modify the initial schedule of values if and as requested by the Consultant. Obtain Consultant's written acceptance of the initial schedule of values prior to the first application for payment.
.2 Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of work performed and Products delivered to Place of the Work.
.3 Provide the schedule of values in an electronic spreadsheet format based on the format provided and content described in latest edition of CCDC 24–A Guide to Model Forms and Support Documents.
.4 A work breakdown structure based on Specification sections and material and labour breakdown. Include separate line items for closeout procedures including closeout submittals, demonstration and training, start-up and testing, and commissioning.
.5 Provisions for approved Change Orders and allowances so that the breakdown amounts indicated in the schedule of values aggregate to the current total Contract Price. Also provide for indicating the estimated value of Change Directives within the schedule of values, separately from the current total Contract Price.
.6 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:
  .1 Breakdown Amount: A dollar amount, including an appropriate pro rata portion of Contactor's overhead and profit.
  .2 Performed to Date: The value of Work performed, and Products delivered to Place of the Work up to the date of the application for payment, stated as a percentage of the Contract Price and in dollars.
  .3 Previously Performed: The value of Work performed, and Products delivered to the Place of the Work for which payment has been previously certified, stated in dollars.
  .4 Current Period: The value of Work performed, and Products delivered to Place of the Work for which Contractor is currently applying for payment, stated in dollars.
  .5 Balance to Complete: The value of Work not yet performed, and Products not yet delivered to Place of the Work, stated in dollars.

1.03 CASH FLOW PROJECTION

.1 Prior to the first application for payment submit, for Consultant's review, a forecast of approximate monthly progress payments for each month of the Contract Time.
.2 Submit revised cash flow forecasts monthly and when requested by Consultant.

1.04 WORKERS' COMPENSATION CLEARANCE

.1 Submit proof of workers' compensation clearance with each application for payment.

1.05 STATUTORY DECLARATIONS

.1 Submit a statutory declaration in the form of CCDC 9A–Statutory Declaration of Progress Payment Distribution by Contractor with each application for payment except the first.

1.06 PAYMENT FOR PRODUCTS STORED OFF SITE

.1 The Owner may, due to extraordinary circumstances and at the Owner's sole discretion, make payments for Products delivered to and stored at a location other than the Place of the Work, subject to:

.1 a request submitted by Contractor in writing, with appropriate justification, and

.2 whatever conditions the Owner or the Consultant may establish for such payments, as required to protect the Owner's interests.

END OF SECTION

Section 01 31 00
Project Coordination

Part 1 General

1.1 PRE-CONSTRUCTION MEETING

.1 Immediately prior to construction, upon notification attend at location of the Owner's choice, pre-construction meeting, along with authoritative representatives of certain key subcontractors as specifically indicated in the conference notice.

.2 Purpose of meeting is as follows:

.1 Review project communications procedures.

.2 Review contract administration requirements including submittals, payment and change order procedures.

.3 Identify all critical points on construction schedule for positive action.

.4 Identify any product availability problems and substitution requests.

.5 Establish site arrangements and temporary facilities.

.6 Review Consultant’s inspection requirements.

.7 Review any points which, in Board's, Consultant's and Contractor's opinion, require clarification.

.3 The Consultant shall organize and chair the pre-construction meeting. Prime Consultant shall record minutes of pre-construction meeting and distribute a copy to each participant within ten days of meeting.

1.2 SITE MEETING

.1 Prior to the commencement of the Work, the Contractor together with the Prime Consultant shall mutually agree to a sequence for holding regular site meetings.

.2 Organize and chair site meetings. Ensure that persons, whose presence is required, are present and that relative information is available to allow meetings to be conducted efficiently.

.3 Once a month or more often if directed by Prime Consultant include review with Consultant and the Board of construction schedule and application for progress payment, during or immediately following site meeting. Submit to Consultant and sub-consultants a draft progress application not less than 48 hours prior to site meeting.

.4 Prepare and update for review at each site meeting a change order and shop drawing log.

.5 Record minutes of each meeting and promptly distribute copies to be received by all participants not later than seven days after meeting has been held. Distribute minutes of meetings to all Consultants, whether in attendance or not.

1.3 SUPERVISION

.1 Employ an experienced and qualified supervisor who shall be in complete charge of the Work from commencement to final completion of the Work and who shall be present at the site

whenever work is being carried out. A working foreperson will not be acceptable. The supervisor shall not be changed after commencement of work without the Owner's approval.

.2 Supervise, direct, manage and control the work of all forces carrying out the Work, including subcontractors and suppliers. Carry out daily inspections to ensure compliance with the Contract Documents and the maintenance of quality standards. Ensure that the supervisory staff includes personnel competent in supervising all Sections of Work required.

.3 Arrange for sufficient number of qualified assistants to the supervisor as required for the proper and efficient execution of the Work.

1.4 DOCUMENTS ON SITE

.1 Contractor's field office shall at all times contain a complete set of Contract Documents (Drawings and Specifications) with all addenda, site instructions, change orders, reviewed shop drawings and samples, colour schedule, paint materials schedules, hardware list, progress reports and meeting minutes.

1.5 INTERFERENCE AND COORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.

.2 Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Within 4 weeks of contract award submit interference drawings to Prime Consultant for review.

1.6 SLEEVING AND INSERT DRAWINGS

.1 Prepare sleeving drawings for work of Division 15 and 16, showing size and location of all penetrations through load bearing elements. Submit sleeving drawings to Prime Consultant for review not less than 15 days prior to construction of affected elements.

.2 Prepare insert setting drawings for work to be cast into concrete and / or mortared into masonry elements. Submit insert setting drawings to Prime Consultant for review not less than 15 days prior to construction of affected elements.

END OF SECTION

Section 01 31 19
Progress Meetings

Part 1 General

1.1 ADIMINISTRATIVE REQUIREMENTS

.1 Schedule and administer project meetings throughout the progress of the work and at the call of Prime Consultant.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Prime Consultant and all members of the project team as established at the pre-construction meeting.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and all other members of the project team not in attendance.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRE-CONSTRUCTION MEETING

.1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Owner, Prime Consultant, Sub-consultants, Contractor, major Subcontractors, field inspectors and Contractor's site superintendent shall be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: Contractor shall provide a Critical Path Construction Progress Schedule at each site meeting and as requested by Owner or Prime Consultant.

.3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 – Construction Facilities and 01 53 00 - Temporary Construction.

.5 Site security in accordance with Section 01 52 00 - Construction Facilities.

.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.7 Owner provided products.

.8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.11 Monthly progress claims, administrative procedures, photographs, hold backs.

.12 Appointment of inspection and testing agencies or firms.

.13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During the course of Work and 2 weeks prior to project completion, schedule progress meetings every 2 weeks or as otherwise established at pre-construction meeting.

.2 Contractor, major Subcontractors involved in Work, Prime Consultant, required Sub-consultants and Owner are to be in attendance.

.3 Notify parties minimum 5 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business.

END OF SECTION

Section 01 32 00
Project progress documentation

Part 1 General

1.1 CONSTRUCTION SCHEDULE

.1 Within 14 days of Contract award, submit in format acceptable to Prime Consultant, minimum 6 copies of Contractor's critical path construction schedule.

.2 Set up format to permit plotting of actual construction progress against scheduled progress.

.3 Schedule shall show:

.1 Commencement and completion dates of Contract.

.2 Commencement and completion dates of construction stages/phases, if any.

.3 Commencement and completion dates of each trade. Major trades shall be further broken down as directed by Prime Consultant; generally follow Specification format.

.4 Order and delivery dates for major or critical equipment.

.5 Critical dates for shop drawing/sample submissions.

.6 Any other information relating to orderly progress of Contract, considered by Contractor or Consultant to be pertinent.

.4 Prime Consultant, together with Contractor shall review construction progress once a month during or immediately following regular site meeting, or more often as directed by Consultant.

.5 Update construction schedule, whenever changes occur, in manner and at times acceptable to Prime Consultant.

.6 Plot actual construction progress or schedule at least once a week.

.7 Submit copy of updated schedule to Prime Consultant once a month, concurrently with application for payment.

1.2 CASH FLOW CHART

.1 Within 7 days after award of Contract, submit, in form approved by Consultant, cash flow chart broken down on a monthly basis in an approved manner. Cash flow chart shall indicate anticipated Contractor's monthly progress billings from commencement of work until completion.

.2 Update cash flow chart whenever changes occur to scheduling and in manner and at times satisfactory to Consultant.

1.3 PROGRESS RECORD

.1 Maintain on site, permanent written record of progress of work. Record shall be open to inspection by Consultant at all times and copy shall be furnished to Consultant upon request.

.2 This record shall show weather conditions dates of commencement, progress and completion of various trades and items of work. Particulars pertaining to erection and removal of forms, pouring of concrete, installation of roofing and other critical or major components as well as

number of employees of various trades and type and quantity of equipment employed daily, shall be noted.

.3 Display a copy of the construction schedule in the site office from start of construction to completion. Superimpose actual progress of work on schedule at least once each week.

1.4 RECORD DRAWINGS

.1 Obtain and keep on site at all times a complete and separate set of black line white prints.

.2 Note clearly, neatly, accurately and promptly as the work progresses all architectural, structural mechanical and electrical changes, revisions and additions to the work and deviations from the Contract Documents.

.3 Accurate location, depth, position, size and type of concealed and underground services, both inside and outside shall be included as part of these record drawings.

.4 Record drawings shall be available for review at each site meeting.

.5 Refer to drawings for additional requirements.

1.5 PROGRESS PHOTOGRAPHS

.1 Concurrently with monthly application for payment submit digital photographs as follows:

.1 Up to four photographs shall be taken from positions determined by Consultant.

.2 Photographs shall be properly exposed and in focus; views shall be unobstructed.

.3 Identify each photograph stating name of project, name of photographer, description of view and date of photograph taken.

1.6 CERTIFIED SURVEY PLAN

.1 Upon completion of the Work, submit four copies (and a CAD version) of a topographic survey of the final site condition from a qualified Ontario Land Surveyor certifying that the Work is in accordance with the requirements of the Contract Documents.

.2 The surveyor shall verify and certify additional lines and levels of any part of the work if deemed necessary by the Prime Consultant. Deviations from Drawings shall be reported to the Prime Consultant in writing within 24 hours of detection.

1.7 PRODUCT DELIVERY CONTROL

.1 It is the responsibility of the Contractor to ensure that the supplier or distributor of materials specified or alternatives accepted, which he intends to use, has materials on the site when required. The Contractor shall obtain confirmed delivery dates from the supplier.

.2 Provide equipment delivery schedule, coordinated with construction and submittals schedule, showing delivery dates for major and/or critical equipment.

.3 The Contractor shall contact the Prime Consultant immediately upon receipt of information indicating that any material or item, will not be available on time, in accordance with the original schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.

.4 The Prime Consultant reserves the right to receive from the Contractor at any time, upon request, copies of actual purchase or work orders of any material or products to be supplied for the work.

.5 If materials and products have not been placed on order, the Prime Consultant may instruct such items to be placed on order, if direct communication in writing from the manufacturer or prime suppliers is not available indicating that delivery of said material will be made in sufficient time for the orderly completion of the Work.

.6 The Prime Consultant's review of purchase orders or other related documentation shall in no way release the Contractor, or his subcontractors and suppliers from their responsibility for ensuring the timely ordering of all materials and items required, including the necessary expediting, to complete the work as scheduled in accordance with the Contract Documents.

END OF SECTION

Section 01 33 00
Submittal Procedures

Part 1 General

1.1 SECTION INCLUDES

.1 Shop Drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 RELATED REQUIREMENTS

.1 Section 01 78 00 - Closeout Submittals.

.2 Other sections requesting submittals.

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present Shop Drawings, product data, samples and mock-ups in SI metric units.

.4 Where items or information is not manufactured or produced in SI metric units, converted values within the metric measurement tolerances are acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

.7 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.8 Verify field measurements and affected adjacent Work are coordinated.

.9 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.11 Keep one (1) reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data that are to be provided by Contractor to illustrate details of a portion of Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow ten (10) days for Consultant's review of each submission.

.4 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.5 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.6 Accompany submissions with duplicate transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.7 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to other parts of the Work.

.8 After Consultant's review, distribute copies.

.9 Submit electronic copy of Shop Drawings for each requirement requested in specification Sections and as consultant may reasonably request.

.10 Submit electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.

.11 Delete information not applicable to project.

.12 Supplement standard information to provide details applicable to project.

.13 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, shop drawings will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Consultant's business address.

.3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in samples that Consultant may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 MOCK-UPS

.1 Erect mock-ups to Section 01 45 00.

.2 Requirements for mock-ups are noted in each respective specification section.

1.7 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

Section 01 35 13
Site Safety Protocol for Occupied Buildings

Part 1 General

1.1 DESCRIPTION AND SCOPE

.1 This Section outlines the mandatory minimum Health and Safety protocols for all renovation, addition and new school construction Projects where all or a portion of the existing school building remains occupied and in use.

.2 These Health and Safety protocols are mandatory minimum requirements, procedures and standards that the Board insists are fully complied with by all parties involved with Board Projects.

.3 The Contractor must receive approval from Board Project Manager for any deviations from this specification Section.

.4 The General Contractor shall recognize that it is he who is the Constructor of the Project. The General Contractor shall also recognize that he is solely responsible for site safety at the Place of the Work and compliance with the requirements of this Section does not limit or remove his total responsibility for site safety as Constructor of the Project.

1.2 RELATED SECTIONS

.1 These specifications apply to all Divisions of this Project specification. It is the responsibility of the Contractor to apply these provisions wherever practical within specification limits to all products and services used on this Project.

.2 The requirements of this Section supersede those of all other specification Sections and Drawings. Where conflicts exist in procedures, methods or materials, they shall immediately be brought to the attention of the Consultant and Board. Where clarification is not immediately available, the Contractor shall assume the specifications contained in this Section are a minimum standard and the more stringent specification shall apply.

.3 Coordinate with the requirements of section 01 31 19 - Project Meetings.

.4 Coordinate with the requirements of section 01 41 00 - Regulatory Requirements and Construction Safety

1.3 REFERENCES

.1 Applicable related regulations, standards and laws related to safety include but are not limited to:

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.3 Province of Ontario

.1 Occupational Health and Safety Act and Regulations for Construction Projects.

1.4 COMPLIANCE REQUIREMENTS

.1 Notwithstanding the requirements of this Section, the Contractor must comply with all applicable health, safety and environmental regulations and statutes.

1.5 BEYOND COMPLIANCE SPECIFICATION

.1 These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Board's intention to develop a specification which provides the safest practical procedures and policies for construction project sites that are occupied and in use by staff, students and visitors during the execution of the Construction Contract.

.2 Beyond compliance specifications recognize that performance well beyond the minimum regulatory standard is often desirable, possible and affordable, often with no cost or low cost options. It also recognizes that application methods or protocols may be as important as the material specified. Therefore, these specifications cover both material and methods.

.3 These provisions apply to both indoor and outdoor applications equally.

Part 2 Products - Not Used

Part 3 Execution

3.1 APPLICATION OF COMPLIANCE REQUIREMENTS

.1 The articles setout herein are to be applied together as a set of related policies and procedures to achieve a comprehensive Health and Safety working protocol.

.2 The Contractor shall execute all of the procedures and meet all of the requirements set out herein and apply these protocols from the outset of the Construction Phase.

.3 These procedures or requirements are to be maintained for the duration of the Construction Phase. The Contractor shall not discontinue any of the individual procedures or requirements without the prior approval of the Board Project Manager.

3.2 SITE SUPERVISOR (SITE SUPERINTENDENT)

.1 A full-time Site Supervisor (Site Superintendent) is required for each site at any site, regardless of the number of active workers on site.

.2 Site Superintendent shall have as a minimum:

.1 Recent, previous experience with renovation or addition projects involving occupied buildings including (but not limited to) school construction, sites with students, tenants, employees, retail customers, pedestrian and vehicular traffic.

.2 Successful completion of a multi-session Supervisor's training course conducted by a recognized Construction Association in Ontario.

.3 Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.

.4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.

.5 Site Superintendent shall not be changed throughout project unless confirmed and approved by the Board Project Manager.

3.3 ONTARIO OCCUPATIONAL HEALTH & SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS

.1 General Contractor to comply with the Ontario Occupational Health & Safety Act and Regulations for Construction Projects, latest edition– including all amendments.

.2 Beyond compliance in item 3.3.1 above, regardless of the number of labourers active on the Project, the General Contractor shall form a contractors' Health & Safety Committee at the outset of construction. This Committee shall then follow the standard requirements for such a Committee as set out in the Occupational Health & Safety Act and Regulations for Construction Projects.

3.4 ON-SITE COMMUNICATIONS

.1 At the outset of the project the General Contractor shall provide to the Board Project Manager all relevant contact information for the Site Superintendent, General Contractor's Project Manager and key sub-contractors including names and cell phone numbers.

.2 The General Contractor shall provide at least one 'emergency contact' telephone number at which the Contractor's representative can be reached directly during all work hours and have the ability to have voicemail recorded during all non-work hours including weekends and holidays. As outlined below, this may be designated to the Site Superintendent's cell phone number.

.3 Regardless of compliance method for the emergency contact telephone number stated above, the Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.

.4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.

.5 The Contractor is to ensure that the Board Project Manager is immediately apprised of any safety issues as each arises and the related request and/or resolution. The Board Project Manager is responsible for any decisions that have an effect on the contract execution.

.6 Notwithstanding the reporting to the Project Manager noted above the Site Superintendent shall liaise with school principal or designate on all safety related matters as required on a daily basis.

.7 In the event of a safety issue requiring contractual clarification or action (i.e. Change Notice, etc.), the contractor shall ensure that, where applicable, the action is followed up with appropriate documentation.

3.5 FULL-TIME ON-SITE FLAGMEN

.1 A full-time, designated Flagman is required at all vehicular construction entrances.

.2 In the event there is more than one entrance to the hoarded/fenced construction area, there must be a separate Flagman for each entrance.

.3 Flagman may not be same person as Site Superintendent or other construction worker.

.4 Flagman shall not be changed throughout the Project unless confirmed and approved by the Board Project Manager.

.5 Flagman must have means of phone communication with Site Superintendent (phone or walkie-talkie).

.6 The Flagman shall not be designated for any other duties than to act as a Flagman for safety purposes as described herein.

.7 The Flagman shall meet and escort any construction traffic from the site entrance into and out of the hoarded/fenced construction area (including through open site areas until entrances to hoarding.

.8 The Flagman shall only open hoarded areas when construction traffic moves through and immediately re-close gates.

.9 The Flagman shall control construction parking at the school site (including vehicles parking or travelling in unauthorized areas).

.10 The location of the Flagman shall be set to ensure the safe guarding of staff, student, and pedestrian traffic.

.11 If not designated on the Contract Documents, the location of the Flagman shall be confirmed with the Board Project Manager and Consultant at the outset of the project and before the placement of hoarding and fencing.

.12 Where the Contractor deems it necessary, in order for the Flagman to carry out the required full-time duties, the cost of a temporary shelter shall be included in the Tender Price.

.13 The Flagman shall be properly attired to carry out his duties, including the use of safety equipment (e.g. wear reflective vest, have appropriate traffic hand-held “Stop” sign and have a visible identification tag).

3.6 SITE SAFETY SIGNAGE

.1 Standardized Safety Signage is required at all construction entrances. Refer to detail drawings for types and requirements.

.2 If not designated on the Contract Documents, the location of the Safety Signage shall be confirmed with the Board Project Manager and Consultant at the outset of the Project and before the placement of hoarding and fencing.

.3 Safety Signage is to be posted at all street entrances to school site and at each entrance to hoarded/fenced construction area.

.4 Total surface area of signage is to avoid exceeding municipal standards that would require a separate signage permit.

.5 Access signage text shall include cell phone contact number for Site Superintendent.

.6 Signage posted at gates shall state restrictions on hours of entry and egress as described in the Contract Documents and under no circumstances shall construction traffic be allowed within 30 minutes prior to school start, during recess, lunch break, and 30 minutes after dismissal periods.

3.7 ACCESS / EGRESS CONTROLS

.1 At the outset of the Contract, the General Contractor shall advise all suppliers and subcontractors of the protocols listed herein and of the requirement to contact the Site Superintendent by Cell phone prior to entering the site.

.2 The drivers of all construction vehicles entering the site, including delivery vehicle drivers, are to contact site Superintendent by cell phone prior to entering site; the Site Superintendent shall, in turn, give notice to the Flagman to be aware of the traffic and authorize the Flagman to allow entry of that vehicle.

.3 Vehicular Gates are only for entry and exit of for construction purposes such as construction personnel, Authorities performing inspections, Board representative, delivery personnel, and disposal pickup and ONLY under escort by the Flagman. As such vehicular gates must remain closed and locked at all times and only opened for access/egress under escort by the Flagman, then closed and locked again.

.4 Gates are to be lockable swing gates for vehicles and man gates at all access points to the hoarded/fenced construction area.

3.8 CONTRACTOR PARKING

.1 Contractor parking shall be restricted to hoarded areas or designated parking areas only where pre-approved by Board Project Manager and Principal.

.2 Contractor parking is restricted from all off-site street areas that interfere with site specific parent drop-off and parking areas.

3.9 REQUIRED PRE-CONSTRUCTION MEETINGS

.1 Meeting 1: Contractor shall receive approval from the Architect and the Board Project Manager for parking, vehicular movement, access/egress strategies at a Pre-construction meeting taking place in advance of mobilizing on site.

.2 Meeting 2: Once hoarding and fencing is erected BEFORE site construction is fully active and vehicles or equipment is mobilized on site, an initial site meeting shall take place at which time the layout of trailers and staging, deliveries, storage of materials, parking areas and vehicular movement to be reviewed and approved by the Board Project Manager.

.3 See article 3.12- ‘Site Meetings’ following.

3.10 CONSTRUCTION FENCING AND HOARDING

.1 Construction hoarding requirements shall be a site based decision to be determined by the Architect and the Board Project Manager at the design stage and shown on Contract Documents.

.2 No fencing or hoarding shall be less than a continuous 2400 mm high.

.3 In portions of the site where chain link is approved, it shall be continuous 2400 mm high chain link fencing, wire-tied to staked iron ‘tees’ at 1800 mm on centre - OR - leased, modular ‘quick fencing’ if staked down and wire tied together.

.4 All fenced and hoarded areas to be gated with lockable vehicular and man gates- minimum construction to be steel rail and chain link construction.

.5 Plastic snow fencing is NOT permitted.

.6 All hoarding and fencing shall be maintained in a stable condition, for duration of construction period as part of the base contract price and to include Superintendent’s inspection at the beginning and end of each work day.

.7 All Fire Routes to be outside all fenced and hoarded areas and maintained clear at all times.

.8 'Covered way' protection shall be provided when accesses or pathways are in proximity to construction, in accordance with Ministry of Labour Occupational Health & Safety Act Regulations.

3.11 BOARD HEALTH, WELLNESS & SAFETY DEPARTMENT REPRESENTATIVE

.1 A representative of the Board's Health, & Safety Dept. ('Environment, Health and Safety Officer') may visit site at any anytime throughout the duration of the Contract to review the site, as it relates to the safety of the occupied areas of the site. Such site review shall neither constitute an inspection or approval for the Contractor.

.2 Concerns or issues identified by the representative from the Board's Health, Wellness & Safety Dept. shall be communicated through the Board Project Manager and the school Principal for corrective action.

.3 Contractor shall ensure full access to all site areas, at all times, for the Board's Health, Wellness & Safety Department Representative.

3.12 SITE MEETINGS

.1 Initial site meeting to take place after erecting fencing and hoarding but prior to the mobilization of any vehicles, equipment or start of Work.

.2 Contractor shall ensure that the Board Project Manager, School Principal and a representative of the Board's Health, Wellness & Safety Department and the School Principal attend the initial site meeting.

.3 The initial meeting shall review and approve a standardized agenda for all site meetings and a thorough review of the Site Safety Protocol.

.4 The standardized agenda shall include a Checklist and Report of Health and Safety items at the beginning of the agenda. This Checklist shall be included and each item reviewed at all site meetings for the duration of the project.

.5 The Checklist of Site Safety items shall include but not be limited to:

.1 Contractor's report of site safety record and report of recent site activities, precautions or actions.

.2 Review any visits to the site and actions required by Ministry of Labour or Board Health, Wellness & Safety representatives or other Authorities Having Jurisdiction.

.3 Contractor's Health & Safety policy manual posted in site trailer.

.4 Copy of Ministry of Labour Occupational Health & Safety Act and Regulations for Construction Projects in site trailer.

.5 Name of General Contractor H&S representative.

.6 Continuing compliance with Safety Signage.

.7 Hoarding & fencing layout and condition.

.8 Access and egress measures and any breaches of requirements.

.9 Confirmation of communications link between Site Superintendent & Flagman.

.10 Work that may produce any noxious odours and the containment measures, (i.e.: schedule, type, approvals required therefore).

.11 Copies of Material Safety Data sheets in site trailer.

.12 Complete meeting minutes including details of Safety Checklist shall be copied to Architect, Board Project Manager and Principal.

.6 Contractor to produce record of written Memorandum to all subtrades and suppliers detailing but not limited to: hours of delivery; site access procedures and restrictions; use of existing facilities.

.7 Contractor to prepare detailed and accurate written record of all meetings to be kept and issued to all parties.

3.13 CONTRACTOR'S HEALTH AND SAFETY COMMITTEE MEETINGS

.1 As required in item 3.1.2, the Contractor shall form a Health and Safety Committee, hold meetings and record minutes of meetings for the duration of the Contract.

.2 Contractor to maintain a copy of Health & Safety Committee minutes on site for review by Ministry of Labour or Board representative(s).

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

.1 Regulatory Documents.
.2 Construction Safety.
.3 Fire Safety.
.4 Safety Data Sheets.
.5 Bylaws, Permits and Approvals.

1.02 RELATED SECTIONS

.1 Section 01 52 00–Construction Facilities.
.2 Section 01 53 00–Temporary Construction
.3 Section 01 60 00–Common Product Requirements.
.4 Appendix F – Toronto District School Board Fire Watch Guidelines
.5 Appendix G – Toronto District School Board Hot Work Precaution Checklist

1.03 REGULATORY DOCUMENTS

.1 The Contractor and all Subcontractors, Suppliers, and installers shall conform to all applicable building and fire Codes and Municipal Building By-Laws. All shall conform to the requirements of the Authorities Having Jurisdiction, such as Public Utilities. Where required under the Occupational Health and Safety Act, engage a Professional Engineer to design formwork and falsework for concrete.
.2 Give all notices, conduct all tests and required inspections, obtain all permits, and pay all resulting charges.
.3 Construction Management Plan: the Contractor shall prepare and submit a Construction Management Plan in conformance with municipal requirements.
.4 Waste Auditing and Reduction:
  .1 Demolition and construction waste shall be audited and source-separated as required under the Environmental Protection Act. Materials that shall be source-separated include corrugated cardboard, brick, concrete, steel, wood, and gypsum board.
  .2 Comply with O.Reg. 102/94, Waste Audits and Waste Reduction Workplans and O.Reg. 103/94, Industrial, Commercial and Institutional Source Separation Programs.
.5 Contract forms, codes, standards and manuals referred to in these Specifications are the latest published editions at the date of closing of Bids. The Contractor and all of his Subcontractors, suppliers, and installers shall meet or exceed the requirements of specified standards.
.6 Provide, on site, copies of documents referred to in the Specifications for joint use of Contractor and Consultant.

1.04 CONSTRUCTION SAFETY

.1 The Contractor shall provide a site specific safety plan to the Owner and Consultant within 7 days after date of Notice to Proceed and prior to mobilization to site that includes project details, site conditions and hazard assessments, key personnel and their responsibilities, specific safety rules and procedures, personal protective equipment (PPE) requirements, emergency procedures, communication protocols, and plans for regular inspections and incident reporting.

.2 Include all provisions for construction safety such as fences, barricades, bracing supports, storage facilities, fire protection, ventilation, construction ramps, platforms, runways, ladders, scaffolds, guardrails, all as required by the Construction Safety Act and other jurisdictional authorities.
.3 The Contractor and all trades shall observe and enforce construction safety measures required by the Canadian Construction Safety Code, Workplace Safety and Insurance Board and Municipal

statutes. In particular, the Ontario Construction Safety Act, the regulations of the Ontario Department of Labour and Ontario Hydro Safety Requirements shall be strictly enforced. In the event of a conflict between any provisions of the above authorities the most stringent provisions will apply.

.4 The Contractor is reminded that it is he who is responsible for Occupational Health and Safety on this Project. The items listed below are only guidelines of the Owner=s expectations in this regard and are not to be construed to be comprehensive or total in nature.

.1 The Owner, in concert with the contractors, will endeavour to make every effort to ensure that the contractors provide a work site which is a safe and healthy work environment. The Owner insists that all contractors and their workers are dedicated to the continuing objective of reducing risk and injury.

.2 The Contractor covenants and agrees to comply with all statutory and other obligations, including, without limitation, the provisions of the Occupational Health and Safety Act (Ontario) and all Regulations thereto, and all amending and successor legislation, including without limitation, Bill 208 (the AAct@), in connection with all work performed by either the Contractor, Subcontractors, or any other contractor on, or in connection with, the Project.

.3 Without limiting the foregoing, for the purposes of this Contract, the Contractor agrees that he shall be the Constructor@ of the Project within the meaning of the Act, and as such, shall assume all the obligations and responsibilities, and observe all construction safety requirements and procedures, and duties of inspection imposed by the Act on the Constructor@ as therein defined, for all work and services performed by the Contractor, Subcontractors and other contractors on or in connection with the Project.

.4 The Contractor further covenants and agrees that the Owner and its existing and former officers, trustees, employees and agents, and their respective heirs, executors, administrators, successors and assigns shall be released from any obligations or liabilities otherwise imposed on the Owner, or on any of them, pursuant to the Act in connection with the Project, and that the Contractor shall assume all liability and responsibility in connection with same.

.5 The Contractor agrees to save harmless and indemnify the Owner from any losses, damages, costs and expenses of any kind, or nature whatsoever, including all legal expenses, and all defence costs and related expert or consulting fees, incurred by the Owner, or any of them, arising in connection with the failure, default, or inability of the Contractor or the Owner, or any of them, to comply with any of the aforementioned statutory, or other legal requirements, or arising in connection with any breach by the Contractor of any of its covenants, agreements and obligations under this Contract.

.6 The Contractor shall inform and instruct other contractors that they, while performing work on this project, are under the authority of the Contractor. Other contractors are to discuss and co-ordinate with, and follow instructions from, the Contractor on all matters of site access, vehicles, deliveries, storage, temporary facilities, coordination with the work of other Subcontractors, work methods, scheduling, labour conditions, construction safety, environmental protection, security and all other matters which relate to the safe and proper execution of construction work.

.7 The Contractor shall ensure that all supervisory personnel on the job site are fully aware of the procedures and requirements outlined above and comply with all requirements specified.

.8 All contractors are responsible to ensure that all machinery and equipment is safe and that the workers perform their tasks in compliance with established safe work practices or procedures. Workers must receive adequate training in their specific work tasks to protect their health and safety.

.9 The Contractor shall be responsible for all persons and companies performing work, including other contractors, on this project, at all times, up to and including, the date of Substantial Performance of the Work. Authority for coordination and instruction relating to all matters which relate to the safe and proper execution of construction work shall rest with the Contractor. The Contract Price must include the Contractor's fees for the coordination and supervision of the work of all Other Contractors.

.10 In addition to the responsibility of all contractors as outlined above, Subcontractors will be held accountable for the health and safety of workers under their supervision.

.11 Workers shall protect their own health and safety by working in compliance with the law and with safe work practices and procedures established by the Authorities Having Jurisdiction.

.12 All sections of the Occupational Health and Safety Act for Industrial Establishments, latest edition, and the Occupational Health and Safety Act for Construction Projects, latest edition, shall be enforced, by the Contractor, in their entirety, throughout the duration of the construction project.

.13 The Contractor shall provide the Consultant with the telephone number where the Contractor or his representative can be reached at any time, day or night, for the duration of the Contract.

.14 Where an accident, explosion, or fire causes a personal injury at the work place, and the worker is disabled from performing the usual task, the Contractor shall prepare a written notice and shall forward same to the Ministry of Labour within four days of the occurrence with a copy to the Owner's Representative.

.15 Where a person is killed or critically injured from any cause at the work place, the Contractor shall immediately call the Ministry of Labour. A written notice from the Contractor shall be given to the Ministry of Labour within 48 hours after the occurrence, containing such information and particulars as may be prescribed, with copies to the Consultant and the Owner's Representative.

.16 The Contractor is advised that the accident scene is under the jurisdiction of the Ministry of Labour and no wreckage, articles, etc., shall be interfered with, disturbed, destroyed, altered or carried away at the scene, or connected with the occurrence, until the Ministry of Labour has given permission.

.5 The Contractor shall notify the Ontario Ministry of Labour of the intended work of this Contract and shall provide one copy of the Notice of Project to the Consultant.

1.05 FIRE SAFETY

.1 The appropriate clauses of the Ontario Building Code relating to fire protection shall be strictly followed.

.2 The Contractor shall provide and maintain free access to temporary or permanent fire hydrants acceptable to the local fire department.

.3 Materials and components required to construct fire rated assemblies and materials requiring fire hazard classification shall be listed and labeled.

.4 Fire rated assemblies shall be constructed in accordance with applicable fire test report information issued by the fire rating authority. Deviation from fire test report will not be allowed.

.5 Construct fire rated assemblies as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from the top of the floor assembly to underside of the deck above.

1.06 SAFETY DATA SHEETS

.1 The Contractor shall ensure that Material Safety Data Sheets (MSDS) are submitted prior to

delivery and commencing installation and application of at least the following:

.1 Lead-free solder.
.2 Resilient flooring.
.3 Fertilizers.
.4 Pesticides.
.5 Sealants and caulking.
.6 Painting and finishing.
.7 Glues and adhesives.
.8 Herbicides.
.9 Any other Product which may give off air borne particles or vapour after installation.

.2 The Contractor and all Subcontractors must note that specifically, Asbestos and Asbestos containing materials, solder for piping containing lead, and Painting and Coatings containing lead or mercury must be excluded from any part of the Work.

.3 The Contractor shall submit Certificates of Compliance, prior to the application for Substantial Performance, for each of the following items.

.1 An affidavit relative to the use of lead-free solder for all domestic water lines, regardless of location.
.2 Products for which Material Safety Data Sheets have been submitted and accepted.
.3 Other work or Products identified in the Contract Documents as requiring a Certificate of Compliance.

.4 Each Certificate of Compliance must indicate names and addresses of the Project, the Owner, the date of issue, Product description including name, number and manufacturer, with a statement verifying that the work or Product installed meets specified requirements and, if applicable, complies with the submitted and accepted Material Safety Data Sheets.

.5 Each Certificate of Compliance must be issued on the trades letterhead, properly executed, under whose work the respective work or Product has been provided. Each Certificate of Compliance must be endorsed by the Contractor with his authorized stamp and signature.

.6 The Contractor must ensure that submissions are made to allow sufficient time for review without delaying progress of scheduled completion and that WHMIS sheets are kept on site at all times.

.7 Ensure that Material Safety Data Sheets are up-to-date. (Note that MSDS are valid for three years from date of production).

.8 Ensure that work site copies of Material Safety Data sheets are available to workers wishing to consult them and to the health and safety representative and joint health and safety committee.

.9 Ensure that workers are instructed in the purpose and content of Material Safety Data Sheets.

1.07 BYLAWS, PERMITS AND APPROVALS

.1 Nothing indicated on the Drawings or Specifications is intended to be in conflict with any law, by-law or regulation of Municipal, Provincial, or similar Authority Having Jurisdiction.

.2 Work of this Contract shall conform to such laws, by-laws, and regulations. Any required variation to, or deviation from, the Drawings and Specifications, shall be performed in accordance with the General Conditions.

.3 The Site Plan Approval and the general Building Permit have been applied for by the Consultant and paid for by the Owner.

.4 It is the final responsibility of the Contractor to apply, pay for, and obtain all other required approvals and permits from Authorities Having Jurisdiction, and where required pay inspection fees. Include in the Contract Price the cost of such approvals, permits and fees. Refer also to Section 01 11 00–Summary of Work.

.5 Each subtrade shall obtain and pay for all permits, licenses, and inspection fees particular to their

trade and required by Municipal, Provincial, or other Authorities Having Jurisdiction.

.6 Testing and Inspections:
- .1 Arrange for inspection of all work by Authorities Having Jurisdiction. Submit final unconditional certificate of approval by inspecting authorities.
- .2 Provide Consultant and Owner's Representative with 24 hours' notice of date when tests will occur.
- .3 Do not conceal work until tested and approved.
- .4 Re-testing and re-inspections of work found deficient, and the costs of Making Good, shall be paid for by the Contractor.

.7 Drawings Required by Authorities: Supply copies of detail drawings for various building components if requested by the Municipal Building Departments, Provincial Agencies, and the Local Fire Department.

.8 Furnish inspection certificates and permits as may be applicable as evidence that installed work conforms to laws, by-laws and regulations of Authorities Having Jurisdiction.

.9 Any revisions or deviations required by any Authorities Having Jurisdiction must be reviewed by the Consultant before implementation.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 APPLICATION OF COMPLIANCE REQUIREMENTS

.1 The articles setout herein are to be applied together as a set of related policies and procedures to achieve a comprehensive Health and Safety working protocol.

.2 The Contractor shall execute all of the procedures and meet all of the requirements set out herein and apply these protocols from the outset of the Construction Phase.

.3 These procedures or requirements are to be maintained for the duration of the Construction Phase. The Contractor shall not discontinue any of the individual procedures or requirements without the prior approval of the Board Project Manager.

3.2 SITE SUPERVISOR (SITE SUPERINTENDENT)

.1 A full-time Site Supervisor (Site Superintendent) is required for each site at any site, regardless of the number of active workers on site.

.2 Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.

.3 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.

.4 Site Superintendent shall not be changed throughout project unless confirmed and approved by the Board Project Manager.

3.3 ONTARIO OCCUPATIONAL HEALTH & SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS

.1 General Contractor to comply with the Ontario Occupational Health & Safety Act and Regulations for Construction Projects, latest edition– including all amendments.

.2 Beyond compliance in item .1 above, regardless of the number of labourers active on the Project, the General Contractor shall form a contractors' Health & Safety Committee at the

outset of construction. This Committee shall then follow the standard requirements for such a Committee as set out in the *Occupational Health & Safety Act and Regulations for Construction Projects.*

3.4 ON-SITE COMMUNICATIONS

.1 At the outset of the project the General Contractor shall provide to the Board Project Manager all relevant contact information for the Site Superintendent, GC Project Manager and key sub-contractors including names and cell phone numbers.

.2 The General Contractor shall provide at least one "emergency contact" telephone number at which the Contractor's representative can be reached directly during all work hours and have the ability to have voicemail recorded during all non-work hours including weekends and holidays. As outlined below, this may be designated to the Site Superintendent's cell phone number.

.3 Regardless of compliance method for the emergency contact telephone number stated above, the Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.

.4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.

.5 The Contractor is to ensure that the Board Project Manager is immediately apprised of any safety issues as each arises and the related request and/or resolution. The Board Project Manager is responsible for any decisions that have an effect on the contract execution.

.6 Notwithstanding the reporting to the Project Manager noted above the Site Superintendent shall liaise with school principal or designate on all safety related matters as required on a daily basis.

.7 In the event of a safety issue requiring contractual clarification or action (i.e. Change Notice, etc.), the contractor shall ensure that, where applicable, the action is followed up with appropriate documentation.

3.5 FULL-TIME ON-SITE FLAGMEN

.1 A full-time, designated Flagman is required at all vehicular construction entrances.

.2 In the event there is more than one entrance to the hoarded/fenced construction area, there must be a separate Flagman for each entrance.

.3 Flagman may not be same person as Site Superintendent or other construction worker.

.4 Flagman shall not be changed throughout the Project unless confirmed and approved by the Board Project Manager.

.5 Flagman must have means of phone communication with Site Superintendent (phone or walkie-talkie).

.6 The Flagman shall not be designated for any other duties than to act as a Flagman for safety purposes as described herein.

.7 The Flagman shall meet and escort any construction traffic from the site **entrance** into and out of the hoarded/fenced construction area (including through open site areas until entrances to hoarding.

.8 The Flagman shall only open hoarded areas when construction traffic moves through and immediately re-close gates.

.9 The Flagman shall control construction parking at the school site (including vehicles parking or traveling in unauthorized areas).

.10 The location of the Flagman shall be set to ensure the safeguarding of staff, student, and pedestrian traffic.

.11 If not designated on the Contract Documents, the location of the Flagman shall be confirmed with

the Board Project Manager and Consultant at the outset of the project and before the placement of hoarding and fencing.

.12 Where the Contractor deems it necessary, in order for the Flagman to carry out the required full-time duties, the cost of a temporary shelter shall be included in the Tender Price.

.13 The Flagman shall be properly attired to carry out his duties, including the use of safety equipment (e.g. wear reflective vest, have appropriate traffic hand-held "Stop" sign and have a visible identification tag).

3.6 SITE SAFETY SIGNAGE

.1 Standardised Safety Signage is required at all construction entrances.

.2 Safety Signage is to be posted at all street entrances to school site and at each entrance to hoarded/fenced construction area.

.3 Total surface area of signage is to avoid exceeding municipal standards that would require a separate signage permit.

.4 Access signage text shall include cell phone contact number for Site Superintendent.

.5 Signage posted at gates shall state restrictions on hours of entry and egress as described in the Contract Documents and under no circumstances shall construction traffic be allowed within 30 minutes prior to school start, during recess, lunch break, and 30 minutes after dismissal periods.

3.7 ACCESS/EGRESS CONTROLS

.1 At the outset of the Contract, the General Contractor shall advise all suppliers and subcontractors of the protocols listed herein and of the requirement to contact the Site Superintendent by Cell phone prior to entering the site.

/2 The drivers of all construction vehicles entering the site, including delivery vehicle drivers, are to contact site Superintendent by cell phone prior to entering site; the Site Superintendent shall, in turn, give notice to the Flagman to be aware of the traffic and authorize the Flagman to allow entry of that vehicle.

.3 Vehicular Gates are only for entry and exit of for construction purposes such as construction personnel, Authorities performing inspections, Board representative, delivery personnel, and disposal pickup and ONLY under escort by the Flagman. As such vehicular gates must remain closed and locked at all times and only opened for access/egress under escort by the Flagman, then closed and locked again.

.4 Gates are to be lockable swing gates for vehicles and man gates at all access points to the hoarded/fenced construction area.

3.8 CONTRACTOR PARKING

.1 Contractor parking shall be restricted to hoarded areas or designated parking areas only where pre-approved by Board Project Manager and Principal.

.2 Contractor parking is restricted from all off-site street areas that interfere with site specific parent drop-off and parking areas.

3.9 REQUIRED PRECONSTRUCTION MEETINGS

.1 Meeting 1: Contractor shall receive approval from the Architect and the Board Project Manager for parking, vehicular movement, access/egress strategies at a Pre- construction meeting taking place in advance of mobilising on site.

.2 Meeting 2: Once hoarding and fencing is erected BEFORE site construction is fully active and vehicles or equipment is mobilised on site, an initial site meeting shall take place at which time the layout of trailers and staging, deliveries, storage of materials, parking areas and vehicular movement to be reviewed and approved by the Board Project Manager.

3.10 CONSTRUCTION FENCING AND HOARDING

.1 Construction hoarding requirements shall be defined within the required site-specific safety plan, where the Contractor will define within a hoarding plan for Board project representative and school principal review and approval.

.2 No fencing or hoarding shall be less than a continuous 2400 mm high.

.3 In portions of the site where chain link is approved, it shall be continuous 2400 mm high chain link fencing, wire-tied to staked iron 'tees' at 1800 mm on centre - OR - leased, modular 'quick fencing' if staked down and wire tied together.

.4 All fenced and hoarded areas to be gated with lockable vehicular and man gates- minimum construction to be steel rail and chain link construction.

.5 Plastic snow fencing is NOT permitted.

.6 All hoarding and fencing shall be maintained in a stable condition, for duration of construction period as part of the base contract price and to include Superintendent's inspection at the beginning and end of each work day.

.7 All Fire Routes to be outside all fenced and hoarded areas and maintained clear at all times.

.8 'Covered way' protection shall be provided when accesses or pathways are in proximity to construction, in accordance with Ministry of Labour *Occupational Health & Safety Act* Regulations

END OF SECTION

Section 01 43 00
Quality Control

Part 1 General

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Written and electronic reports.

.6 Equipment and system adjust and balance.

1.2 RELATED REQUIREMENTS

.1 Section 01 21 00 - Allowances.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCE STANDARDS

.1 ISO/IEC 17025-2017 - General Requirements for the Competence of Testing and Calibration Laboratories.

.2 SCC (Standards Council of Canada).

1.4 INSPECTION BY AUTHORITY

.1 Allow Authorities Having Jurisdiction access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

1.5 REVIEW BY CONSULTANT

.1 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.

.2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

.3 If such Work is found in accordance with Contract Documents, Owner will pay cost of review and replacement.

1.6 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection and Testing Agencies will be engaged by Owner for purpose of inspecting and testing portions of Work. Cost of such services will be borne by Owner.

.2 A schedule of required tests and inspections will be provided by the Prime Consultant, three competitive bids are required for each item.

.3 Testing Organizations: Listed by SCC within info.palcan@scc.ca listings.

.4 Allocate Costs: To Section 01 21 00.

.5 Provide equipment required for executing inspection and testing by appointed agencies.

.6 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.7 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

1.7 ACCESS TO WORK

.1 Allow inspection and testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Cooperate to provide reasonable access and facilities for such access.

1.8 PROCEDURES

.1 Notify appropriate agency and Consultant in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.9 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Consultant.

1.10 REPORTS

.1 Submit one (1) electronic copy of signed inspection and test reports to Consultant.

.2 Provide signed paper copies to Subcontractor of work being inspected or tested.

1.11 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.12 MOCK-UPS

.1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations as specified in specific Section.

.3 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

1.13 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.14 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

.2 Refer to Mechanical and Electrical specifications for definitive requirements.

END OF SECTION

Section 01 51 00
Temporary Utilities

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

.2 Salvaging products for reuse.

1.2 RELATED REQUIREMENTS

.1 Section 01 52 00 - Construction Facilities.

.2 Section 01 53 00 - Temporary Construction.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Salvage and assist in recycling products for potential reuse.

.3 Remove from site all such work after use.

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.4 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

.2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.

.3 Pay for utility charges at prevailing rates.

1.6 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building, may not be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, complete the following:

.1 Replace Filters.

.2 Refer to Mechanical specifications for additional requirements.

.8 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.

.9 Owner will pay utility charges when temporary heat source is existing building equipment.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER AND LIGHT

.1 Owner will provide a source for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 120 volt, 30 amp. Provide a temporary meter and reimburse Owner for costs of temporary power used.

.2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

.3 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power in excess of above noted requirements.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination is not less than 162 lx.

.5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three (3) months.

1.8 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary wireless or wired communications and equipment necessary for own use and use of Consultant.

END OF SECTION

Section 01 52 00
Construction Facilities

Part 1 General

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 RELATED REQUIREMENTS

.1 Section 01 51 00 - Temporary Utilities.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, and ramps as may be required for access to Work.

.2 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

.3 Maintain access to property including overhead clearances for use by emergency response vehicles.

.4 Protect surrounding private and public property from damage during performance of Work. Contractor shall be responsible for damage incurred.

1.5 CONSTRUCTION PARKING

.1 Parking will be permitted on site

1.6 SCAFFOLDING

.1 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs as required to complete the Work.

1.7 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists and Cranes shall be operated by qualified operator.

1.8 ELEVATORS/LIFTS

.1 Existing elevators and lifts shall not be used for construction operations.

1.9 USE OF THE WORK

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with Products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.10 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.11 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.13 SANITARY FACILITIES

.1 Existing and new sanitary facilities shall not be used by construction workforce.

.2 Provide sanitary facilities for workforce in accordance with governing regulations and ordinances.

.3 Post notices and take such precautions as required by local health authorities.

.4 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

END OF SECTION

Section 01 53 00
Temporary Construction

Part 1 General

1.1 SECTION INCLUDES

.1 Site enclosure.

.2 Guardrails and barriers.

.3 Weather enclosures.

.4 Dust tight barriers.

.5 Protection for off-site and public property.

.6 Protection of applied finishes.

.7 Protection of surrounding Work.

1.2 RELATED REQUIREMENTS

.1 Section 01 51 00 - Temporary Utilities.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 SITE ENCLOSURE

.1 Erect temporary site enclosures using 1.83m (6'-0") high modular metal mesh fencing with fabric dust screen. Fence struts shall be spiked/bolted into the ground to prevent overturning.

.2 Apply panels vertically flush and butt jointed.

.3 Provide one (1) lockable truck entrance gate/gates and at least one (1) pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys with restricted availability, in the project office.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.5 Provide engineered overhead hoarding wherever work will take place above a space occupied by the public as well as where temporary exits are noted on the drawings. Hoarding shop drawings shall be stamped by an engineer licensed in jurisdiction where the Work is taking place.

.6 Paint public side of site enclosure in selected colours with one coat of exterior alkyd primer and one coat of exterior alkyd paint. Maintain public side of enclosure in clean condition. Paint particleboard panels, on project side with one coat of exterior alkyd primer.

.7 Provide tree protection barriers around trees scheduled to remain in conformance with local by-laws. Provide barriers around other landscape designated to remain.

.8 Protect from damage by equipment and construction procedures.

1.5 GUARDRAILS AND BARRIERS

.1 Provide secure, rigid guardrails and barricades around deep excavations, open shafts, open stairwells, open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.6 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.7 INTERIOR HOARDING AND DUST TIGHT BARRIERS

.1 Provide engineered overhead hoarding wherever work will take place above a space occupied by the public as well as where temporary exits are noted on the drawings. Hoarding shop drawings shall be stamped by an engineer licensed in jurisdiction where the Work is taking place.

.2 Provide insulated hoarding to localize dust generating activities, and for protection of workers, finished areas of Work and the public. Interior hoarding shall be constructed using 2x4 lumber framing with 13mm gypsum board finish to underside of existing ceiling finish to remain.

.3 Provide dust tight barriers and screens to localize dust generating activities, and for protection of workers, finished areas of Work and the public.

.4 Maintain and relocate protection until such work is complete.

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Provide dust mitigation in the form of watering.

.2 Protect surrounding private and public property from damage during performance of Work.

.3 Be responsible for damage incurred.

1.9 PROTECTION OF APPLIED FINISHES

.1 Provide protection for finished and partially finished surfaces and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant locations and installation schedule three (3) days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.10 PROTECTION OF SURROUNDING WORK

.1 Provide protection for finished and partially finished Work from damage.

.2 Provide necessary cover and protection.

.3 Be responsible for damage incurred due to lack of or improper or inappropriate protection.

END OF SECTION

Section 01 61 00
Common Product Requirements

Part 1 General

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Product substitution procedures.

.3 Manufacturer's instructions.

.4 Quality of Work, coordination and fastenings.

.5 Existing facilities.

1.2 RELATED REQUIREMENTS

.1 Section 01 23 00 - Alternatives

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TERMINOLOGY

.1 New: Produced from new materials.

.2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.3 Defective: A condition determined exclusively by the Consultant.

1.4 PRODUCT QUALITY

.1 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.

.2 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Prime Consultant.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.

.2 If delays in supply of Products are foreseeable, notify Prime Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.3 In event of failure to notify Prime Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE AND PROTECTION

.1 Store and protect Products in accordance with manufacturers' written instructions.

.2 Store with seals and labels intact and legible.

.3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

.4 For exterior storage of fabricated Products, place on sloped supports above ground.

.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

.6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

.7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

.8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.7 TRANSPORTATION AND HANDLING

.1 Transport and handle Products in accordance with manufacturer's written instructions.

.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.8 PRODUCT CHANGES

.1 Change in Product/Products: Submit request for alternatives in accordance with Section 01 23 00.

1.9 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to building occupants, pedestrians, and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.10 MANUFACTURER'S WRITTEN INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Prime Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Prime Consultant may establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Prime Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.11 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Prime Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in his or her required duties. Prime Consultant reserves right to require dismissal from site any workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Prime Consultant, whose decision is final.

1.12 COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.13 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is interference. Install as directed by Prime Consultant.

1.14 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.15 LOCATION OF FIXTURES

.1 Unless specifically dimensionned on drawings, consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation or for clarification of installation locations. Install as directed.

1.16 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 All fastenings shall be concealed unless specifically noted otherwise.

.6 Where exposed fasteners are specified, they shall be countersunk and colour matched unless noted otherwise.

.7 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.17 FASTENINGS - EQUIPMENT AND INFRASTRUCTURE

.1 The following clauses shall apply to mechanical and electrical equipment, duct work, conduit, piping and other infrastructure only. Where these items are exposed, outside of service and concealed spaces, they shall be painted as noted on the drawings.

.2 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.3 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.

.4 Bolts may not project more than one diameter beyond nuts.

.5 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.18 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of the Project.

.2 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Prime Consultant.

END OF SECTION

Section 01 71 00
Examination and Preparation

Part 1 General

1.1 SECTION INCLUDES

.1 Field engineering survey services to measure and stake site.

.2 Recording of subsurface conditions found.

.3 Survey services to determine measurement inverts for the Work.

.4 Requirements and limitations for cutting and patching the Work.

1.2 RELATED REQUIREMENTS

.1 Section 01 23 00 - Alternatives.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCE STANDARDS

.1 Owner's identification of existing survey control points and property limits.

1.4 SUBMITTALS

.1 Submit name and address of Surveyor to Prime Consultant.

.2 On request of Prime Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.5 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in the Place of the Work, acceptable to Owner.

1.6 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on Drawings.

.2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Prime Consultant.

.4 Report to Prime Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.7 SURVEY REQUIREMENTS

.1 Establish two (2) permanent benchmarks on site, referenced to established benchmarks by survey control points.

.2 Record locations, with horizontal and vertical data in Project Record Documents.

.3 Establish lines and levels, locate and layout, by instrumentation.

.4 Stake for grading.

.5 Stake slopes and berms.

.6 Establish pipe invert elevations.

.7 Stake batter boards for foundations.

.8 Establish foundation column locations and floor elevations.

.9 Establish lines and levels for mechanical and electrical work.

1.8 SUBSURFACE CONDITIONS

.1 Promptly notify Prime Consultant in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.

.2 Advise the Prime Consultant of a reasonable assumption of probable conditions when determined.

1.9 EXAMINATION

.1 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of the Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

1.10 PREPARATION

.1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.2 Provide protection from elements for areas that may be exposed by uncovering work; maintain excavations free of water.

1.11 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Prime Consultant of findings.

.2 Remove abandoned service lines within 2m of structures. Cap or seal lines at cut-off points as directed by Consultant.

1.12 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.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 Consultant of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Prime Consultant.

1.13 SURVEY RECORD

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

END OF SECTION

Section 01 73 00
Execution

Part 1 General

1.1 SECTION INCLUDES

.1 Submittal requirements associated with connecting to new and existing facilities.

.2 Execution requirements for all Work.

1.2 RELATED REQUIREMENTS

.1 Section 01 71 00 - Examination and Preparation.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBMITTALS - ATTACHING TO EXISTING WORK

.1 Submit written request in advance of cutting or alteration that affects:

.1 Structural integrity of any element of Project.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 Work of Owner or separate contractor.

.2 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed Work, and products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on Work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.4 TOLERANCES

.1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

.2 Do not permit tolerances to accumulate beyond effective or practical limits.

.3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Consultant before proceeding.

.4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.5 EXECUTION

.1 Execute cutting, fitting, and patching to complete the Work.

.2 Perform all required excavation and fill to complete the Work.

.3 Fit several parts together, to integrate with other Work.

.4 Uncover Work to install ill-timed Work.

.5 Remove and replace defective or non-conforming Work.

.6 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.

.7 Provide openings in non-structural elements of Work for penetrations of associated Work. Limit opening dimensions to minimal sizes required, and performed in a neat and clean fashion.

.8 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.9 Employ qualified workers to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.10 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry or concrete work without prior approval.

.11 Restore work with new products in accordance with requirements of Contract Documents.

.12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, for full thickness of the constructed element.

.14 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.

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

END OF SECTION

Section 01 74 10
Cleaning

Part 1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Cleaning prior to acceptance.

1.2 RELATED REQUIREMENTS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

Part 2 Products

2.1 CLEANING MATERIALS

.1 Cleaning Agents and Materials: Low VOC content.

Part 3 Execution

3.1 PROGRESSIVE CLEANING

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Owner. Do not burn waste materials on site, unless approved by Prime Consultant.

.3 Clear snow and ice from area of construction, bank or pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Containers:

.1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.

.2 Provide and use clearly marked, separate bins for recycling.

.3 Refer to Section 01 74 19.

.6 Remove waste material and debris from site and deposit in waste container at end of each working day.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.

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

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

3.2 CLEANING PRIOR TO ACCEPTANCE

.1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris including that caused by Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Prime Consultant.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Clean and polish surface finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to a sanitary condition; replace filters of mechanical equipment.

.18 Clean roof surfaces, down-spouts, and drainage components.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to facilities.

3.3 FINAL PRODUCT CLEANING

.1 Execute final cleaning prior to final project assessment. Refer to Section 01 74 10.

.2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

.3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

.4 Replace filters of operating equipment.

.5 Clean site; sweep paved areas, rake clean landscaped surfaces.

.6 Remove waste and surplus materials, rubbish, and construction facilities from the site.

END OF SECTION

Section 01 78 00
Closeout Submittals

Part 1 General

1.1 SECTION INCLUDES

.1 Inspections and declarations.

.2 Closeout submittals.

.3 Operation and maintenance manual format.

.4 Contents each volume.

.5 Recording actual site conditions.

.6 Record (as-built) documents and samples.

.7 Record documents.

.8 Final survey.

.9 Warranties and bonds.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 79 00 - Demonstration and Training.

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSPECTIONS AND DECLARATIONS

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Consultant's Inspection.

.2 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.

.3 Completion: Submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted, balanced, and are fully operational.

.4 Certificates required by authorities having jurisdiction have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by Consultant, and Owner. If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: When Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.

.6 Commencement of Warranty Periods: The date of Substantial Performance of the Work shall be the date for commencement of the warranty period.

.7 Commencement of Lien Periods: The date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

.8 Final Payment: When Consultant considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

.9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection with Consultant's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Two weeks prior to Substantial Performance of the Work, submit to the Consultant a final electronic copy of operating and maintenance manuals. Provide a hard copy of operating and maintenance manuals to the Owner.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

1.5 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Digital File: PDF format with sections bookmarked.

.3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch with spine and face pockets.

.4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.5 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.6 Arrange content by systems under Section numbers and sequence of Table of Contents.

.7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.8 Text: Manufacturer's printed data, or typewritten data.

.9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.10 Drawings: provide 1:1 scaled CAD files in .dwg format, latest release.

.11 Model: provide Building Information Model in .rvt fromat. Refer to project BIM Execution Plan for specific requirements.

1.6 CONTENTS - EACH VOLUME

.1 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.4 Schedule of products and systems, indexed to content of volume.

.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

.4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including life safety systems performance certificate.

.6 Training: Refer to Section 01 79 00.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Consultant.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.

.3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.

.4 Contract drawings and Shop Drawings: legibly mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain manufacturer's certifications, inspection certifications, and field test records required by individual specifications sections.

1.8 AS-BUILT DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Consultant, one (1) record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS in neat, large, printed letters.

.4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.

.5 Keep as-built documents and samples available for inspection by Consultant.

1.9 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

.2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.10 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of the responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

Section 06 10 53
Miscellaneous Rough Carpentry

Part 1 General

1.1 SECTION INCLUDES

.1 Miscellaneous rough carpentry, including:

.1 Rooftop equipment curbs and bases.

.2 Minor rough framing.

.3 Wood blocking.

.4 Wood furring.

.2 Fasteners.

.3 Preservative treatment.

1.2 RELATED REQUIREMENTS

.1 Refer to structural specifications

.2 Section 04 20 00 - Unit Masonry.

.3 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim.

.5 Section 10 10 00 - Miscellaneous Specialties: Plywood blocking in stud partitions.

1.3 REFERENCE STANDARDS

.1 ANSI A135.4 - Basic Hardboard.

.2 ASTM A123/A123M-17 Standard specification for zinc (hot-dip galvanized) coatings on iron and steel products

.3 ASTM A153/A153M-23 Standard specification for zinc coating (hot-dip) on iron and steel hardware

.4 ASTM A653/A653M-23 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.5 Canadian plywood handbook

.6 CSA O80 SERIES:21 Wood preservation

.7 CAN/ULC-S706.1 - Standard for Wood Fibre Insulating Boards for Buildings.

.8 STD O121-17 Douglas fir plywood

.9 STD O151-17 Canadian softwood plywood

.10 CSA O153:19 Poplar plywood

.11 STD O437 SERIES-93 Standards on OSB and waferboard. (Withdrawn)

.12 NLGA Standard grading rules for Canadian lumber, 2022 edition

.13 ANSI A208.1-2022 Particleboard

.14 Standard A208.2-2022 Medium density fiberboard (MDF) for interior applications

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide technical data on wood preservative materials.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.7 QUALITY ASSURANCE

.1 Perform Work in accordance with the following agencies:

.1 Lumber Grading Agency: Certified by NLGA Grading Rules.

.2 Plywood Grading Agency: Certified by CANPLY.

.3 Wood Based Panel Products: Marked with a recognized, visible grade stamp showing Grade or span rating as required.

.2 Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Store plywood panels flat and level.

.2 Keep finish faces inward and cover stacks to protect from bumping and abrasion.

.3 Protect tongue and groove plywood panel edges and corners.

.4 Protect panels from sunlight, water or excessive humidity.

.5 Store materials off the floor, indoors in dry, well-ventilated area.

Part 2 Products

2.1 LUMBER MATERIALS

.1 Dimension Lumber: CSA-O141, softwood lumber unless indicated otherwise, S4S, maximum moisture content 19%; graded to NLGA Grading Rules Standard Grading Rules for Lumber. Finger jointed lumber not acceptable.

.1 Studs - Non-Structural: Grade Standard, species Spruce-Pine-Fir.

2.2 PANEL MATERIALS

.1 Plywood: CSA-O121 as indicated in schedule below, certified and graded by CANPLY, meeting the requirements of CSA-O325.

2.3 FASTENERS AND ANCHORS

.1 Screws and Nails: Galvanized steel; type and size suitable for application.

.2 Anchors: Stainless steel Type 304; toggle bolt type for anchorage to hollow masonry, expansion shield and lag bolt type for anchorage to solid masonry or concrete, and bolt or ballistic fastener for anchorages to steel.

.3 Galvanized Coating for Exterior Work: Hot dip galvanized to ASTM A153/A153M.

.4 Galvanized Coating for Treated Wood: Hot dip galvanized to ASTM A153/A153M, Class A or B1 (G185) zinc coating.

2.4 MISCELLANEOUS ACCESSORIES

.1 Adhesives: Waterproof adhesive, approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

.2 Building Paper:

.1 Spun bonded polyolefin building wrap sheeting.

.3 Polyethylene: Sheet polyethylene, 10 mil thick.

2.5 PRESERVATIVE TREATMENT

.1 Wood Preservative (Pressure Treatment): CAN/CSA-O80, and in accordance with Table 2 - Use Categories for Specific Products, Uses, and Exposures.

.1 UC1: Interior construction, above-ground and dry applications; use inorganic boron (SBX) preservative.

.2 UC2: Interior construction, above-ground and potentially damp applications; use inorganic boron (SBX) preservative.

.2 Wood Preservative (Surface Application): CAN/CSA-O80, copper naphthenate.

.3 Fire Retardant (FRT): CAN/CSA-O80, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of CAN/ULC-S102, to Class A.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on Shop Drawings.

3.2 INSTALLATION

.1 Set members level and plumb, in correct position. Place horizontal members, crown side up.

.2 Construct curb members of single pieces.

.3 Place horizontal members, crown side up.

.4 Space furring at 400 mm on centre.

.5 Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

.6 Coordinate curb installation with installation of roofing vapour retardant.

3.3 SITE APPLIED WOOD TREATMENT

.1 Apply preservative treatment to manufacturer's written instructions.

.2 Brush apply two (2) coats of preservative treatment on wood requiring cutting or drilling after treatment and on wood in contact with cementitious materials.

.3 Allow preservative to dry prior to erecting members.

3.4 ERECTION TOLERANCES

.1 Framing Members: 6 mm from true position, maximum.

END OF SECTION

Section 06 40 00
Architectural Woodwork

Part 1 General

1.1 SECTION INCLUDES

.1 Shop fabricated casework.

.2 Shop fabricated window sills.

.3 Shop fabricated trims and profiles.

1.2 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants: Sealant materials and application.

.2 Section 09 91 00 - Painting: Field finishing materials and application.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI/ASME 18.6.1 1981 (R2012) Wood Screws (Inch Series).

.2 ANSI/BHMA A156.9-2010, Cabinet Hardware.

.3 ANSI/BHMA A156.11-2014, Cabinet Locks.

.4 ANSI/BHMA A156.16-2013, Auxiliary Hardware.

.5 ANSI/BHMA A156.18-2012, Materials and Finishes.

.6 ANSI/BHMA A156.20-2006, Strap and Tee Hinges and Hasps.

.7 ANSI A208.1-09, Particleboard.

.8 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.

.9 ANSI/HPVA HP-1-10, Standard for Hardwood and Decorative Plywood.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.1 Architectural Woodwork Standards (AWMAC AWS), 2014.

.3 ASTM International (ASTM)

.1 ASTM A 153/A 153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM E 1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.

.3 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-M87, Hardboard.

.2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.3 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.

.5 CSA Group (CSA)

.1 CSA O112-M Series 1977 (R2006) Standards for Wood Adhesives.

.2 CSA O121-08(R2013), Douglas Fir Plywood.

.3 CSA O141-05 (R2014), Softwood Lumber.

.4 CSA O151-14, Canadian Softwood Plywood.

.5 CSA O153-M1980 (R2014), Poplar Plywood.

.6 CAN/CSA-Z809-08(R2013), Sustainable Forest Management.

.6 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.7 Green Seal Environmental Standards (GS)

.1 GS-11-2015, Paints, Coatings, Stains and Sealers.

.2 GS-36-2013, Adhesives for Commercial Use.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.9 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).

.10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2011, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.11 Sustainable Forestry Initiative (SFI)

.1 SFI-2015-2019 Standard and Rules.

1.4 PREINSTALLATION MEETING

.1 Before enclosing framing, convene a meeting of contractor, casework fabricator, casework installer, framing subcontractor and Prime Consultant.

.1 Review locations of backing required for casework installation as shown on shop drawings and as necessary for installation.

.2 Review method of attachment for backing to wall system.

.3 Review coordination with other affected sections.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Prepare and submit material list in accordance with AWMAC AWS, cross-referenced to specifications.

.2 Include manufacturer's instructions, printed product literature, data sheets and catalogue pages for all materials and products to be incorporated into architectural wood casework and include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.

.3 Hardware List:

.1 Submit hardware list cross-referenced to specifications.

.2 Include manufacturer's specification sheets indicating name, model, material, function, finish, BHMA designations and other pertinent information.

.4 Shop Drawings:

.1 Prepare and submit shop drawings in accordance with AWMAC AWS and as follows.

.2 Submit electronic sets of shop drawings for initial review in accordance with requirements of Division 01. Revise as directed, submit electronic copies for final acceptance and distribution.

.3 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.4 Indicate materials, thicknesses, finishes and hardware.

.5 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.6 Show location on casework elevations of backing required in supporting structure for attachment of casework.

.7 Indicate AWMAC AWS quality grade where different from predominant grade specified.

.8 Include color schedule of all casework items, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.

.5 Samples:

.1 Prepare and submit samples in accordance with AWMAC AWS and as follows.

.2 Submit samples as follows:

.1 300mm long section of solid white rift-cut oak and white rift-cut oak veneer surround at stage opening. Clear finished as specified.

.2 300x300mm sample of cabinetry with white rift-cut oak face and edge finish.

.3 300x300mm sample of cabinetry with plastic laminated face and edge finish.

.4 300mm long sample of wood veneer windows sills with solid wood edging. Painted as specified.

.3 Shop applied coatings:

.1 For transparent finish, submit 2 samples of each species and cut of wood to be used, one sample finished with G1 - Flat sheen and one sample finished with G4 - Satin sheen. Architect to advise which sheen will be accepted.

.2 For opaque finish, submit duplicate samples for each colour selection, finished as specified.

.4 Submit duplicate samples of laminated plastic for each specified colour selection.

.5 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Submit statement of experience and qualifications of architectural wood casework fabricator.

1.6 QUALITY ASSURANCE

.1 Perform Work of this Section by single architectural wood casework fabricator with minimum 5 years of current architectural casework production experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.

.2 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Shop prepare one lower cabinet with drawers, one upper cabinet with doors, one sink cabinet and one teacher's cabinet, complete with hardware , counter top, and shop applied finishes, and install where directed by Prime Consultant

.3 Prepare one window sill complete with specified finish and install where directed by Prime Consultant.

.4 Coordinate installation of mock-up with a scheduled site meeting to allow for review by Prime Consultant.

.5 When accepted, mock-up will demonstrate minimum standard for Work.

.6 Do not proceed with work before receipt of written acceptance of mock-up by Prime Consultant.

.7 Accepted mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver wood casework only when area of work is enclosed, plaster and concrete work is dry, and area is broom clean and site environmental conditions are acceptable for installation.

.3 Protect millwork against dampness and damage during and after delivery.

.4 Store millwork in ventilated areas, protected from extreme changes of temperature and humidity, and within range recommended by AWMAC AWS for location of project.

.5 Store materials indoors in clean, dry, well-ventilated area.

.6 Protect architectural woodwork and hardware from nicks, scratches, and blemishes.

.7 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUSTAINABILITY CHARACTERISTICS

.1 Lumber, plywood and composite wood products to be CAN/CSA-Z809 orFSC orSFI certified

.2 Composite wood products: contain no added formaldehyde.

.1 Hardwood plywood with veneer core (HWPW-VC): 0.05 ppm.

.2 Hardwood plywood with composite core (HWPW-CC): 0.05 ppm.

.3 Particleboard (PB): 0.09 ppm.

.4 Medium density fibreboard (MDF): 0.11 ppm.

.5 Thin (less than 8 mm) medium density fibreboard (tMDF): 0.13 ppm.

.3 Recycled content:

.1 Fibreboard must contain less than 10% roundwood by weight, using weighted average over three month period at manufacturing locations.

.4 Adhesives: VOC limit 30 g/L maximum to SCAQMD Rule 1168.

.5 Coatings

.1 Clear Wood Finishes: VOC limit 350 g/L maximum to GS-11.

2.2 QUALITY GRADE

.1 Provide all materials and perform all fabrication in accordance with AWMAC AWS Premium Grade.

.2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

2.3 LUMBER

.1 Softwood and Hardwood Lumber: Sound lumber to specified AWMAC AWSquality grade requirements, kiln-dried to moisture content recommended by AWMAC AWS for location of the Work

.2 Machine stress-rated lumber is acceptable for all purposes.

2.4 PANEL MATERIALS

.1 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, industrial grade M-2 or M-3, medium density (640-800 kg/m^3), thickness 19 mm unless indicated otherwise.

.1 For all casework unless otherwise noted below or on drawings.

.2 Hardwood plywood: to CHPA: 19mm thick for doors and drawer fronts, 13mm thick for drawer sides and 6mm for drawer bottoms unless otherwise specified.

.3 Marine grade hardwood plywood: A-B grade, 19 mm thick for counter-tops unless otherwise specified.

.4 Hardboard: To CAN/CGSB-11.3

.1 For casework rear panels at concealed areas, only where laminated plastic is specified.

2.5 LAMINATED PLASTIC MATERIALS

.1 Laminated plastic for flatwork: to NEMA LD3

.1 High pressure decorative laminated (HPDL) plastic.

.1 Type: GP (general purpose).

.2 Horizontal Surfaces: HGS to suit application, 1.2 mm thick.

.3 Vertical Surfaces: HGS to suit application, 1.2 mm thick.

.4 Colour: integral colour throughout, refer to item 3.5 - Schedule below.

.2 Laminated plastic for postforming work: to NEMA LD3

.1 Type: postforming.

.2 Grade: HGP.

.3 Size: 1.0 mm thick.

.4 Colour: integral colour throughout, refer to item 3.5 - Schedule below.

.3 Edge finishing for doors, drawer fronts, shelves and false fronts:

.1 Laminated plastic matching faces, edge finish to overlap face finish.

.4 Laminated plastic adhesive:

.1 Adhesive: As per laminate manufacturer's written specifications.

2.6 CASEWORK FABRICATION - GENERAL

.1 Fabricate casework of specified core and surface finish materials to specified AWMAC AWS quality grade

.1 Construction type: Frameless, unless otherwise shown on drawings..

.2 Door-cabinet interface: Flush overlay unless otherwise shown on drawings.

.2 Set nails and countersink screws apply colour-matched wood filler to indentations, sand smooth and leave ready to receive finish.

.3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.4 Shelving to cabinetwork to be adjustable unless otherwise noted.

.5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

2.7 WOOD VENEER SURFACING

.1 Apply wood veneer to specified core material in accordance with AWMAC AWSrequirements for grade specified and as follows

.2 Exposed exterior surfaces:

.1 Species: White Oak.

.2 Veneer slicing: Rift cut.

.3 Veneer leaf matching: Book.

.4 Door, drawer and panel matching: Sequenced matching.

.5 End matching: Panel continuous end match.

.6 Grain direction: as indicated.

.3 Edge finishing:

.1 6mm solid lumber moulding of same species and grain as exposed surfaces. Veneer shall stop short of, and be flush with 6mm solid wood edge finish..

2.8 WOOD CASEWORK FABRICATION

.1 Fabricate casework bodies of specified veneered plywood panel materials in accordance with AWMAC AWSrequirements for grade specified and as follows

.1 Exposed interior surfaces: Veneer of same species and cut and grade as exposed exterior surfaces.

.2 Semi-exposed surfaces: Veneer of same species as exposed exterior surfaces.

.3 Edges: Square edge with inset hardwood edgeband of same species as veneer.

.2 Fabricate door, drawer and panel surfaces of specified veneered plywood panel materials of specified veneers laid up as specified.

.1 Edges: Square edge with inset hardwood edgeband of same species as veneer.

.3 Drawer construction:

.1 Sides:

.1 AWMAC AWS Premium grade: Premium grade: 7-ply veneer core with HPDL faces.

.2 Bottoms: Hardwood plywood of same finish as drawer sides, 6 mm thick.

.3 Joinery: Meeting requirements of AWMAC AWS for Grade specified.

2.9 SHOP APPLIED FINISH COATINGS

.1 Clear finish for wood and wood veneer: Benjamin Moore 'Stays Clear' #F425 Flat or #F423 Low Luster.

.1 Gloss Level: G1 - Flat or G4 - Satin to be determined by Architect.

.2 Apply finish system component materials in accordance with manufacturer's instructions.

2.10 CABINET HARDWARE

.1 Cabinet hardware: to AWMAC AWSquality grade specified and to ANSI/BHMA A156.9, designated by letter B and numeral identifiers as listed below

.2 Finish:

.1 Exposed hardware: 'Brushed nickel'.

.3 Drawer sliders: heavy duty roller assembly, Accuride or Hettiche.

.4 Hinges: self closing European type, 125 degree open, Hettiche or Blum Module. Each door shall have hinges spaced no more than 600mm vertically with no less than 3 hinges per door.

.5 Pulls; drawers, doors: Richelieu #6211, Functional Metal Pull; length as shown on drawings; finish 'Brushed nickel'

.6 Garbage/Recycling Centre: Richelieu Rev-A-Shelf Double Pull-Out Recycling Centre; metallic silver finish. Provide 2 bins, for each Rev-a-shelf system.

2.11 CABINET LOCKS

.1 Provide locks at all cabinet doors and drawers.

.2 Cabinet locks: to ANSI/BHMA A156.11, designated by letter E and numeral identifiers as listed below

.1 Door or drawer locks: Haefele or Richelieu

.2 Elbow catches: at all double doors with locks.

.3 Keying: All locks keyed alike.

.1 Provide 2 keys per lock.

.4 Finished to brushed nickel.

2.12 ACCESSORIES

.1 Wood screws: stainless steel, type and size to suit application.

.2 Nails and staples: to CSA B111 and ASTM F1667

.3 Splines: wood.

.4 Sealant: in accordance with 07 92 00 - Joint Sealants.

2.13 LAMINATED PLASTIC COUNTERTOPS

.1 Core material: Marine grade plywood with a non-telegraphing grain with type ll water-resistant adhesive.

.2 Back splashes: As shown on drawings.

.3 Front edges: As shown on drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate.

.2 Inform Prime Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Prime Consultant.

3.2 INSTALLATION

.1 Install architectural wood casework in accordance with AWMAC AWSgrade for respective items

.2 In case of conflict between Contract Documents and AWMAC AWSgrade requirements, Contract Documents govern.

.3 Install prefinished millwork at locations shown on drawings.

.1 Position accurately, level, plumb straight.

.4 Fasten and anchor millwork securely.

.1 Supply and install heavy duty fixture attachments for wall mounted cabinets.

.5 Countersink mechanical fasteners at exposed and semi-exposed surfaces, excluding installation attachment screws and screws securing cabinets end to end.

.6 Use draw bolts in countertop joints.

.7 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.8 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.

.9 Apply moisture barrier between wood framing members and masonry or cementitious construction.

.10 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.11 Make cutouts for inset equipment and fixtures using templates provided.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Clean all millwork and casework surfaces, inside and outside.

.2 Remove excess glue, pencil and ink marks from surfaces.

3.4 PROTECTION

.1 Protect millwork and casework from damage until final inspection.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent materials caused by architectural woodwork installation.

3.5 SCHEDULES

.1 Finishes tags and associated materials and finishes as follows

Drawing Tag	Description	Manufacturer	Product Name / Colour Number
PLAM1	Plastic laminate	Abet Laminati	842 SEI
PLAM2	Plastic laminiate	Abet Laminati	477 SEI
PLAM3	Plastic laminate	Abet Laminati	1831 SEI
PLAM4	Plastic laminate	Formica	934-58 Mouse, Matte
PLAM5	Plastic Laminate	Abet Laminati	879 SEI BK
MLAM1	Metal laminate	Octopus	Octolux Stainless Aluminum
WV1	Wood veneer	Levey or CWP Wood Architectural	Rift cut white oak

END OF SECTION

Section 07 52 00
Modified Bituminous Membrane Roofing

Part 1 General

1.1 SECTION INCLUDES

.1 SBS modified bituminous roofing membrane.

.2 Cover boards.

.3 Insulation.

.4 Vapour Retarder.

.5 Substrate board (sheathing) over deck surface.

.6 Walkway pavers.

.7 Expansion joints.

1.2 RELATED REQUIREMENTS

.1 Refer to structural specifications: Deck material.

.2 Section 07 27 00 - Air Barriers: Wall air barrier for roof/wall interface.

.3 Section 07 62 00 - Sheet Metal Flashing and Trim: flashing.

.4 Division 22 - Plumbing for roof drains, refer to Mechanical specifications.

.5 Division 23 - HVAC for prefabricated roof curbs for mechanical equipment, refer to Mechanical specifications.

1.3 REFERENCE STANDARDS

.1 ASTM C208-12(2017)e2 Standard specification for cellulosic fiber insulating board

.2 ASTM C1177/C1177M-17 Standard specification for glass mat gypsum substrate for use as sheathing

.3 ASTM C1278/C1278M-17 Standard specification for fiber-reinforced gypsum panel

.4 ASTM C1289-21 Standard specification for faced rigid cellular polyisocyanurate thermal insulation board

.5 ASTM C1396/C1396M-17 Standard specification for gypsum board

.6 ASTM D41/D41M-11(2016) Standard specification for asphalt primer used in roofing, dampproofing, and waterproofing

.7 ASTM D2178/D2178M-15a(2021) Standard specification for asphalt glass felt used in roofing and waterproofing

.8 ASTM D6162/D6162M-21 Standard specification for styrene butadiene styrene (SBS) modified bituminous sheet materials using a combination of polyester and glass fiber reinforcements

.9 CSA A123.21:20 Standard test method for the dynamic wind uplift resistance of membrane-roofing systems

.10 CAN/ULC-S107-19 - Standard Methods of Fire Tests of Roof Coverings.

.11 CAN/ULC-S701.1-2022 - Standard for Thermal Insulation, Polystyrene Boards.

.12 CAN/ULC-S704.1-2017 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.13 Roofing specifications manual

.14 FM (Factory Mutual) - Roof Assembly Classifications.

.15 Province of Ontario Roofing Contractors Association - Roofing Specifications Manual.

.16 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with the installation of associated metal flashings, as the work of this section proceeds.

.2 Pre-installation Meetings:

.1 Convene one (1) week before starting work of this section.

.2 Review preparation and installation procedures and coordinating and scheduling required with related work.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide characteristics of products listed in Part 2 below including flashing materials.

.3 Shop Drawings:

.1 Indicate conditions of interface with other materials, setting plan for tapered insulation, and base flashing and joint or termination details.

.2 Indicate fastener spacing and patterns.

.3 Indicate location and pattern for walkways.

.4 Samples: Submit one (1) sample of the following:

.1 Roof membrane, 300 x 300 mm in size.

.2 Vapour-permeable rain barrier membrane.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements, including special precautions required for seaming the membrane.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Field Reports: Indicate ambient temperatures, wind velocity during application, humidity, and procedures followed.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14001 certification requirements.

.2 Install roofing system in compliance with the requirements of:

.1 CRCA Roofing Specifications Manual.

.2 Maintain a copy of document on site.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and a member in good standing with the applicable provincial Roofing Contractors Association, and licensed or approved by the manufacturer.

.5 Source Quality Control: Provide roof system components from same manufacturer as roof membrane.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver roofing materials in original, unopened containers, complete with labels indicating manufacturer's name, product brand name, date of manufacture, approval or listing agency markings, usage instructions and safety precautions.

.3 Protect membranes and insulation from physical damage and deterioration by sunlight in clean, dry weather protected environment, clear of ground and moisture.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not apply roofing membrane during inclement weather or when ambient temperatures are above or below material manufacturer's recommendations.

.2 Do not apply roofing membrane to damp or frozen deck surface.

.3 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 WARRANTY

.1 Roofing Subcontractor's Warranty:

.1 Submit written OIRCA warranty for roofing and membrane flashings of two (2) year period.

.2 Include materials, labour, workmanship, tools and equipment.

.3 Repair or replacement of work judged defective by the Toronto District School Board.

.4 Repair or replacement of other work damaged due to faulty or defective work, including leaks in roofing membrane, membrane flashing, and related sheet metal work.

.5 Roofing Subcontractor to enter into three (3) year maintenance agreement with the Toronto District School Board after expiration of initial warranty. During this period, Roofing Subcontractor to provide labour, materials, and tools, at no cost to the Toronto District School Board, to repair or replace defects, including leakage and failure and delamination.

.2 Manufacturer's Warranty:

.1 Provide a No Dollar Limit (NDL), non-pro-rated system warranty from the roofing material manufacturer for twenty (20) years commencing at Substantial Performance of the Work as follows:

.2 Include for repair (including replacement of deteriorated or damaged insulation substrate) defects in materials and workmanship in roofing and metal flashing work.

.3 Provide labour, materials, tools and equipment to repair or replace any material defects.

.4 Written warranty shall be in a form approved by the Toronto District School Board, covering roof assembly, including vapour retarder, roof insulation, roof membranes and flashings.

.5 Provide inspection of completed roof during years two (2), five (5), and ten (10).

Part 2 Products

2.1 MEMBRANE MATERIALS

.1 Manufacturers:

.1 Soprema - Roofing and insulation.

.2 Accuplane - Tapered insulation.

.3 Thaler - Roof drains, vents and roof accessories.

.4 Other acceptable manufacturers offering functionally and aesthetically equivalent products.

.1 Johns Manville - Roofing and insulation.

.2 IKO - Roofing and insulation.

.3 Tremco - Roofing, insulation, and tapered insulation.

.4 Posislope - Tapered insulation

.5 Platinum Technologies - Roof drains.

.5 Substitutions: Refer to 01 23 00 - Alternatives.

.6 Or approved equivalent alternate. Roof membranes, insulation, vapour-permeable membrane, and adhesives shall be from same manufacturer.

2.2 DESCRIPTION

.1 System Description - Roof Type **R1**:

.1 SBS conventional membrane roofing system consisting of a two (2) ply fully adhered membrane with high-albedo surface, cover board, insulation and vapour retarder. No open flame is required for installation.

.1 Cover Board: Fully adhered.

.2 Insulation: Fully adhered.

.3 Vapour Retarder: Fully adhered.

.2 System Description - Roof Type **R2**:

.1 Existing 4-ply built-up roofing system under warranty. All work related to roof type R2 shall be undertaken by vendors approved by Johns Manville, to ensure maintenance of warranty . Specifications and warranty information to be provided by the Owner.

.3 Regulatory Requirements:

.1 Conform to applicable provincial code for windloads and roof assembly fire hazard requirements.

.1 Fire Hazard Classification: CAN/ULC-S107, Class A.

.2 Wind Uplift Resistance:

.1 Membrane roofing system meeting dynamic wind uplift resistance to CAN/CSA-A123.21.

2.3 MEMBRANE MATERIALS

.1 SBS Modified Bituminous Membrane: Prefabricated styrene-butadiene-styrene (SBS) modified sheets.

.1 Base Sheet Membrane: CAN/ULC-S107 Class A, fully adhered modified bitumen membrane, with composite glass and non-woven polyester reinforcement.

.1 Thickness: Nominal 3mm.

.2 Top surface sanded.

.3 Underside self-adhesive.

.4 Product: 'Sopraply Stick Duo', manufactured by Soprema.

.2 Base Sheet Flashing: CAN/ULC-S107 Class A, fully adhered modified bitumen membrane, with composite glass and non-woven polyester reinforcement.

.1 Thickness: Nominal 3mm.

.2 Top surface sanded.

.3 Underside self-adhesive.

.4 Product: 'Sopraply Stick Duo', manufactured by Soprema.

.3 Cap Sheet Membrane: CAN/ULC-S107 Class A, fully adhered modified bitumen membrane, composite glass and non-woven polyester reinforcement with flame-retarding agent.

.1 Thickness: Nominal 4mm.

.2 Top surface high-reflectivity granules.

.3 Underside sanded.

.4 Face Colour:

.1 'Ultra White'.

.2 White with SRI 90.

.5 Product: 'Soprastar GR', manufactured by Soprema.

.4 Cap Sheet Flashing: CAN/ULC-S107 Class A, fully adhered modified bitumen membrane, composite glass and non-woven polyester reinforcement with flame-retarding agent.

.1 Thickness: Nominal 4mm.

.2 Top surface high-reflectivity granules.

.3 Underside sanded.

.4 Face Colour:

.1 'Ultra White'.

.2 White with SRI 90.

.5 Product: 'Soprastar GR', manufactured by Soprema.

.2 Membrane Accessories:

.1 Perimeter Membrane: SBS modified bitumen heavy-duty, self-adhesive membrane.

.2 Adhesives and Sealants: Manufacturer's standard cold-applied adhesives and sealants.

.3 Membrane Fasteners: Manufacturer's recommended corrosion-resistant, factory-coated steel fasteners and plates, suitable for deck types and materials being fastened, and capable of meeting wind uplift criteria requirements.

.3 Liquid-Applied Flashing at structural upstands:

.1 Single component polyurethane & bitumen resin; 'Alsan Flashing'.

.2 Surface preparation and application as per manufacturer's written installation instructions.

2.4 COVER BOARDS

.1 SBS modified bitumen membrane with non-woven polyester reinforcement; adhered.

.1 Product: '2-1 Soprasmart Board', 7mm thick, manufactured by Soprema.

.2 Adhesive: 'Duotack', manufactured by Soprema.

2.5 INSULATION

.1 Polyisocyanurate Insulation: CAN/ULC-S704, closed-cell polyisocyanurate rigid board faced with polymer-bonded glass fibre mats on both major surfaces of foam; edges square.

.1 Thermal Resistance: Total RSI-1.00/25.4mm - R-5.7 / inch.

.2 Board Thickness: As indicated on Drawings.

.3 Product: Sopra-ISO PLUS with inorganic facers, manufactured by Soprema.

.2 Tapered Insulation: Factory-cut tapered boards, same material as field insulation, with minimum thickness 25 mm and slope 1:48.

.1 Average Thermal Resistance: Total RSI-1.00/25.4mm - R-5.7 / inch.

.3 Miscellaneous Insulation Shapes: Preformed insulation-based crickets, saddles, cants and other shapes, fabricated with slopes and shapes as indicated.

.4 Insulation Accessories:

.1 Insulation Fasteners: Manufacturer's recommended corrosion-resistant, factory-coated steel fasteners and metal or plastic plates, designed for fastening insulation and cover boards, and suitable for deck type.

.2 Insulation Adhesive: Manufacturer's recommended cold-applied, low-expansion foam adhesive suitable for full-spread application.

2.6 VAPOUR RETARDER

.1 Bituminous Membrane Vapour Retarder:

.1 Self-Adhesive, SBS modified bitumen membrane, with polyethylene reinforcement; nominal thickness 0.8mm.

.2 Product: 'Sopravap'r Self-Adhesive' , manufactured by Soprema.

.2 Vapour Retarder Continuity Strips: SBS modified bitumen self-adhesive membrane, compatible with wall air barrier and roof vapour retarder.

2.7 SUBSTRATE BOARDS

.1 Gypsum Board: ASTM C1177/C1177M, glass-mat faced gypsum board, Type X, moisture and mould resistant, 13 mm thick.

.1 Product: 'DensDeck Prime', manufactured by Georgia Pacific.

.2 Or approved, equivalent alternative.

.2 Accessories:

.1 Fasteners: Corrosion-resistant, factory-coated steel fasteners and plates, suitable for deck type and approved by system manufacturer.

.2 Adhesive: Non-combustible type, for adhering gypsum sheathing to metal deck.

.3 Joint Tape: Heat resistant type.

2.8 MISCELLANEOUS ACCESSORIES

.1 Wood Cant Strips: Specified in Section 06 10 53, preservative treated.

.2 Primers and Sealants: As recommended by membrane manufacturer.

.3 Metal Flashing:

.1 Counterflashing: Custom powder-coated sheet metal, as specified in Section 07 62 00; RAL colour by Prime Consultant.

.2 Cap Flashing: Custom powder-coated sheet metal, as specified in Section 07 62 00; RAL colour by Prime Consultant.

.4 Prefabricated Roof Specialties:

.1 Mechanical equipment curbs: refer to mechanical for specification; architectural drawings for roofing details.

.2 Mechanical equipment supports: Thaler 'Air Handling Unit Roof Support' fastened to structure. Refer to architectural drawings for roofing details.

.3 Mechanical stack vents: refer to mechanical for specification; architectural drawings for roofing details.

.4 Roof drains: refer to mechanical for specification; architectural drawings for roofing details.

.5 Miscellaneous Fasteners: Galvanized or non-ferrous type, appropriate for purpose intended and approved by system manufacturer; length required for thickness of material being fastened.

2.9 WALKWAYS

.1 Concrete Walkway Pavers: Precast concrete paverswith integrated elevation footings, minimum 1.05 kPa.

.1 Size: Nominal 600 x 600 x 50 mm.

.2 Colour: Grey.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify openings and penetrations are in place, curbs and nailers are in place and drain bodies are securely clamped.

.3 Verify that surfaces, planes and slopes are as specified and ready to receive work.

.4 Verify steel deck is supported and secured.

.5 Verify deck surfaces are dry and free of snow or ice.

.6 Confirm dry deck by moisture meter with 12% moisture maximum.

3.2 PREPARATION

.1 Clean deck of dust, debris, sharp objects and other substances in accordance with roofing manufacturer's requirements..

.2 Prevent debris from entering or clogging roof drains and other openings; remove roof drain plugs when no work is taking place or when rain is forecast.

.3 Install wood roof curbs where indicated.

.4 Wood Decks:

.1 Verify securement, flatness and joint spacing and slope of wood decking; seal joints of plywood with tape.

.2 Fill knot holes with latex filler.

.5 Concrete Deck:

.1 Verify condition and slope of concrete decking.

.2 Fill surface honeycomb and variations with latex filler.

.6 Metal Deck:

.1 Verify securement and slope of metal decking.

3.3 SUBSTRATE BOARD INSTALLATION

.1 Install substrate board as specified in Section 06 10 53 - Miscellaneous Rough Carpentry.

.2 Cut substrate boards cleanly and accurately at roof breaks and protrusions to provide smooth surface.

.3 Lay with long side at right angle to flutes; stagger end joints; provide support at ends.

.4 Install over metal deck with full mopping of adhesive on each flute to resist uplift pressure at corners, perimeter, and field of roof in accordance with applicable code and to system manufacturers' written instructions.

3.4 VAPOUR RETARDER INSTALLATION

.1 Apply primer and vapour retarder in accordance with manufacturer's written instructions for system specified.

.2 Apply vapour retarder starting at lowest point of roof slope.

.3 Align membrane, maintaining uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps minimum 300 mm.

.4 Apply continuity strips under parapet framing and wood cant strips and seal to air barrier on building envelope walls.

.5 Seal and envelope vapour retarder at all terminations, projections and penetrations to provide complete seal to roofing system.

.6 Apply asphalt at temperature and rate recommended by manufacturer. In cold weather, warm membrane underface as recommended by manufacturer.

.7 Apply laminated sheet in single layer, with adhesive.

3.5 INSULATION INSTALLATION

.1 Install insulation to manufacturer's written instructions, with fastening meeting FM requirements to resist wind uplift pressure at corners, perimeter, and field of roof.

.2 Do not apply more insulation than can be covered with roof membrane on same day.

.3 Install tapered insulation under area of roofing to provide slopes as indicated on approved Shop Drawings.

.4 Apply insulation layers with tightly butted, flush joints and fit tight to perimeter blocking and around roof projections.

.5 Fill gaps greater than 6 mm wide with insulation.

.6 Stagger joints minimum 150 mm between layers of insulation and between rows. Tape joints of insulation in accordance with insulation manufacturer's instructions.

.7 Adhered Insulation: Set each layer in a uniform coverage of full-spread insulation adhesive.

3.6 COVER BOARD INSTALLATION

.1 Adhesive-adhere cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows.

.2 Offset joints of insulation below minimum of 150 mm in each direction.

.3 Fasten corners and perimeters to meet FM requirements.

3.7 ROOF MEMBRANE INSTALLATION

.1 Install membranes to manufacturer's written instructions, and provincial roofing association requirements.

.2 Install membranes without wrinkles, air pockets or fishmouths.

.3 Unroll membranes on substrate, aligning edge of first selvage with drain centre and parallel to roof edge.

.4 Align membranes, maintaining uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps minimum 300 mm.

.5 Shingle joints on sloped substrate in direction of drainage.

.6 Extend membrane up vertical surfaces minimum 200 mm.

.7 Cut and seal membranes around roof penetrations, tie-ins and other interfaces using manufacturer's recommended details and securement methods.

.8 Base Sheets:

.1 Weld base sheet onto prepared surface.

.2 Avoid overheating membrane and reinforcement.

.3 Install base sheet over surface covered with adhesive at rate recommended by manufacturer.

.4 Apply even pressure with roller to ensure good adherence.

.5 Seal side and end laps following manufacturer's recommended methods.

.6 Remove silicone release paper and adhere to substrate by applying even pressure with roller to ensure good adherence.

.7 Seal side and end laps following manufacturer's recommended methods.

.8 Seal side and end laps following manufacturer's recommended methods for membrane specified.

.9 Cap Sheets:

.1 Install membranes over surface covered with adhesive at rate recommended by manufacturer.

.2 Seal end laps and side laps following manufacturer's recommended methods.

.3 Apply even pressure with roller to ensure good adherence.

.4 Apply primer to area being covered.

.5 Remove silicone release paper and adhere to substrate by applying even pressure with roller to ensure good adherence.

.6 Seal end laps and side laps following manufacturer's recommended methods.

3.8 MEMBRANE FLASHING INSTALLATION

.1 Apply base and cap sheet flashing to manufacturer's written instructions, avoiding formation of wrinkles, air pockets or fishmouths.

.2 Apply flashing after primer coat is dry.

.3 Follow manufacturer's recommended methods for overlaps for system specified.

.4 Install reinforcing gusset at all inside and outside corners.

.5 Overlap ends by 150 mm; seal overlaps at end of workday.

.6 Remove silicone release paper and adhere self-adhesive sheet to substrate. Follow with equal pressure with roller for full adhesion.

.7 Install base sheet flashing in full bed of adhesive at rate recommended by manufacturer.

3.9 WALKWAY INSTALLATION

.1 Concrete Paver Walkways:

.1 Install concrete walkway pavers on pedestals in locations indicated.

.2 Provide minimum 75 mm space between pavers to permit surface water drainage.

3.10 FLASHINGS AND ACCESSORIES

.1 Install roofing accessories to manufacturer's written instructions.

.2 Adhere flexible flashings and preformed flashing accessories with bonding adhesive at the required rate, to membrane manufacturer's written instructions. Reinforce with mechanical fasteners as required.

.3 Movement Joints: Install roofing expansion joints to isolate roof into areas as indicated on Drawings. Install prefabricated expansion joints to manufacturer's written instructions.

.4 Roof Drains and Roofing Specialties: Apply sealant or mastic bed over deck flange at roof drains and securely seal membrane roofing in place with clamping ring to provide watertight seal.

.5 Coordinate installation of roof drains and related flashings.

.6 Seal flashings and flanges of items penetrating membrane.

3.11 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection and testing by third party.

.2 Provide inspection services in accordance with Province of Ontario warranty requirements.

.3 Monitor and report unacceptable conditions, deterioration and damage, and installation procedures.

.4 Correct identified defects or irregularities.

3.12 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by Work of this section.

3.13 PROTECTION

.1 Protect membrane from damage and wear during remainder of construction period where traffic must continue over finished roof membrane.

.2 Protect adjacent building surfaces against damage from roofing work.

END OF SECTION

Section 07 84 00
Firestopping

Part 1 General

1.1 SECTION INCLUDES

.1 Tested and listed firestopping systems.

1.2 RELATED REQUIREMENTS

.1 Section 05 12 00 - Structural Steel: Building structural substrate surfaces. Refer to Structural specifications.

.2 Section 07 27 00 - Air Barriers: Air barrier materials to adjacent insulation.

.3 Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

.4 Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC): Mechanical work requiring firestopping.

.5 Section 26 - Electrical: Electrical work requiring firestopping.

1.3 REFERENCE STANDARDS

.1 ASTM E84-21a Standard test method for surface burning characteristics of building materials

.2 ASTM E119-20 Standard test methods for fire tests of building construction and materials

.3 ASTM E814-13a(2017) Standard test method for fire tests of penetration firestop systems

.4 ASTM E1966-15(2019) Standard test method for fire-resistive joint systems

.5 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.6 CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.7 CAN/ULC-S102.2-18 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.8 CAN/ULC-S115-18 - Standard Method of Fire Tests of Firestop Systems.

.9 FM (Factory Mutual) - FM 4991-2013 - Approval Standard for Firestop Contractors.

.10 Firestop industry manual of practice (FCIA MOP)

.11 NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 edition.

.12 OPL (Omega Point Laboratories).

.13 UL 263-2011 - Standard for Fire Tests of Building Construction and Materials (14th Edition).

.14 UL 1479-2015 - Standard for Fire Tests of Through-Penetration Firestops (4th Edition).

.15 UL 1709-2017 - Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel (5th Edition).

.16 UL 2079-2015 - Standard for Tests for Fire Resistance of Building Joint Systems (5th Edition).

.17 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

.18 WHI (Intertek/Warnock Hershey).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other work having a direct bearing on work of this section.

.3 Pre-Installation Meeting: Convene one (1) week before starting work of this section.

.4 Sequencing: Coordinate and sequence firestopping installation with all affected trades.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide manufacturer's written data on product characteristics, performance and limitation criteria.

.3 System Design Listings: Submit system design listings including illustrations from a qualified nationally recognized testing and inspection agency applicable to each firestop configuration.

.4 Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) from firestop manufacturer where no specific third party tested, listed and classified firestop system is available for a particular firestop configuration.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's written special preparation and installation requirements and tested and listed firestop systems designs.

.3 Contractor's Certificates:

.1 Provide FCIA Member in Good Standing letter or certificate for the current year, on FCIA letterhead.

.2 Current ULC Qualified Firestop Contractor Certificate and individual Designated Responsible Individual Certificate.

.4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience and FCIA Manufacturer Member in good standing.

.3 Contractor Qualifications: Company specializing in performing the work of this section and as follows:

.1 FCIA Member in good standing.

.2 Minimum one (1) person employed at the firm who has passed the ULC Firestop Exam.

.3 ULC Qualified Firestop Contractor Program.

.4 FM approved in accordance with FM standard 4991 - Approval of Firestop Contractors.

.5 FCIA Member in good standing.

.6 Licensed by the province or local authority where applicable.

.7 Completed not less than five (5) comparable scale projects.

.4 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer. Obtain firestop systems for complete project, from a single primary firestop systems manufacturer, to the greatest extent possible.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver firestopping products in original, unopened containers with labels intact and legible, identifying product and manufacturer.

.3 Store and handle firestopping materials to manufacturer's instructions.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not apply materials when temperature of substrate material and ambient air is below 15 degrees C.

.2 Maintain this minimum temperature before, during, and for three (3) days after installation of materials.

.3 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 3M Fire Protection Products.

.2 BALCO, Inc.

.3 HILTI, Inc.

.4 Specified Technologies, Inc

.5 Thermal Ceramics, Inc.

.6 Thermafiber, Inc.

.2 Substitutions: Or approved equivalent alternates. Refer to Section 01 23 00.

2.2 DESCRIPTION

.1 System Description:

.2 Tested and listed firestopping systems consisting of a material or materials, the wall or floor assembly, and penetrating items or gaps, assembled or placed in spaces, gaps, joints and building perimeters, to restore the fire resistance rating and or smoke resistant properties of a fire resistance rated assembly or smoke resistant assembly.

.3 Regulatory Requirements:

.1 Conform to applicable code for fire resistance ratings and surface burning characteristics.

.2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials, tested and listed systems or engineering judgments used.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Materials, accessories and application procedures listed by ULC, or tested to CAN/ULC-S115 to comply with applicable building code requirements.

.2 Firestopping Materials: CAN/ULC-S101, to achieve a fire rating as noted on Drawings.

.3 Surface Burning Characteristics: CAN/ULC-S102 or CAN/ULC-S102.2, as applicable.

.4 Smoke Resistance: For areas where smoke resistance is required, provide firestop systems with L-ratings of maximum 25.4l/sec/sq m opening area.

.5 Environmental Resistance: Systems to be resistant to environmental conditions they will be exposed to, as apparent at design stage.

2.4 MATERIALS

.1 Fire Stopping Systems and Materials: Tested and listed by ULC, and conforming to construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.

2.5 ACCESSORIES

.1 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

.2 Forming/Packing Material: Permanent type, suitable for application.

.3 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this section.

.3 Verify tested and listed systems selected are applicable to the conditions encountered.

.4 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Clean substrate surfaces as recommended in manufacturer's written instructions, of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material and performance of firestop system for fire or smoke resistant situations.

.2 Remove incompatible materials which may affect bond.

.3 Install damming and backing materials to arrest liquid material leakage.

3.3 APPLICATION

.1 Apply primer and firestopping materials to manufacturer's written instructions.

.2 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to tested and listed system or engineering judgment.

.3 Apply firestopping material, thickness sufficient to achieve rating, to uniform density and texture.

.4 Compress fibred material to achieve a density of 40% of its uncompressed density.

.5 Place intumescent coating in sufficient coats to achieve rating required.

.6 Dam Material: Dam material to remain.

3.4 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION

.1 Protect adjacent surfaces from damage by material installation.

END OF SECTION

Section 07 92 00
Joint Sealants

Part 1 General

1.1 SECTION INCLUDES

.1 Preparing substrate surfaces.

.2 Sealant and joint backing.

.3 Structural sealant for glazing assemblies.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete: Sealants required in conjunction with cast-in-place concrete. Refer to structural specifications.

.2 Section 04 20 00 - Unit Masonry:Sealants required in conjunction with concrete and clay brick masonry.

.3 Section 06 40 00 - Architectural Woodwork: Sealants required at joints between dissimilar interior finishes.

.4 Section 07 24 40 - Non-Combustible Exterior Insulation and Finish Systems: Sealants required in conjunction with joint sealing.

.5 Section 07 27 00 - Air Barriers: Sealants required in conjunction with air barrier.

.6 Section 07 84 00 - Firestopping: Sealants required in conjunction with firestopping.

.7 Section 07 52 00 - Modified Bituminous Membrane Roofing: Sealants required in conjunction with roofing.

.8 Section 07 61 01 - Sheet Metal Roofing, Fascia and Soffits: Sealants required in conjunction with roofing and associated cladding.

.9 Section 07 62 00 - Sheet Metal Flashing And Trim: Sealants required in conjunction with metal flashings.

.10 Section 08 11 13 - Metal Doors and Frames: Sealants required in conjunction with door frames.

.11 Section 08 14 13 - Aluminum-Framed Entrances and Storefronts: Sealants required in conjunction with door and sidelight frames.

.12 Section 08 41 23 - Fire Rated Glass and Framing Systems: Sealants required in conjunction with door, sidelight and window frames.

.13 Section 08 44 23 - Structural Sealant Glazed Curtain Walls: Sealants required in conjunction with curtain wall frame perimeter. Structural silicone sealant for glazing by Section 08 44 23.

.14 Section 08 80 00 – Glass and Glazing: Sealants required in conjunction with glazing methods.

.15 Section 09 21 61 - Gypsum Board Assemblies: Sealants required at joints between dissimilar interior finishes.

1.3 REFERENCE STANDARDS

.1 ASTM C834-17 Standard specification for latex sealants

.2 ASTM C919-22 Standard practice for use of sealants in acoustical applications

.3 ASTM C920-18 Standard specification for elastomeric joint sealants

.4 ASTM C1184-23 Standard specification for structural silicone sealants

.5 ASTM C1193-16 Standard guide for use of joint sealants

.6 ASTM C1311-22 Standard specification for solvent release sealants

.7 ASTM C1330-23 Standard specification for cylindrical sealant backing for use with cold liquid-applied sealants

.8 ASTM C1401-23 Standard guide for structural sealant glazing

.9 ASTM C1481-12(2017) Standard guide for use of joint sealants with exterior insulation and finish systems (EIFS)

.10 ASTM E330/E330M-14 Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with all sections referencing this section.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations and colour availability.

.3 Structural Sealant Joint Design: Provide calculations for structural bite, dead load support, glueline thickness, shear, and other parameters.

.4 Shop Drawings: Indicate sealant joints and dimensions, materials, structural bite, glueline thickness, joint profile, and support framing.

.5 Samples: Submit two (2) samples, 50mm in size illustrating sealant colours for selection.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

.1 Indicate special procedures, surface preparation, perimeter conditions requiring special attention and field quality control testing.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Perform work to sealant and EIFS manufacturer's requirements for preparation of surfaces and material installation instructions.

.3 Perform acoustical sealant application work to ASTM C919.

.4 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.

.5 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 MOCK-UPS

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide mock-up to include sealant joints in conjunction with windows and curtain wall.

.3 Construct mock-up with specified sealant types and with other components noted.

.4 Locate where directed by Prime Consultant.

.5 Approved mock-up may remain as part of the Work.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.11 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Warranty: Provide a five (5) year warranty for failure to meet specified requirements including coverage for installed sealants and accessories which fail to achieve water tight seal, air tight seal, exhibit loss of adhesion or cohesion, or do not cure.

.3 Manufacturer's Warranty: Provide manufacturer's twenty (20) year material warranty for installed silicone sealant.

Part 2 Products

2.1 PERFORMANCE / DESIGN CRITERIA

.1 Sealant Design: Design structural sealant to withstand specified loads without breakage, loss, failure of seals, product deterioration, and other defects.

.2 Design installed sealant to withstand:

.1 Loads: Design and size to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of panel:

.1 As calculated in accordance with applicable code.

.2 As measured in accordance with ASTM E330/E330M.

.2 Movement from ambient temperature range of 50 degrees C.

.3 Movement and deflection of structural support framing.

.4 Water and air penetration.

2.2 SEALANTS

.1 Interior Sealant (Type 1): ASTM C920, single component paintable acrylic latex:

.1 Product: 'Tremflex 834', manufactured by Tremco.

.2 Or approved equivalent alternative.

.2 Exterior Sealant (Type 2): ASTM C920, single component urethane:

.1 Product: Dymonic 100, manufactured by Temco.

.2 Or approved equivalent alternative.

.3 Sealant for EIFS systems (Type 3): ASTM C920, as recommended in writing by EIFS system manufacturer.

2.3 STRUCTURAL SEALANT

.1 Structural silicone sealant by Section 08 44 23 - Structural Sealant Glazed Curtain Walls.

2.4 ACCESSORIES

.1 Primer: Non-staining type, as recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

.3 Joint Backing: ASTM C1330, round, closed cell; polyethylene foam rod, oversized 30% to 50% larger than joint width.

.4 Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

.5 Masking tape: Non-staining, non-absorbent type compatible with sealant and adjacent surfaces.

.6 Setting Blocks and Spacers: Compatible with silicone sealant and recommended by sealant manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that substrate surfaces and joint openings are clean, dry, and free of frost and ready to receive work.

.3 Verify that joint backing and release tapes are compatible with sealant and EIFS materials.

3.2 PREPARATION

.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

.2 Clean and prime joints to sealant manufacturer's written instructions.

.3 Perform preparation to sealant manufacturer's written instructions.

.4 Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

.1 Perform installation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C919 for acoustical sealants, or ASTM C1481 for EIFS systems.

.2 Measure joint dimensions and size materials to achieve required width/depth ratios.

.3 Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

.4 Install bond breaker where joint backing is not used.

.5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

.6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.7 Tool joints concave.

3.4 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection and testing.

.2 Joint Sealants: Perform adhesion tests to manufacturer's written instructions and ASTM C1193, Method A - Field-Applied Sealant Joint Hand Pull Tab.

.1 Perform test twenty-one (21) days after installation at a rate of one test every 300 m of installed sealant.

.3 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.

.4 Maintain test log and submit report to Prime Consultant indicating tests, locations, dates, results, and remedial actions.

.2 Manufacturer's Services:

.1 Monitor and report installation procedures and unacceptable conditions.

3.5 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Clean adjacent soiled surfaces.

3.6 PROTECTION

.1 Remove masking tape and excess sealant.

.2 Protect sealants until cured, remove temporary glass supports.

3.7 SCHEDULE

.1 Window perimeter: Type 2; colour to match finish of window frame.

.2 Door perimeter: Type 2; colour to match finish of door frame.

.3 Metal roofing and cladding: Type 2, to match siding colour.

.4 Control joints in exterior masonry: Type 2, to match masonry colour.

.5 Under thresholds: Type 2, Black.

.6 All interior joints between dissimilar materials and plumbing fixtures: Type 1

END OF SECTION

Section 08 11 13
Hollow Metal Doors and Frames

Part 1 General

1.1 SECTION INCLUDES

.1 Hollow metal steel frames.

1.2 RELATED REQUIREMENTS

.1 Section 04 05 13 - Masonry Mortar and Grout: Masonry grout fill of metal frames. Refer to Structural specifications.

.2 Section 08 14 16 - Flush Wood Doors: Doors for the frames specified in this section.

.3 Section 08 71 00 - Door Hardware.

.4 Section 08 80 00 - Glazing.

.5 Section 09 91 00 - Painting: Field painting of doors.

1.3 REFERENCE STANDARDS

.1 ASTM A653/A653M-23 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.2 ASTM B29-19 Standard specification for refined lead

.3 ASTM B749-20 Standard specification for lead and lead alloy strip, sheet, and plate products

.4 ASTM C553-13(2019) Standard specification for mineral fiber blanket thermal insulation for commercial and industrial applications

.5 ASTM C578-23 Standard specification for rigid, cellular polystyrene thermal insulation

.6 ASTM C591-22 Standard specification for unfaced preformed rigid cellular polyisocyanurate thermal insulation

.7 ASTM C665-23 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing

.8 ASTM C1289-23 Standard specification for faced rigid cellular polyisocyanurate thermal insulation board

.9 ASTM E90-09(2016) Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements

.10 ASTM E413-22 Classification for rating sound insulation

.11 CAN/ULC-S104 - Standard Method for Fire Tests of Door Assemblies.

.12 CAN/ULC-S105 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

.13 STD G40.20/G40.21-13 General requirements for rolled or welded structural quality steel/structural quality steel

.14 STD W59-18 Welded steel construction

.15 FM (Factory Mutual).

.16 CSDMA (Canadian Steel Door Manufacturers Association).

.1 Recommended Dimensional Standards for Commercial Steel Doors and Frames.

.2 Recommended Selection and Usage Guide for Commercial Steel Doors and Frame Products.

.17 NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

.18 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

.19 ULC - Fire Resistance Directory.

.20 UL - Fire Resistance Directory.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with frame opening construction, door, and hardware installation.

.3 Sequencing: Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.

.3 Shop Drawings:

.1 Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Conform to requirements of CSDMA. Maintain one (1) of document on site.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

.3 Store in vertical position, spaced with blocking to permit air circulation between components.

.4 Store materials on planks or dunnage, out of water and covered to protect from damage.

.5 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers:

.1 Artek Door Ltd.

.2 Daybar Industries Ltd.

.3 Fleming-Baron Door Products

.4 M.J. Daley Manufacturing Co. Ltd.

.5 Trillium Steel Doors Limited.

.2 Or approved equivalent alternatives. Refer to 01 23 00 - Alternatives.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Coordinate the following requirements with Section 08 14 16 - Flush Wood Doors.

.2 Fire Rated Door and Frame Construction: Labelled and listed to CAN/ULC-S104. Refer to fire ratings noted on door schedule.

.3 Fire Rated Door Construction: Rate of rise of 250 C degrees across door thickness.

.4 Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as scheduled.

2.3 MATERIALS

.1 Sheet Steel: Galvanized steel to ASTM A653/A653M, commercial grade (CS), Type B.

.1 Exterior Doors: Coating designation A60.

.2 Interior Doors: Coating designation A40.

.2 Reinforcement Channel: CSA-G40.20/G40.21, Type 44W, ZF75 coating designation to ASTM A653/A653M.

2.4 PRIMERS

.1 Primer: Rust inhibitive touch-up only.

2.5 ACCESSORIES

.1 Door Silencers: Single stud rubber/neoprene.

2.6 FABRICATION - FRAMES

.1 Interior Frames: 1.6 mm thick base metal thickness.

.1 Door Frames and Window Assemblies: Welded type construction.

.2 Transom Frames: Welded type construction.

.3 Sidelight Assemblies: Welded type construction.

.2 Mullions for Double Doors: Fixed type, of same profiles as jambs. Coordinate with Section 08 71 00 - Door Hardware where removable mullions are scheduled.

.3 Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.

.4 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier. Provide mortar guard boxes.

.5 Reinforce frames wider than 1 200 mm with roll formed steel channels fitted tightly into frame head, flush with top.

.6 Prepare frames for silencers. Provide three (3) single silencers for single doors and mullions of double doors on strike side. Provide two (2) single silencers on frame head at double doors without mullions.

.7 Configure exterior frames with special profile to receive recessed weatherstripping.

.8 Attach fire rated label to each fire rated door unit.

2.7 FINISHES

.1 Colour by Prime Consultant; Refer to Section 09 91 00 - Painting.

.2 Coat inside of frame profile with bituminous coating to a thickness of 1.5 mm.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that opening sizes and tolerances are acceptable; check floor area within path of door swing for flatness.

.3 Verify doors and frames are correct size, swing, rating and opening number.

.4 Remove temporary shipping spreaders.

3.2 INSTALLATION

.1 Install doors and frames to CSDMA.

.2 Install fire-rated doors and frames in accordance with NFPA 80, and local authority having jurisdiction.

.3 Coordinate with masonry, gypsum board, and concrete wall construction for anchor placement.

.4 Coordinate installation of glass and glazing.

.5 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.

.6 Set frames plumb, square, level and at correct elevation.

.7 Secure anchorages and connections to adjacent construction.

.8 Ensure integrity of lead-lining between interior of frame and adjacent wall assembly.

.9 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 1 200 mm in width.

.10 Remove wood spreaders after frames have been built-in.

.11 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

.12 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.

.13 Adjust operable parts for correct clearances and function.

.14 Install louvers, glazing and door silencers.

.15 Finish paint as specified in Section 09 91 00.

.16 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES

.1 Maximum Diagonal Distortion: 1.5 mm measured with straight edges, crossed corner to corner.

END OF SECTION

Section 08 14 16
Flush Wood Doors

Part 1 General

1.1 SECTION INCLUDES

.1 Flush wood doors.

.2 Transom panels.

1.2 RELATED REQUIREMENTS

.1 Section 06 40 00 - Architectural Woodwork; wood veneer specifications to coordinate with doors.

.2 Section 08 12 13 - Hollow Metal Doors and Frames.

.3 Section 08 71 00 - Door Hardware - General.

.4 Section 08 80 00 - Glass and Glazing.

.5 Section 09 91 00 - Painting: Factory clear finishing of doors.

1.3 REFERENCE STANDARDS

.1 ASTM E90-09(2016) Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements

.2 ASTM E413-22 Classification for rating sound insulation

.3 NAAWS 4.0 - North American Architectural Woodwork Standards (AWS).

.4 CAN/ULC-S104 - Standard Method for Fire Tests of Door Assemblies.

.5 NEMA LD 3-2005 High-pressure decorative laminates (HPDL). (Withdrawn)

.6 NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

.7 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

.8 UL - Fire Resistance Directory.

.9 ULC - Fire Resistance Directory.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with door opening construction, door frame and door hardware installation.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

.3 Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required and special blocking for hardware. Identify cutouts for glazing and louvres.

.4 Samples:

.1 Submit two (2) samples of door construction, 150x150mm in size cut from top corner of door.

.2 Submit two (2) samples of door veneer, 150x150mm in size, illustrating species, grain direction and clear finish.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Perform work in accordance with AWMAC standards, Premium Grade.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experienceand a member in good standing with AWMAC.

.4 Finish doors in accordance with AWS to finish as specified.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Package, deliver and store doors in accordance with AWS.

.3 Accept doors on site in manufacturer's packaging. Inspect for damage.

.4 Deliver materials only when Project is ready for installation and when area of operation is enclosed, plaster and concrete work dry and area broom clean.

.5 Protect doors from exposure to natural and artificial light after delivery.

.6 Maintain indoor temperature and humidity within range recommended by AWS.

1.10 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Provide warranty to include coverage for failure to meet specified requirements, to the following term:

.1 Interior Doors: Two (2) years.

.2 Exterior Doors: Five (5) years.

.3 Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Coordinate the requirements below with Section 08 41 23 - Fire Rated Glass & Framing System.

.2 Fire Rated Doors:

.1 Labelled and listed to CAN/ULC-S104. Refer to fire ratings noted on door schedule.

.2 Conform to NFPA 80 for fire rated class as scheduled.

2.2 DOOR CONSTRUCTION

.1 Flush Wood Doors: heavy duty performance quality, Premium.

.1 Core (Non-Rated): Solid medium density fiberboard (MDF) core.

.2 Core (Fire Rated): Manufacturer's standard, fire rating as indicated on Door Schedule.

.3 Thickness: 44 mm.

.4 Door Construction: 7-ply.

.5 Facing (Transparent Finish): Grade AA, White Oak species wood, rift cut, with book veneer match; vertical grain direction.

.1 Wood veneer finish at doors shall exactly match wood veneer finish of millwork as specified in section 06 40 00 - Architectural Woodwork.

.6 Exposed Edges: Vertical solid wood edges, and top; species and drain to match veneer, finished to match door faces.

.2 Transom Panels: To match door, fire rated as indicated for doors.

2.3 ADHESIVE

.1 Facing Adhesive: Type II - water resistant.

2.4 ACCESSORIES

.1 Metal Louvres:

.1 Material: Extruded aluminum.

.2 Finish: Pre-painted, custom colour as selected by Prime Consultant.

.3 Louvre Blade: Inverted Y blade, sight proof.

.4 Fire Rated Louvres: Fire rated with fusible link design to ULC requirements.

.1 Fire rating as indicated on Schedule.

.5 Louvre Free Area: Refer to Mechanical Specifications.

.2 Glazing Stops: Wood, of same species as door facing, channel shape, mitred corners; prepared for countersink style tamper proof screws.

2.5 FABRICATION

.1 Fabricate non-rated doors to AWS requirements.

.2 Fabricate fire rated doors to AWS and labelling requirements as shown on Door Schedule. Attach fire rating label to door.

.3 Provide lock blocks at lock edge and full blocking at top and hinge side of door for hardware reinforcement.

.4 Fit door edge trim to edge of stiles after applying veneer facing.

.5 Bond edge banding to cores.

.6 Factory machine doors for recessed hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through bolted hardware.

.7 Factory machine exterior door edge to receive recessed weatherstripping devices.

.8 Factory fit doors for frame opening dimensions identified on Shop Drawings.

.9 Provide edge clearances in accordance with AWS or NFPA 80 for fire rated doors.

.10 Fabricate transoms of same construction and finish as associated door.

2.6 FINISHES

.1 Factory finish doors in accordance with AWS with the following finish:

.1 Clear finish as specified in section 09 91 00 - Painting.

.2 Factory finish doors in accordance with approved sample.

.3 Seal door top edge with clear sealer to match door facing.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify mechanical, electrical, plumbing, HVAC and other building components affecting work of this Section are in place and functioning.

.3 Verify that opening sizes and tolerances are acceptable.

.4 Verify frames set square, plumb, level, and in plane. Report openings not within tolerance before hanging doors.

3.2 INSTALLATION

.1 Install doors to AWS requirements.

.2 Install labelled fire rated doors to NFPA 80.

.3 Trim non-rated door width by cutting equally on both jamb edges.

.4 Trim door height by cutting bottom edges to a maximum of 19 mm. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

.5 Machine cut for hardware.

.6 Coordinate installation of doors with installation of frames specified in Section 08 41 13 - Aluminum-Framed Entrances and Storefronts, Section 08 41 23 - Fire Rated Glass and Framing Systems, and hardware specified in Section 08 71 00 - Door Hardware.

.7 Coordinate installation of glass and glazing.

.8 Install door louvres plumb and level.

3.3 TOLERANCES

.1 Conform to AWS requirements for fabrication and installation tolerances.

3.4 ADJUSTING

.1 Adjust door for smooth and balanced door movement.

.2 Adjust closer for full closure.

END OF SECTION

Section 08 71 00
Door Hardware

Part 1 General

1.1 SECTION INCLUDES

.1 Hardware for doors.

.2 Thresholds.

.3 Weatherstripping, seals, and door gaskets.

1.2 RELATED REQUIREMENTS

.1 Section 06 40 00 - Architectural Woodwork: Cabinet hardware.

.2 Section 08 14 16 - Flush Wood Doors.

.3 Section 08 41 13 - Aluminum Framed Entrances and Storefronts: Hardware for same except cylinders.

.4 Section 08 41 23 - Fire Rated Glass and Framing Systems: Hardware supplied by manufacturer.

.5 Section 08 71 13 - Automatic Door Operators: Hardware for same except cylinders.

.6 Section 08 44 13 - Glazed Aluminum Curtain Walls: Hardware for integral doors and frames except lock cylinders.

.7 Division 28 – Electronic Safety and Security: Power supply to electric hardware devices card access equipment.

1.3 REFERENCE STANDARDS

.1 CAN/ULC-S104 - Standard Method for Fire Tests of Door Assemblies.

.2 CAN/ULC-S132 - Standard for Emergency Exit and Emergency Fire Exit Hardware.

.3 CSDMA (Canadian Steel Door Manufacturers Association).

.4 DHI (Door and Hardware Institute Canada) - AHC and EHC certification programs.

.5 STD A115.16-1994 Installation guide for doors and hardware. (Withdrawn)

.6 STD WDHS-3-1996 Recommended hardware locations for wood flush doors. (Withdrawn)

.7 BHMA (Builders Hardware Manufacturers Association)

.8 NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

.9 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

.10 UL 10B - Standard for fire tests of door assemblies.

.11 UL 305 - Standard for panic hardware.

1.4 PRICE AND PAYMENT PROCEDURES

.1 Hardware shall be supplied by cash allowance; refer to Section 01 21 00 - Cash Allowances.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other work having a direct bearing on work of this section.

.1 Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.

.2 Coordinate Owner's keying requirements during the course of the Work.

.3 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.6 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings:

.1 Indicate locations and mounting heights of each type of hardware, schedules, catalogue cuts, electrical characteristics and connection requirements.

.2 Submit manufacturer's parts lists and templates.

1.7 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

.3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.9 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special wrenches and tools applicable to each different or special hardware component.

.2 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.10 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Perform Work to the following requirements:

.1 BHMA A156 series.

.2 DHI A115 series.

.3 DHI WDHS-3.

.4 CSDMA.

.5 NFPA 80.

.6 NFPA 252.

.7 UL 10B .

.8 UL 305.

.9 CAN/ULC-S132.

.10 CAN/ULC-S104.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.5 Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

.6 Hardware Supplier Personnel: Employ an Electrified Hardware Hardware Consultant (EHC) to assist in the electronics and controls work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.12 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Provide five (5) year manufacturer warranty for door closers.

Part 2 Products

2.1 SUPPLIERS

.1 Acceptable Suppliers:

.1 Empire Hardware Limited; (416) 638-5400.

.2 Substitutions: Not permitted.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for Products requiring electrical connection. Listed and classified by CSA as suitable for the purpose specified and indicated.

2.3 KEYING

.1 Include construction keying. Key to existing keying system.

.2 Supply keys in the following quantities:

.1 Two (2) master keys.

.2 Two (2) grand master keys.

.3 Two (2) control keys and two (2) extra cylinder cores.

.4 Two (2) change keys for each lock.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that doors and frames are ready to receive work and dimensions are as indicated on Shop Drawings.

.3 Verify that electric power is available to power operated devices and is of the correct characteristics.

3.2 INSTALLATION

.1 Install hardware to manufacturer's written instructions.

.2 Use templates provided by hardware item manufacturer.

3.3 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection, testing, and adjusting.

3.4 ADJUSTING

.1 Adjust hardware for smooth operation.

3.5 PROTECTION

.1 Do not permit adjacent work to damage hardware or finish.

3.6 SCHEDULES

.1 Hardware by Cash Allowance, schedule shall be provided by Prime Consultant.

END OF SECTION

Section 08 80 00
Glazing

Part 1 General

1.1 SECTION INCLUDES

.1 Glass and glazing for sections referencing this section for Products and installation.

1.2 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants: Sealant and back-up materials.

.2 Section 08 14 16 - Flush Wood Doors: Glazed doors.

1.3 REFERENCE STANDARDS

.1 AAMA CW11-85 Curtain wall manual no. 11 - design windloads for buildings and boundary layer wind tunnel testing

.2 ANSI Z97.1-2015 Safety glazing materials used in buildings - safety performance specifications and methods of test

.3 ASTM C542-05(2017) Standard specification for lock-strip gaskets

.4 ASTM C864-05(2019) Standard specification for dense elastomeric compression seal gaskets, setting blocks, and spacers

.5 ASTM C920-18 Standard specification for elastomeric joint sealants

.6 ASTM C1036-21 Standard specification for flat glass

.7 ASTM C1048-18 Standard specification for heat-strengthened and fully tempered flat glass

.8 ASTM C1172-19 Standard specification for laminated architectural flat glass

.9 ASTM C1464-21 Standard specification for bent glass

.10 ASTM C1503-18 Standard specification for silvered flat glass mirror

.11 ASTM D2240-15(2021) Standard test method for rubber property—durometer hardness

.12 ASTM E84-23c Standard test method for surface burning characteristics of building materials

.13 ASTM E119-22 Standard test methods for fire tests of building construction and materials

.14 ASTM E283/E283M-19 Standard test method for determining rate of air leakage through exterior windows, skylights, curtain walls, and doors under specified pressure differences across the specimen

.15 ASTM E330/E330M-14 Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

.16 ASTM E2190-19 Standard specification for insulating glass unit performance and evaluation

.17 CAN/CGSB 12.8-2017 Insulating glass units

.18 CAN/ULC-S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.19 CAN/ULC-S104 - Standard Method for Fire Tests of Door Assemblies.

.20 16 CFR 1201 - Safety standard for architectural glazing materials

.21 Glazing manual - international year of glass edition

.22 IGMA (Insulating Glass Manufacturers Alliance).

.23 NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials.

.24 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

.25 NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.

.26 UL 263 - Fire tests of building construction and materials

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meeting: Convene one (1) week before starting work of this section.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Glass Sheets: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

.2 Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colours.

.3 Samples:

.1 Submit two (2) samples 300mm in size, exampling single and sealed glazing unit.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Certificates: Certify that Products meet or exceed specified requirements.

.3 Manufacturer's Certificate: Certify that sealed insulated glass, meets or exceeds specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Perform Work in accordance with GANA Glazing Manual for glazing installation methods.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by the manufacturer.

1.9 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not install glazing when ambient temperature is less than 10 degrees C.

.2 Maintain minimum ambient temperature before, during and twenty-four (24) hours after installation of glazing compounds.

1.10 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Provide a ten (10) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

.3 Provide a ten (10) year warranty to include coverage for delamination of laminated glass and replacement of same.

Part 2 Products

2.1 MANUFACTURERS

.1 Vitro Architectural Glass; Product: 'Starphire Ultra-Clear Glass'.

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for fire rating, temperature rise, and impact safety rating requirements.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Provide glass and glazing materials for continuity of building enclosure vapour retarder and air barrier:

.2 In conjunction with materials described in Section 07 92 00.

.3 To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapour retarder seal.

.4 To maintain a continuous air barrier and vapour retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

.5 Loads: Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass.

.1 As calculated in accordance with applicable code.

.2 To a design pressure of 0.80kpa.

.3 As measured in accordance with ASTM E330/E330M.

.6 Limit glass deflection to flexural limit of glass with full recovery of glazing materials, whichever is less.

2.4 FLAT GLASS MATERIALS

.1 Silvered Flat Glass Mirrors (Type FG-1): ASTM C1503, annealed monolitic clear low iron glass, 6mm, nominal glass thickness Mirror Select Quality; cut size as shown on drawings.

.2 Safety Glass:

.1 Fully Tempered Glass Sheet (Type FG-2): CAN/CGSB 12.1, clear low iron; minimum 6mm glass thickness.

.2 Fully Tempered Glass Sheet (Type FG-3): CAN/CGSB 12.1, clear low iron; minimum 12mm glass thickness.

.3 Fire Protective Glass: CAN/ULC-S104, listed and labeled for rating as shown on Drawings.

.1 Ceramic Glass: Type FG-2: 'FireLite Plus' fire-rated glazing as fabricated and distributed by Technical Glass Products, phone (800.426.0279), e-mail tgp.sales@allegion.com, http://www.fireglass.com.

2.5 PLASTIC FILMS

.1 3M Canada; Product: film type **FILM1:** Translucent window film: 3M #SH2EMCH “Chamonix’.

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

2.6 GLAZING ACCESSORIES

.1 Compression Gaskets: ASTM C864, ozone-resistant, preformed dense elastomeric compression compound, Option I; extruded shape supplied by framing manufacturer; black colour.

.2 Setting Blocks: ASTM C864, ozone-resistant, preformed dense elastomeric compression compound; Option I; length of 25 mm for each sq m of glazing or minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area.

.3 Spacer Shims: ASTM C864, ozone-resistant, preformed dense elastomeric compression compound; Option I, minimum 75 mm long x one half the height of the glazing stop x thickness to suit application self adhesive on one face.

.4 Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; coiled on release paper; 12 mm size; black colour.

.5 Glazing Clips: Manufacturer's standard type.

.6 Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units destined for removal for smoke control.

2.7 SOURCE QUALITY CONTROL AND TESTS

.1 Section 01 45 00: Provide testing and analysis of glass.

.2 Provide shop inspection and testing for safety and fire protective glass.

.3 Test safety glass samples to CAN/CGSB 12.1.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that openings for glazing are correctly sized and within tolerance.

.3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

.4 Install sealant in accordance with manufacturer's written instructions.

3.3 INSTALLATION - GLAZING

.1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.2 Interior Dry Method (Tape and Tape):

.1 Cut glazing tape to length and set against permanent stops, projecting 1.5 mm above sight line.

.2 Place setting blocks at 1/4 points with edge block no more than 150 mm from corners.

.3 Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

.4 Place glazing tape on free perimeter of glazing in same manner described above.

.5 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.6 Knife trim protruding tape.

3.4 INSTALLATION - PLASTIC FILM

.1 Install plastic film with adhesive, applied in accordance with film manufacturer's written instructions.

.2 Place without air bubbles, creases or visible distortion.

.3 Fit tight to glass perimeter with razor cut edge.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Services:

.1 Glass product manufacturers to provide field surveillance of the installation of their Products.

.2 Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels after Work is complete.

.4 Clean glass and adjacent surfaces.

3.7 PROTECTION

.1 After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.8 SCHEDULE

.1 Type **FG-1**: Mirrors.

.2 Type **FG-2**: Fire rated glazing for interior doors.

END OF SECTION

Section 09 21 16
Gypsum Board Assemblies

Part 1 General

1.1 SECTION INCLUDES

.1 Gypsum board.

.2 Cementitious backer board.

.3 Acoustic insulation.

.4 Access Hatches

1.2 RELATED REQUIREMENTS

.1 Section 07 62 00 - Joint Sealants: Interior sealant at dissimilar materials.

.2 Section 07 84 00 - Firestopping.

.3 Section 09 22 16 - Non-Structural Metal Framing

.4 Section 10 10 00 - Miscellaneous Specialties: Items requiring wood blocking for fastening.

.5 Mechanical and Electrical specifications: Items requiring wood blocking for fastening.

1.3 REFERENCE STANDARDS

.1 STD A108/A118/A136.1:2021 American National specifications for the installation of ceramic tile

.2 ASTM C475/C475M-17 Standard specification for joint compound and joint tape for finishing gypsum board

.3 ASTM C514-04(2020) Standard specification for nails for the application of gypsum board

.4 ASTM C557-03(2017) Standard specification for adhesives for fastening gypsum wallboard to wood framing

.5 ASTM C645-18 Standard specification for nonstructural steel framing members

.6 ASTM C665-23 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing

.7 ASTM C754-20 Standard specification for installation of steel framing members to receive screw-attached gypsum panel products

.8 ASTM C840-20 Standard specification for application and finishing of gypsum board

.9 ASTM C1002-22 Standard specification for steel self-piercing tapping screws for application of gypsum panel products or metal plaster bases to wood studs or steel studs

.10 ASTM C1047-19 Standard specification for accessories for gypsum wallboard and gypsum veneer base

.11 ASTM C1278/C1278M-17 Standard specification for fiber-reinforced gypsum panel

.12 ASTM C1288-17e1 Standard specification for fiber-cement interior substrate sheets

.13 ASTM C1325-22e1 Standard specification for fiber-mat reinforced cementitious backer units

.14 ASTM C1396/C1396M-17 Standard specification for gypsum board

.15 ASTM E90-09(2016) Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements

.16 CAN/ULC-S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.17 CAN/ULC-S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.18 CAN/ULC-S702 - Standard for Mineral Fibre Thermal Insulation for Buildings.

.19 Gypsum Association GA-214 - Recommended Levels of Gypsum Board Finish.

.20 Gypsum Association GA-216 - Application and Finishing of Gypsum Panel Products.

.21 Gypsum Association GA-600 - Gypsum Fire Resistance Design Manual.

.22 Gypsum Association GA-801 - Handling and Storage of Gypsum Panel Products.

.23 UL - Fire Resistance Directory.

.24 ULC - Fire Resistance Directory.

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Provide data on metal framing gypsum board, cementitious backer board, joint tape, and trim profiles.

.2 Provide MSDS on all products within the shaft wall assembly.

.3 Shop Drawings: Indicate special details associated with fireproofing, trim profiles, and acoustic seal for openings.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.7 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Perform Work in accordance with ASTM C840.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.4 Handling Gypsum Board: Comply with GA-801.

Part 2 Products

2.1 MANUFACTURERS

.1 CGC Inc.; Product: gypsum board panels and installation materials .

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for fire rated assemblies as shown on drawings:

.1 Fire Rated Partitions and ceilings: ULC Listed Assembly Design number as shown on Assembly Schedule.

.2 Fire Rated Structural Column and beam framing: ULC Listed Assembly Design number as shown on Assembly Schedule.

.2 Conform to applicable code for seismic requirements.

2.3 FRAMING MATERIALS

.1 Studs and Tracks: Specified in Section 09 22 16.

.2 Furring,Framing, and Accessories: Specified in Section 09 22 16 - Non-Structural Metal Framing.

.3 Fasteners: ASTM C1002.

.4 Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

.5 Adhesive: ASTM C557.

2.4 GYPSUM BOARD MATERIALS

.1 Gypsum Ceiling Board ASTM C1396/C1396M, paper-faced, regular core, 16 mm thick; 1220 mm wide, maximum available length in place; tapered edges, ends square cut.

.2 Abuse-Resistant Gypsum Board: ASTM C1396/C1396M, paper-faced, impact resistant; maximum available length in place; tapered edges, ends square cut.

.1 Regular core, 16 mm thick.

.1 'Sheetrock Mold Tough AR Firecode Core' Gypsum Panels

.2 Fire rated core, 16 mm thick.

.1 'Sheetrock Mold Tough AR Firecode Core' Gypsum Panels

.3 Cementitious Backer Board: ASTM C1325, high density, fibre reinforced cementitious board, 16 mm thick; maximum available size in place; smoothed edges, ends square cut.

.4 Gypsum Coreboard/Shaft Liner: ASTM C1396/C1396M, 254mm thick, maximum available size in place.

2.5 ACCESSORIES

.1 Acoustic Insulation: CAN/ULC-S702; preformed mineral wool, friction fit type, unfaced, thickness as shown on Assembly Schedule.

.2 Corner Beads: ASTM C1047, metal corner bead.

.3 Edge Trim: ASTM C1047; Type as shown on drawings.

.4 Joint Materials: ASTM C475/C475M.

.1 Reinforcing tape, adhesive, and water.

.2 Joint compound: Asbestos-free dust-controlled.

.5 Gypsum Board Fasteners: ASTM C1002, as required to fasten to specified stud gauge.

.6 Cementitious Board Fasteners: Board manufacturer's purpose made screws, corrosion resistant steel, self-drilling points, counter-sink heads to prevent strip-out, for steel substrate.

.7 Frameless Access Hatches: Accudor DW-5058 with inset gypsum panel; 610x610mm.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 METAL STUD INSTALLATION

.1 Refer to Section 09 22 16 - Non-Structural Metal Framing.

3.3 WALL FURRING INSTALLATION

.1 Refer to Section 09 22 16 - Non-Structural Metal Framing.

3.4 FURRING FOR FIRE RATINGS

.1 Install furring as required for fire resistance ratings indicated and to GA-600 requirements.

3.5 CEILING FRAMING INSTALLATION

.1 Install to ASTM C754.

.2 Install metal suspension system requiring seismic restraint to meet requirements of the Ontario Building code.

.3 Coordinate location of hangers with other work.

.4 Install ceiling framing independent of walls, columns, and above ceiling work.

.5 Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.

.6 Laterally brace entire suspension system.

3.6 ACOUSTIC ACCESSORIES INSTALLATION

.1 Install resilient channels at maximum 600 mm on centre. Locate joints over framing members.

.2 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

.3 Install acoustic sealant within partitions in accordance with manufacturer's written instructions.

.4 Install acoustic sealant at gypsum board perimeter at:

.1 Metal Framing: Two (2) beads.

.2 Base Layer.

.3 Face Layer.

.4 Caulk all penetrations of partitions by conduit, pipe, duct work, rough-in boxes, and sprinkler lines.

3.7 GYPSUM BOARD INSTALLATION

.1 Install gypsum board to ASTM C840.

.2 Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing.

.3 Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.

.4 Use screws when fastening gypsum board to metal furring or framing.

.5 Use screws when fastening gypsum board to wood furring or framing. Staples may only be used when securing the first layer of double layer applications.

.6 Double Layer Applications: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions and ceilings.

.7 Double Layer Applications: Secure second layer to first with mechanical fasteners.

.8 Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.

.9 Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.

.10 Treat cut edges and holes in cementitious backer board with sealant.

.11 Place control joints consistent with lines of building spaces as directed.

.12 Place corner beads at external corners as indicated. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.

.13 Install backing board over metal studs to manufacturer's written instructions.

.14 Apply gypsum board to curved walls in accordance with GA-216.

3.8 JOINT TREATMENT

.1 Finish to ASTM C840, Level as shown in item 3.10 - Schedule below.

.2 Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

.3 Feather coats on to adjoining surfaces so that camber is maximum 0.8 mm.

.4 Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

.5 Fill and finish joints and corners of cementitious backing board.

3.9 TOLERANCES

.1 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 3 mm in 3 m in any direction.

3.10 SCHEDULES

.1 Gypsum board / cementitious panel schedule unless otherwise noted on drawings:

.1 Abuse-Resistant Gypsum Board: All areas where gypsum board is specified other than that noted below.

.2 Gypsum Ceiling Board: All ceilings and bulkheads.

.3 Flexible Gypsum Board: Only where radii are noted on drawings.

.4 Cementitious Backer Board: At all locations where wall tile is shown on drawings

.5 Gypsum Coreboard/Shaft Liner: At all locations where fire rated shafts are shown on drawings.

.6 Acoustic Gypsum Board where noted on drawings.

.2 Gypsum board finishing level schedule unless otherwise noted on drawings:

.1 Level 1: Above finished ceilings concealed from view.

.2 Level 3: Walls exposed to view.

.3 Level 4: Ceilings exposed to view.

.4 Level 5: Where applied graphic film is shown on drawings.

END OF SECTION

Section 09 22 16
Non-Structural Metal Framing

Part 1 General

1.1 SECTION INCLUDES

.1 Formed metal framing of studs and furring, at interior locations.

.2 Framing accessories.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 53 - Miscellaneous Rough Carpentry: Rough wood blocking within stud framing.

.2 Section 09 21 16 - Gypsum Board Assemblies: Gypsum board on metal studs for partitioning.

.3 Section 10 10 00 - Miscellaneous Specialties: Wood blocking.

1.3 REFERENCE STANDARDS

.1 ASTM A123/A123M-24 Standard specification for zinc (hot-dip galvanized) coatings on iron and steel products

.2 ASTM A653/A653M-23 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.3 ASTM C645-18 Standard specification for nonstructural steel framing members

.4 ASTM C754-20 Standard specification for installation of steel framing members to receive screw-attached gypsum panel products

.5 ASTM C1002-22 Standard specification for steel self-piercing tapping screws for application of gypsum panel products or metal plaster bases to wood studs or steel studs

.6 MPI Maintenance repainting specification manual

.7 SSPC 16-01 Steel structures painting manual. Volume 1: good painting practice

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.

.2 Provide MSDS information for all products.

.3 Shop Drawings:

.1 Indicate prefabricated work component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories.

.2 Describe method for securing studs to tracks, splicing and for blocking and reinforcement to framing connections.

.3 Provide calculations for loadings and stresses of specially fabricated framing under the Professional Structural Engineer's seal.

.1 Provide engineered shop drawing for suspended gypsum board ceiling and vault at Library.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

Part 2 Products

2.1 MANUFACTURERS

.1 Bailey Metal Products; Product: Metal framing.

.2 Substitutions: Refer to Section 01 23 00.

2.2 DESCRIPTION

.1 System Description:

.1 Interior Walls: Metal stud framing assembly with batt type acoustic insulation specified in Section 09 21 16 - Gypsum Board Assemblies, interior gypsum board specified in Section 09 21 16 Gypsum Board Assemblies.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Exterior wind load bearing studs: refer to structural specifications.

.2 Maximum Allowable Deflection: 1:360 span.

.3 Wall Assembly:

.1 Design assembly to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.4 STUD FRAMING MATERIALS

.1 Framing Assembly Components: ASTM C645.

.2 Studs: ASTM A653/A653M, non-load bearing rolled steel, channel shaped, punched for utility access, as follows:.

.1 Depth: As noted on drawings.

.2 Thickness: 20 gauge.

.3 Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

.4 Ceiling Runners: With extended leg retainer.

.5 Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

.6 Fasteners: ASTM C1002, self drilling, self tapping screws.

.7 Anchorage Devices: Drilled expansion bolts.

.8 Acoustic Sealant: As specified in Section 09 21 16.

.9 Touch-Up Primer for Galvanized Surfaces: MPI #19, organic zinc-rich primer.

2.5 FABRICATION

.1 Fabricate assemblies of framed sections to sizes and profiles required.

.2 Fit, reinforce, and brace framing members to suit design requirements.

.3 Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.6 FINISHES

.1 Studs Tracks and Headers: Galvanize to Z180 zinc coating designation.

.2 Accessories: Same finish as framing members.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that rough-in utilities are in proper location.

3.2 ERECTION

.1 Align and secure top and bottom runners at 600 mm on centre.

.2 Place two (2) beads of acoustic sealant between runners and substrate studs and adjacent construction to achieve an acoustic seal.

.3 Achieve an airtight seal between runners and substrate with acoustic sealant in conjunction with Section 07 27 00.

.4 Place two (2) beads of acoustic sealant between studs and adjacent vertical surfaces to achieve an acoustic seal.

.5 Achieve an airtight seal between studs and adjacent vertical surfaces with acoustic sealant in conjunction with Section 07 27 00.

.6 Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

.7 Install studs vertically at 400 mm on centre.

.8 Align stud web openings horizontally.

.9 Secure studs to tracks using fastener method. Do not weld.

.10 Stud Splicing: Not permissible.

.11 Fabricate corners using a minimum of three studs.

.12 Double stud at wall openings, door and window jambs, not more than 50 mm from each side of openings.

.13 Brace stud framing assembly rigid.

.14 Coordinate erection of studs with requirements of door and window frames; install supports and attachments.

.15 Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.

.16 Blocking: Install blocking for support of plumbing fixtures, toilet partitions, toilet accessories, millwork and miscellaneous specialties.

.1 Secure wood blocking to studs.

.17 Extend stud framing to ceiling only. Attach ceiling runner securely to ceiling framing to manufacturer's written instructions.

.18 Refer to Drawings for indication of partitions extending stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

.19 Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

.20 Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

.1 Maximum Variation From True Position: 3 mm in 3 m.

.2 Maximum Variation From Plumb: 3 mm in 3 m.

END OF SECTION

Section 09 30 00
Tiling

Part 1 General

1.1 SECTION INCLUDES

.1 Ceramic tiling.

.2 Porcelain tiling.

.3 Waterproofing membrane.

.4 Uncoupling membrane.

.5 Tile accessories.

.6 Mortar and Grout.

.7 Floor levelling.

1.2 RELATED REQUIREMENTS

.1 Section 04 20 00 - Masonry Units: Masonry wall substrate surface.

.2 Section 07 92 00 - Joint Sealants: Mildew resistant sealant.

.3 Section 09 21 16 - Gypsum Board Assemblies: Gypsum board wall substrate.

1.3 REFERENCE STANDARDS

.1 STD A108/A118/A136.1:2021 American National specifications for the installation of ceramic tile

.2 ANSI A137.1:2022 American national standard specifications for ceramic tile

.3 ANSI A326.3, American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials

.4 ASTM C144-18 Standard specification for aggregate for masonry mortar

.5 ASTM C171-20 Standard specification for sheet materials for curing concrete

.6 ASTM C207-18 Standard specification for hydrated lime for masonry purposes

.7 ASTM C373-18 Standard test methods for determination of water absorption and associated properties by vacuum method for pressed ceramic tiles and glass tiles and boil method for extruded ceramic tiles and non-tile fired ceramic whiteware products

.8 ASTM C627-18 Standard test method for evaluating ceramic floor tile installation systems using the Robinson-type floor tester

.9 ASTM C1353/C1353M-20e1 Standard test method for abrasion resistance of dimension stone subjected to foot traffic using a rotary platform abraser

.10 CAN/CGSB 25.20-95 Surface sealer for floors. (Withdrawn)

.11 STD A3000-18 Cementitious materials compendium

.12 ISO 10545 Series - Ceramic Tiles, Standards for Testing.

.13 ISO 13006:2018 Ceramic tiles - Definitions, classification, characteristics and marking

.14 Handbook for ceramic, glass, and stone tile installation, 2023 edition

.15 2019-2021 Specifications guide 09 30 00 tile installation manual

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate requirements for floor recesses, accounting for mortar bed, bond coat and tile thickness where finished tile surfaces are installed flush with adjacent floor finishes.

.3 Pre-installation Meetings: Convene one (1) week before starting work of this section.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Submit manufacturer's product data for each type of product specified.

.3 Shop Drawings: Indicate tile layout, patterns, edging details, transitions and intersections with dissimilar materials, and movement joints.

.4 Samples for Verification: Submit the following samples for final verification, including full range of colour and texture variations expected.

.1 Tiles: Submit two (2) pieces of each tile specified.

.2 Trims: Submit full size units of each type of trim and accessory in each colour required for installation; minimum 150 mm lengths.

.3 Grout: Submit grout colour samples unless a custom colour to match is specified in this section. Where custom grout colours are specified, refer to item 1.10 - Mock-ups.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Manufacturer's Certificate: Certify that Products meet or exceed the requirements of ANSI A137.1.

.3 Installation Data:

.1 Manufacturer's recommended and special installation requirements.

.2 Written instructions for using adhesives and grouts.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Submit digital copies of TTMAC Maintenance Guide and additional information as follows.

.1 Manufacturer's maintenance data sheets for floor sealers and other non-tile maintenance materials and accessories.

.2 Warning of maintenance practices or materials that may damage or disfigure finished Work.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide 5% of each size, colour, and surface finish of tile specified.

.1 Store in original containers, clearly marked to identify the following:

.1 Manufacturer, stone quarry and distributor's name.

.2 Material series name and stocking number.

.3 Material description, including colour and pattern.

1.9 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Conform to TTMAC Tile Installation Manual.

.3 Quality Assurance Program: Provide specifications and material compatibility submissions to TTMAC as required for Verispec Program; include costs for Verispec Program as part of submitted Bid.

.4 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.5 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and having completed tile installations similar in material, design and extent to this Project and be a member in good standing with TTMAC at time of bidding.

1.10 MOCK-UPS

.1 Refer to Section 01 45 00

.2 Provide 1.2m x 1.2m mock-up for tiles where a custom matching grout colour is specified , with specified trims and edging.

.3 Locate where directed by Prime Consultant.

.4 Accepted mock-up will form the standard of acceptance for the remainder of the Work.

.5 Approved mock-up may remain as part of the Work.

1.11 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver and store packaged materials in original containers with seals unbroken and labels intact.

.3 Store materials to prevent damage or contamination to materials by water, freezing, foreign matter, and other causes; store cementitious materials in a dry area, and raised off floor and ground surfaces.

1.12 SITE CONDITIONS

.1 Ambient Conditions:

.1 Apply tile after completion of Work by other sections, to dry, clean, firm, level and plumb surfaces, free from oil or wax or any other material detrimental to tile adhesion.

.2 Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range.

.3 Maintain temperature range for minimum forty-eight (48) hours before and during installation and until materials are fully set and cured to manufacturer's recommendations.

.4 Maintain adequate ventilation where Work generates toxic gases or where there is a risk of raising relative humidity to levels detrimental to building finishes and assemblies.

Part 2 Products

2.1 DESCRIPTION

.1 System Description:

.1 Porcelain tile, installed on floors and walls, including base where noted on drawings and using thinset application method.

2.2 PERFORMANCE / DESIGN CRITERIA

.1 Tile products manufactured and tested to ANSI A137.1.

.2 Slip Resistance: Minimum dynamic coefficient of friction (DCOF) of 0.42 to ANSI A137.1.

.3 Floor Traffic Load Bearing Performance: ASTM C627, with the following load rating:

.1 Extra Heavy, passing cycles 1 through 14.

.4 Frost Resistance: Maximum water absorption rating of 0.5% or less when measured to ASTM C373 for ceramic and porcelain materials. Submit proof of freeze-thaw stability for tile materials having water absorption higher than 0.5%.

.5 Surface Flatness Tolerances:

.1 Standard Format Floor Tile (100 x 100 mm to 400 x 400 mm): Floor flatness measured to a minimum FF50; equivalent to 3 mm with maximum 2 gaps under a 3 m straightedge measurement.

.2 Large Format Floor Tile (400 x 400 mm and larger): Floor flatness measured to a minimum of FF50; equivalent to 3 mm with maximum 2 gaps under 3 m straightedge measurement.

.3 Wall Tiles: Wall levelling similar to floors tiles having similar sizes listed above.

2.3 PORCELAIN AND CERAMIC TILE MATERIALS

.1 Refer to item 3.9 - Schedules for size, colour and manufacturers/distributors of tile materials. Alternatives to specified tile types will not be permitted.

.2 Floor Tile: Porcelain: ANSI A137.3, described as follows.

.1 Moisture Absorption: 0 to 0.5%.

.2 Chemical Resistance: Pass Rating to ISO 10545.

.3 Slip Resistance: Minimum Dynamic Coefficient of Friction (DCOF) of 0.42 .

.4 Abrasion and Tread Wear Resistance: ASTM C1027, Class 5.

.5 Stain Resistance: ISO 10545, Class 3 or higher.

.6 Scratch Resistance: MOHS 7-8.

.3 Wall Tile: Porcelain: ANSI A137.1, described as follows.

.1 Moisture Absorption: 0 to 0.5% .

.2 Chemical Resistance: ISO 10545, Pass Rating.

.3 Stain Resistance: ISO 10545, Class 3 or higher.

.4 Scratch Resistance: MOHS 5-6.

.4 Wall Tile: Ceramic: ANSI A137.1, described as follows.

.1 Moisture Absorption: 0.5 to 3.0%.

.2 Chemical Resistance: ISO 10545, Pass Rating.

.3 Stain Resistance: ISO 10545, Class 3 or higher.

.4 Scratch Resistance: MOHS 5-6.

2.4 TRIMS AND EDGING

.1 Straight Edge and Transition Strips: anodized extruded aluminum edge strips, profile shape; height as required to suit tile installation; with integral perforated anchoring leg.

.1 Product: JOLLY, manufactured by Schluter Systems.

.2 Product: DILEX-AHK Cove Base, manufactured by Schluter Systems.

.2 Reducer Strips: Purpose made metal extrusion; anodized aluminum type; maximum slope of 1:2.

.1 Product: RENO, manufactured by Schluter Systems.

.3 Prefabricated Movement Joints: Purpose made, Shore A Hardness minimum 35, elasticity +/- 25% when used to TTMAC Tile Installation Manual, Detail C1 for built-up mortar slopes at depressed slabs or detail C2 otherwise.

.1 Product: DILEX, manufactured by Schluter.

2.5 MORTAR AND GROUT MATERIALS

.1 Refer to item 3.9 - Schedules for colour of mortar materials.

.2 Mortar Bed Materials:

.1 For forming floor slopes at depressed slabs.

.2 Portland Cement: CSA-A3000, Type GU.

.3 Hydrated Lime: ASTM C207, Type S.

.4 Sand: ASTM C144, passing 16 mesh.

.5 Latex Additive: As approved.

.6 Potable water.

.3 Self-Levelling Underlayment: Latex-modified, portland cement-based, as recommended by tile-setting manufacturer.

.4 Wall Tile Mortar: ANSI A108/A118/A136.

.1 Dry-Set Portland Cement (interior thin set): Fast-setting, non-sagging water retentive Portland cement mortar.

.5 Floor Tile Mortar: ANSI A108/A118/A136.

.1 Dry-Set Portland Cement (interior thin set): Fast setting water retentive Portland cement mortar, rated for floor traffic load bearing performance as indicated.

.6 Tile Grout: ANSI A108/A118/A136.

.1 Portland Cement Grout - Unsanded: Factory blended latex-portland cement grout, specifically formulated for joints maximum 3 mm wide.

.1 For use at wall tiles.

.2 Epoxy Grout: Water cleanable, chemical resistant, factory blended modified portland cement compound with epoxy additives and hardeners.

.1 For use at floor tiles and at washroom wall tiles.

2.6 ADHESIVE MATERIALS

.1 Organic Adhesive: ANSI A108/A118/A136, Type 1, thin set bond type, non-flammable, water resistant, latex adhesives.

.2 Epoxy Adhesive: ANSI A108/A118/A136, thin set bond type, stain proof, chemical resistant and high temperature resistance.

2.7 ACCESSORIES

.1 Cleavage Membrane:

.2 Uncoupling Membrane: ANSI A108/A118/A136, corrugated polyethylene membrane with anchoring webbing system, thickness as recommended by manufacturer to accommodate in-plane substrate movement.

.1 Product: DITRA, manufactured by Schluter Systems.

.3 Waterproof Membrane: ANSI A108/A118/A136, corrugated polyethylene with anchoring webbing membrane system.

.1 Product: KERDI, manufactured by Schluter Systems.

.4 Cementitious Backing Board: ASTM C1325, reinforced cementitious boards, 13 mm thick, maximum lengths available.

.1 Corner and Joint Tape: Fibre mesh tape, nominal 50 mm wide.

.2 Refer to Section 09 21 16 - Gypsum Board Assemblies.

.5 Joint Sealant: As specified in Section 07 92 00.

.6 Sealer: Meeting or exceeding requirements of CAN/CGSB 25.20, Type as recommended by tile manufacturer.

2.8 CEMENTITIOUS MIXES

.1 Premanufactured Mortars and Grouts: Mix to manufacturers' written instructions.

.2 Site Mixed Mortar and Grout: Site mix proportioned mortar and grout materials to ANSI A108/A118/A136.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Examine surfaces and verify that surfaces are ready to receive tile installation.

.1 Concrete substrates have cured minimum of ninety (90) days to TTMAC requirements.

.2 Substrates are dry; clean; free from oil, waxy films, and curing compounds; and are ready for application of levelling materials.

.3 Grounds, anchors, recessed frames, electrical and mechanical units of Work in or behind tile have been installed.

.4 Joints and cracks in tile substrates are coordinated with tile joint locations.

.3 Verify tile subject to colour variations has been factory blended and packaged. If not factory blended, blend tiles at site before installing.

3.2 PREPARATION

.1 Protect surrounding work from damage or disfiguration.

.2 Vacuum clean surfaces and damp clean.

.3 Seal substrate surface cracks with filler. Level existing substrate surfaces to flatness tolerances specified.

.4 Install backing board over metal studs to board manufacturer's written instructions. Tape joints and corners.

3.3 INSTALLATION

.1 Install tile to TTMAC Tile Installation Manual.

.2 Request tile pattern from Prime Consultant if not detailed on drawings. Do not interrupt tile pattern through openings.

.3 Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions:

.4 Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align wall, base and floor joints unless otherwise detailed.

.5 Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or grout.

.6 Adjust tile layout to minimize tile cutting. Maintain minimum tile width of one-third unit size unless indicated otherwise on Drawings.

.7 Form internal angles coved and external angles bullnosed if specified tile type includes options for corner tiles.

.8 Sound tile after setting. Replace hollow sounding units.

.9 Keep control joints joints free of adhesive or grout. Apply sealant to joints.

.10 Allow tile to set for a minimum of forty-eight (48) hours prior to grouting.

.11 Install grout to TTMAC Tile Installation Manual and manufacturer's written instructions.

.12 Apply sealant to junction of tile and dissimilar materials and planes.

.13 Install prefabricated edge strips and movement joints at locations indicated or where exposed edge of floor tile meets different flooring materials and exposed substrates.

.14 Protect exposed edges of floor tile with properly sized transition strips; at uneven transitions between 6 mm and 13 mm, use sloped reducer strips.

3.4 INSTALLATION - ACCESSORIES

.1 Membranes:

.1 Install membrane to ANSI A108/A118/A136 and manufacturer's written instructions; lap and seal watertight edges and ends.

.2 Movement Joints: Install control joints where indicated on Drawings, to TTMAC Detail 301MJ-2012/2013; keep control and expansion joints free of setting and grouting materials.

3.5 LIPPAGE TOLERANCES

.1 Field Verification of Finished Installation: To TTMAC Tile Installation Manual lippage limits as follows:

.2

TILE TYPE	TILE SIZE	JOINT WIDTH	ALLOWABLE LIPPAGE
Glazed Wall/Mosaics	25 x 25 mm to 150 x 150 mm	1.5 mm to 3 mm	0.78 mm
Stone or Quarry	150 x 150 mm to 200 x 200 mm	6 mm or greater	1.56 mm
Pressed Floor/Porcelain	All	1.5 mm to less than 6 mm	.78 mm
Pressed Floor/Porcelain	All	6 mm	1.56 mm

3.6 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection.

.2 Provide inspection of the following:

.1 Tiles are set flush and level with adjacent tiles, meeting lippage requirements.

.2 Identify broken, cracked, damaged or hollow sounding tiles.

.3 Accessories are correctly installed.

.4 Grouting and sealant are correctly installed.

.5 Installation is complete to TTMAC.

3.7 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Clean tile and grout surfaces with manufacturer's recommended cleaning methods.

3.8 PROTECTION

.1 Protect finished areas from traffic until setting materials have sufficiently cured to TTMAC requirements.

.2 Protect finished floor areas from foot and wheel traffic from floors for a minimum of seventy-two (72) hours after completion of grouting.

3.9 SCHEDULES

.1 Ceramic tile type **CT1**

.1 Series: 'CESI I COLORI'

.2 Colour: 'Indaco'.

.3 Size: 10mm x 10mm

.4 Grout colour: Mapei 5117 'Pure White'

.5 Distributor: Ciot. Contact: Jackie Kraizer, jkraizer@ciot.com, (416)785-8080 x3202.

.2 Porcelain tile type **PT1**

.1 Series: 'Pavimenti Rock'

.2 Colour: 'Bianco Matte'

.3 Size: 30cm x 60cm

.4 Grout colour: Mapei 5117 'Pure White'

.5 Distributor: Stone Tile International. Contact: Nancy Brenner, (416) 515-9000 x3232.

.3 Porcelain tile type **PT2**

.1 Series: 'Pavimenti Rock'

.2 Colour: 'Nebbia Matte'

.3 Size: 60cm x 60cm

.4 Grout colour: Mapei 5107 'Iron'

.5 Distributor: Stone Tile International. Contact: Nancy Brenner, (416) 515-9000 x3232.

.4 Porcelain tile type **PT3**

.1 Series: 'Medley'

.2 Colour: 'Pop White Matte'

.3 Size: 60cm x 60cm

.4 Grout colour: Mapei 5093 'Warm Grey'

.5 Distributor: Stone Tile International. Contact: Nancy Brenner, (416) 515-9000 x3232.

END OF SECTION

Section 09 51 13
Acoustical Panel Ceilings

Part 1 General

1.1 SECTION INCLUDES

.1 Suspended metal grid ceiling system and perimeter trim.

.2 Acoustic tile.

.3 Seamless acoustic ceiling and wall system.

1.2 RELATED REQUIREMENTS

.1 Section 09 91 00 - Painting.

.2 Division 21 - Fire Suppression: Sprinkler heads in ceiling system.

.3 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Air diffusion devices in ceiling system.

.4 Division 26 – Electrical: Light fixtures in ceiling system.

.5 Division 27 - Communications: Speakers in ceiling system.

.6 Division 28 – Electronic Safety and Security: Fire alarm components in ceiling system.

1.3 REFERENCE STANDARDS

.1 ASTM C635/C635M-22 Standard specification for manufacture, performance, and testing of metal suspension systems for acoustical tile and lay-in panel ceilings

.2 ASTM C636/C636M-19 Standard practice for installation of metal ceiling suspension systems for acoustical tile and lay-in panels

.3 ASTM C665-23 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing

.4 ASTM E580/E580M-22 Standard practice for installation of ceiling suspension systems for acoustical tile and lay-in panels in areas subject to earthquake ground motions

.5 ASTM E1264-23 Standard classification for acoustical ceiling products

.6 CAN/ULC-S702 - Standard for Mineral Fibre Thermal Insulation for Buildings.

.7 AWCCBC (Association of Wall and Ceiling Contractors of British Columbia).

.8 ULC - Fire Resistance Directory.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Sequencing:

.1 Sequence work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

.2 Install acoustic units after interior wet work is dry.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on metal grid system components and acoustic units.

.3 Shop Drawings:

.1 Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

.4 Samples:

.1 Submit one (1) samples, 150x150mm in size, illustrating material and finish of acoustic units.

.2 Submit one (1) samples each, 300 mm long, of suspension system and trim components.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide 5% of total acoustic unit area of extra tile to Owner.

1.9 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Conform to AWCCBC requirements.

.3 Grid Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.4 Acoustic Unit Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain uniform temperature of minimum 16 degrees C, and maximum humidity of 40% prior to, during, and after acoustic unit installation.

Part 2 Products

2.1 MANUFACTURERS - SUSPENSION SYSTEM

.1 USG/CGC; Product: 'DXT Centricitee'.

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for combustibility requirements for materials, fire rated assembly where shown on drawings, and seismic restraint of non-structural building components if required in this section.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Suspension System: Maximum deflection of 1:360 for acoustic ceiling system including integral mechanical and electrical components.

2.4 MATERIALS

.1 Non-fire Rated Grid: ASTM C635/C635M, interlocking.

.2 Grid Materials: Commercial quality cold rolled steel with galvanized coating.

.3 Exposed Grid Surface Width: 14mm (9/16 inch).

.4 Grid Finish: Colour White.

.5 Suspension Wires: Galvanized soft-annealed, mild steel, to suit application thickness.

.6 Support Channels and Hangers: Galvanized steel; size and type to suit application, ceiling system flatness requirement specified.

.7 Accessories: Stabilizer bars, splices and perimeter moldings required for suspended grid system.

2.5 MANUFACTURERS - ACOUSTIC UNIT MATERIALS

.1 USG/CGC; Product: 'Mars' acoustic tile.

.2 Armstrong World Industries; Product: 'ACOUSTIBuilt' seamless acoustical ceiling and wall system.

.3 Substitutions: Refer to Section 01 23 00 - Alternatives.

2.6 MATERIALS

.1 Acoustic Tile: ASTM E1264, conforming to the following:

.1 Size: Refer to item 3.7 - Schedule below.

.2 Thickness: 19mm (3/4").

.3 Composition: Mineral fibre.

.4 NRC Range: 0.75

.5 Fire Hazard Classification: Class A.

.6 Joint: Rabbeted.

.7 Edge: FLB.

.8 Surface Colour: White.

.2 Seamless acoustical ceiling and wall system: ASTM E84 and CAN/ULC S102, conforming to the following:

.1 Size: 72" x 48".

.2 Thickness: 7/8".

.3 Composition: Wet-formed mineral fibre.

.4 NRC Range: 0.80.

.5 Fire Hazard Classification: Class A.

.6 Edge: Tapered.

.7 Surface Colour: White.

.8 Surface Finish: Fine.

2.7 ACCESSORIES

.1 Acoustic Sealant: For perimeter moldings, as specified in Section 07 92 00.

.2 Gaskets (for perimeter moldings): Closed cell rubber sponge tape.

.3 Touch-up Paint: Type and colour to match acoustic and grid units.

.4 Fasteners and adhesive for seamless acoustical wall and ceiling system as per manufacturer's specifications.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

.1 Install suspension system to ASTM C636/C636M, and as supplemented in this section.

.2 Install ceiling suspension systems forming a part of a fire resistance rated assembly in accordance with ULC requirements as listed in this Section.

.3 Install ceiling suspension systems requiring seismic restraint to ASTM E580/E580M.

.4 Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

.5 Lay out system as shown on drawings.

.6 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

.7 Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

.8 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

.9 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.

.10 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.

.11 Do not eccentrically load system or produce rotation of runners.

.12 Perimeter Molding:

.1 Install edge molding at intersection of ceiling and vertical surfaces with continuous gasket.

.2 Use longest practical lengths.

.3 Mitre corners.

.4 Provide concealed molding at junctions with other interruptions.

3.3 INSTALLATION - ACOUSTIC CEILING UNITS

.1 Install acoustic units to manufacturer's written instructions.

.2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

.3 Install units after above ceiling work is complete.

.4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.5 Cutting Acoustic Units:

.1 Cut to fit irregular grid and perimeter edge trim.

.2 Cut square reveal or tegular edges to field cut units.

.3 Double cut and field paint exposed edges of tegular units.

.6 Where bullnose concrete block corners or round obstructions occur, provide preformed closures to match perimeter molding.

3.4 ERECTION TOLERANCES

.1 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.

.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 SCHEDULE

.1 Type **ACT1:** 610x1220mm (24x48") tiles.

END OF SECTION

Section 09 51 14
Acoustical Fabric-Faced Panels

Part 1 General

1.1 SECTION INCLUDES

.1 Acoustic fabric-faced panels for walls

1.2 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies: Attachments

.2 Section 09 91 00 - Painting.

1.3 REFERENCES

.1 CAN/ULC S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4 SUBMITTALS

.1 Samples: Submit samples in accordance with Section 01 30 00.

.2 Submit 300x300mm samples of each type of panel with specified fabric finish.

.3 Submit samples of mounting hardware.

1.5 QUALITY ASSURANCE

.1 Qualifications: Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the product manufacturers.

1.6 MAINTENANCE

.1 Maintenance Instructions: Submit maintenance instructions in accordance with Section 01 78 00.

1.7 WARRANTY

.1 Manufacturers: All materials supplied shall be guaranteed against manufacturing defects for one (1) year.

.2 Contractor: All work shall be guaranteed for one (1) year from final acceptance of completed work.

Part 2 Products

2.1 MANUFACTURERS

.1 Acoustical Fabric-Faced Panel system approved manufacturers:

.1 Sound Solutions; Product: 'Avanti' panels

.2 Spectra-Con Group' Product: 'G&S Acousti-Tack' panels

.2 Alternatives: Refer to Section 01 23 00 - Alternatives.

2.2 MATERIALS

.1 Hard-face fiberglass acoustic wall panels:

.1 Thickness: 28mm

.2 Size: As shown on drawings

.3 Composition: Panels shall be two piece construction using 96 kg/m³ (6 lb/ft³) fibreglass acoustic board with a 3 mm (1/8”) thick high density 288 kg/m³ (18 lb/ft³) fibreglass bonded to the core.

.4 Fabric finish shall be from Duvaltex ; 'Guilford of Maine' collection; pattern FR701-2100. Fabric to be bonded to the face of the panel, wrapped around the edges and returned to the back of the panel.

.1 Type **AP1**; colour: to be selected by Architect

.5 Panels shall have a Noise Reduction Coefficient (NRC) of 0.85.

.6 Panels to be installed using 'Z-rail' system supplied by the panel manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work.Notify Consultant in writing of any conditions which would be detrimental to the installation.Commencement of work implies acceptance of previously completed work.

3.2 APPLICATION

.1 Provide acoustic wall treatment materials on prime painted gypsum board walls where indicated.

.2 Ensure application is by approved experienced installers

.3 Preparation of surfaces and handling, storing and method of application of wall covering materials and adhesives shall be as directed by manufacturers and approved by the applicators.

3.3 CLEANING

.1 Clean adjacent surfaces, which have been soiled or otherwise marred, to completely remove evidence of material causing same.

END OF SECTION

Section 09 65 00
Resilient Flooring

Part 1 General

1.1 SECTION INCLUDES

.1 Resilient sheet flooring.

.2 Resilient base.

.3 Resilient stair treads, nosings, risers and skirting.

.4 Cementitious floor leveler.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

.2 Section 10 10 00 - Miscellaneous Specialties: Tactile warning studs.

.3 Division 26 – Electrical: Electrical floor cover plate with recess for resilient flooring.

1.3 REFERENCE STANDARDS

.1 ASTM E84-23c Standard test method for surface burning characteristics of building materials

.2 ASTM F1861-21 Standard specification for resilient wall base

.3 ASTM F2034-18 Standard specification for sheet linoleum floor covering

.4 ASTM F2169-15(2020) Standard specification for resilient stair treads

.5 CAN/ULC-S102.2 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.6 CAN/CSA-A5-M93 Portland Cement

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, and patterns and colours available.

.3 Shop Drawings: Indicate seaming plan and patterns.

.4 Samples:

.1 Submit two (2) samples, 150x150mm in size illustrating colour and pattern for each floor material for each colour specified.

.2 Submit two (2) long samples of stair and base material for each colour specified.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention and subfloor preparation requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide 5% of flooring, and 10 linear metres of base and stair materials of each material specified.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by the manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Protect roll materials from damage by storing on end.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Store materials for three (3) days prior to installation in area of installation to achieve temperature stability.

.2 Maintain ambient temperature required by adhesive manufacturer three (3) days prior to, during, and twenty-four (24) hours after installation of materials.

Part 2 Products

2.1 MANUFACTURERS - SHEET FLOORING

.1 Tarkett; Product: 'IQ Optima'.

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for flame/smoke rating requirements of Class A to CAN/ULC-S102.2.

2.3 MATERIALS - SHEET FLOORING

.1 Refer to item 3.7 - Schedules for colours.

.2 Vinyl Sheet without Backing: ASTM F1913.

.1 Colour and pattern through total thickness.

.2 Total Thickness: 2mm.

.3 Sheet Width: 2m.

2.4 MATERIALS - BASE

.1 Manufacturers:

.1 Tarkett; Product: Johnsonite Wall Base.

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

.2 Base: ASTM F1861, Type TS vulcanized rubber; top set coved; premoulded external corners:

.1 Height: 100mm, or 150mm where noted on drawings.

.2 Thickness: 3 mm thick.

.3 Length: 3000 mm sections.

.3 Base Accessories: Premoulded end stops and external corners, of same material, size, and colour as base.

2.5 MATERIALS - FLOOR LEVELER

.1 Manufacturers:

.1 Mapei; Product: 'Floor Leveler Plus'

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

.2 Portland cement-based to CAN/CSA-A5-M93 Portland Cement with the following properties:

.1 Compressive strength: 18.6MPa (2,700psi) after 7 days; 29.0MPa (4,200psi) after 28 days.

.2 Pull-out strength: 2.07 MPa (300psi) after 7 days

.3 Density: 2.1kg/L (128lbs/cu.ft.)

2.6 ACCESSORIES

.1 Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

.2 Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

.3 Edge Strips: Vinyl, manufactured by Tarkett:.

.1 Linoleum to floor transition: SSR-XX-B; colour by Architect.

.2 Carpet to floor transition: CTA-XX-J; colour by Architect.

.3 Tile to linoleum transition: CTA-XX-K; colour by Architect.

.4 Tile to carpet transition: CTA-XX-L; colour by Architect.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify concrete floors are dry to a maximum moisture content of 7%, and exhibit negative alkalinity, carbonization, or dusting.

.3 Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

.1 Prepare sub-floor according to manufacturer's written recommendations to ensure proper adhesion of resilient athletic flooring system.

.2 Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

.3 Apply cementitious floor leveler where noted on drawings to achieve smooth, flat, hard surface.

.4 Prohibit traffic until filler and/or floor leveler is cured.

.5 Vacuum clean substrate.

3.3 INSTALLATION - FLOOR LEVELER

.1 Floor leveler shall be installed as per manufacturer's written instructions.

3.4 INSTALLATION - SHEET FLOORING

.1 Install sheet flooring to manufacturer's written instructions.

.2 Spread only enough adhesive to permit installation of materials before initial set.

.3 Set flooring in place, press with heavy roller to attain full adhesion.

.4 Lay flooring with joints and seams parallel to building lines in accordance with seaming plan. If seaming plan is not provided install to produce minimum number of seams.

.5 Install sheet flooring parallel to length of room. Provide minimum of one third (1/3) full roll width. Double cut sheet; provide continuously heat welded seal.

.6 Terminate flooring at centreline of door openings where adjacent floor finish is dissimilar.

.7 Install edge strips at unprotected or exposed edges, and where flooring terminates.

.1 Secure resilient strips by adhesive.

.8 Turn up flooring to form base. Back floor and wall junction with cant strip. Provide cap strip to terminate base.

.9 Inside and outside corners turned-up cove bases to be mitred.

.10 Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

.11 Install flooring in pan type floor access covers. Maintain floor pattern.

3.5 INSTALLATION - BASE

.1 Fit joints tight and vertical. Maintain minimum measurement of 3000 mm between joints.

.2 Mitre internal corners. At external corners, use premoulded units. At exposed ends, use premoulded units.

.3 Install base on solid backing. Bond tight to wall and floor surfaces.

.4 Scribe and fit to door frames and other interruptions.

3.6 INSTALLATION - STAIR COVERINGS

.1 Install stair nosing, treads and risers in one (1) piece for full width and depth of tread.

.2 Install stair skirting configured tight to stair and stringer profile.

.3 Adhere over entire surface. Fit accurately and securely.

3.7 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Remove access adhesive from floor, base, and wall surfaces without damage.

.3 Clean, seal, and wax floor and base surfaces in accordance with manufacturer's written instructions.

3.8 PROTECTION

.1 Prohibit traffic on floor finish for forty-eight (48) hours after installation.

3.9 SCHEDULES

.1 Resilient flooring type **RES1:** #807 'Dark Sand CB'

.2 Resilient flooring type **RES2:** Colour by Architect from manufacturer's standard range.

.3 Resilient wall base type **R1**: #32 'Pebble WG'

.4 Resilient wall base type **R2**: #63 'Burnt Umber B'

.5 Resilient wall base type **R3**: Colour by Architect from manufacturer's standard range.

END OF SECTION

Section 09 68 13
Tile Carpeting

Part 1 General

1.1 SECTION INCLUDES

.1 Carpet tile.

.2 Accessories.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

.2 Section 09 65 00 - Resilient Flooring: Base finish.

1.3 REFERENCE STANDARDS

.1 ASTM D2859-16 Standard test method for ignition characteristics of finished textile floor covering materials

.2 ASTM E84-24 Standard test method for surface burning characteristics of building materials

.3 CAN/ULC-S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 CAN/ULC-S102.2 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.5 CRI 104 Carpet installation standard for commercial carpet

.6 NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on specified products, describing performance, physical characteristics; sizes, patterns, colours available, and method of installation.

.3 Shop Drawings: Indicate layout of joints and pattern.

.4 Samples: Submit two (2) carpet tiles illustrating colour and pattern design for each carpet colour selected.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements indicating special procedures, perimeter conditions requiring special attention.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide 5% carpet tiles of each colour and pattern selected.

1.8 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 SITE CONDITIONS

.1 Ambient Conditions:

.1 Store materials for three (3) days prior to installation in area of installation, to achieve temperature stability.

.2 Maintain minimum 21 degrees C ambient temperature three (3) days prior to, during and twenty-four (24) hours after installation materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Forbo Flooring Systems; Product: Flotex.

.2 Substitutions: Refer to Section 01 23 00.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for carpet flammability requirements of the Ontario Building Code in accordance with CAN/ULC-S102.2.

.2 Verify applicability of the following tests to project requirements and requirements of authority having jurisdiction.

.3 Conform to ASTM D2859 for surface flammability ignition test.

2.3 CARPET TILE

.1 Carpet Tile: 'Flotex' carpet, manufactured in one colour dye lot.

.1 Description: Flocked high performance carpet tile with 100% nylon wear layer, intermediate fibreglass layer and a recycled vinyl cushioned backing.

.2 Tile Size: Nominal 50xm x 50cm.

.3 Thickness: 5.3mm

.4 Colour: Refer to Section 3.6 Schedules.

2.4 FLOOR LEVELER

.1 Manufacturers:

.1 Mapei; Product: 'Floor Leveler Plus'

.2 Substitutions: Refer to Section 01 23 00 - Alternatives.

.2 Portland cement-based to CAN/CSA-A5-M93 Portland Cement with the following properties:

.1 Compressive strength: 18.6MPa (2,700psi) after 7 days; 29.0MPa (4,200psi) after 28 days.

.2 Pull-out strength: 2.07 MPa (300psi) after 7 days

.3 Density: 2.1kg/L (128lbs/cu.ft.)

2.5 ACCESSORIES

.1 Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

.2 Primers and Adhesives: Recommended by carpet manufacturer.

.3 Edge Strips: Resilient Edge Strips: Strips shall be homogeneous vinyl or rubber composition with a tapered edge no less than 1” wide, coloured to match flooring or as selected by Architect from standard colours available.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that surfaces are smooth and flat with maximum variation of 6 mm in 3 m, and are ready to receive work.

.3 Verify concrete floors are dry to a maximum moisture content of 7%; and exhibit negative alkalinity, carbonization, or dusting.

3.2 PREPARATION

.1 Prepare sub-floor to CRI-104.

.2 Sub-floor to receive flooring must be structurally sound, rigid, smooth, flat, clean, and permanently dry. The substrates must be free of all foreign materials including, but not limited to, dust, solvent, paint, wax, oils, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitance, mold, mildew, and other foreign materials that might affect the rate of moisture dissipation from the concrete, the adhesion of flooring to the concrete or cause a discoloration of the flooring from below.

.3 Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

.4 Vacuum clean substrate.

3.3 INSTALLATION

.1 Install carpet tile, accessories and adhesive to manufacturer's written instructions.

.2 Install carpet tile accessories and adhesive in accordance with manufacturer's written instructions.

.3 Integrate and blend carpet from different cartons to ensure minimal variation in colour match.

.4 Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

.5 Lay carpet tile to ashlar pattern, tile direction alternating to next unit, set parallel to building lines.

.6 Locate change of colour or pattern between rooms under door centerline.

.7 Adhere carpet tile to substrate as per manufacturer's written instructions.

.8 Place carpet tile dry over substrate.

.9 Bind cut edges where not concealed by edge strips.

3.4 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Remove excess adhesive without damage, from floor, base, and wall surfaces.

.3 Cleaning procedures as per manufacturer's written instructions.

.4 Clean and vacuum carpet surfaces.

3.5 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Do not permit traffic over unprotected floor surface.

3.6 SCHEDULES

.1 Carpet tile type **CPT1**: 'Modular Montage' series, 147001 'Boreal'

END OF SECTION

Section 09 91 00
Painting

Part 1 General

1.1 SECTION INCLUDES

.1 Surface preparation.

.2 Painting.

1.2 RELATED REQUIREMENTS

.1 Section 04 20 00 - Unit Masonry: Painted concrete block.

.2 Section 06 40 00 - Architectural Woodwork: Clear finish at solid wood and wood veneer components.

.3 Section 08 14 16 - Flush Wood Doors: Clear finish at solid wood and wood veneer components.

1.3 REFERENCE STANDARDS

.1 Master Painters Institute (MPI) Architectural Specification Manual (ASM)

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other Work having a direct bearing on Work of this section.

.3 Scheduling:

.1 Schedule painting operations to prevent disruption of and by other trades.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Submit Product data on all specified finishing products.

.2 Submit two (2) copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Samples:

.1 Submit two (2) sample draw-downs of each specified colour and sheen specified.

.2 Submit product data and instructions for each paint and coating product to be used.

.3 Identify each sample as to Project, finish,formula, colour name, number, sheen name and gloss values, date and name of Contractor and painting Subcontractor.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements including special surface preparation procedures and substrate conditions requiring special attention.

.3 Schedule:

.1 If requested, submit Work schedule for various stages of Work when painting occupied areas for Consultant's review and Owner's approval.

.2 Submit schedule minimum of forty-eight (48) hours in advance of proposed operations.

.3 Obtain written authorization from Owner for changes in Work schedule.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Record Documentation: Upon completion, provide itemized list of products used including the following:

.1 Manufacturer's name.

.2 Product name, type and use.

.3 Colour coding number.

.4 Manufacturer's Material Safety Data Sheets (MSDS).

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide properly packaged maintenance material as follows.

.1 1 gallon of each coating type and colour to Owner.

.2 Label each container with colour, type, texture and room locations in addition to manufacturer's label.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.2 Installer Qualifications: Qualified journey persons or apprentices, provided they work under direct supervision of qualified journey person in accordance with trade regulations.

.3 Conform to MPI Painting Manual requirements for materials, preparation and workmanship.

.4 Paint Products: Paint manufacturers and paint Products listed under the Approved Product List section of the MPI Painting Manual.

.5 Inspection and Testing: Painting and decorating Work to be inspected by paint inspection agency (inspector) acceptable to local MPI Accredited Quality Assurance Association.

.1 Notify Prime Consultant in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate condition or preparation.

.6 Special Systems: Where special painting system applications are used, provide manufacturer's certification of all surfaces and conditions for specific paint or coating system application including inspection and approval of their system application at no additional cost to Owner.

1.10 MOCK-UPS

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide a 600x600mm mock-ups of all paint colours for review by Architect prior to proceeding with the work.

.3 Approved mock-up will be the acceptable standard of finish quality and workmanship for all painting Work.

.4 Approved mock-up may remain as part of the Work.

1.11 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver products to site in sealed and labeled containers showing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.3 Store paint materials at minimum ambient temperature of 7 degrees C and a maximum of 32 degrees C, in dry, ventilated area and as required by manufacturer's written instructions.

.4 Provide adequate fireproof storage lockers and warnings as required by authorities having jurisdiction for storing toxic and volatile/explosive/flammable materials.

1.12 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not perform painting or decorating Work when ambient air and substrate temperatures are below 10 degrees C for both interior and exterior work, or as required by paint product manufacturer.

.2 Do not perform painting or decorating Work when relative humidity is above 85% or when dew point is less than 3 degrees C variance between the air/surface temperature required by paint Product manufacturer.

.3 Provide suitable weatherproof covering and sufficient heating facilities to maintain minimum ambient air and substrate temperatures for twenty-four (24) hours before, during and after paint application.

.4 Do not perform painting and decorating Work when maximum moisture content of substrate exceeds:

.1 Wood: 15%.

.2 Plaster and Gypsum Wallboard: 12 %.

.3 Masonry, Concrete, and Concrete Unit Masonry: 12%.

.4 Concrete Floors: 8%.

.5 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.

.6 Test concrete, masonry and plaster surfaces for alkalinity as required.

.7 Provide minimum lighting level of 323 lux is provided on surfaces to be painted or decorated.

1.13 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials in accordance with Provincial authorities having jurisdiction.

.2 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.3 Place non-reusable materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce contaminants entering waterways, sanitary/storm drain systems or into the ground, adhere to the following procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Dry out empty paint cans prior to disposal or recycling.

.6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.5 Set aside and protect surplus and uncontaminated finish materials and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.14 WARRANTY

.1 Provide local MPI Accredited Quality Assurance Association 1 year guarantee warranting that Work has been performed in accordance with MPI Painting Manual.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for flame and smoke rating requirements for finishes, storage, mixing, application and disposal of paint and related waste materials.

2.2 MATERIALS

.1 Use only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers) listed in the latest edition of the MPI Approved Product List (APL) on this project.

.2 Ancillary materials such as linseed oil, shellac, thinners, solvents to be of highest quality product and provided by an MPI listed manufacturer, and compatible with paint materials being used.

.3 Where required, use only materials having a minimum MPI "Environmentally Friendly" E3 rating based on VOC (EPA Method 24) content levels.

.4 Where indoor air quality (odour) is an issue, use only MPI listed materials having a minimum E3 rating.

.5 Where possible, all materials to be lead and mercury free with low VOC content.

.6 Provide all material for each system from a single manufacturer.

.7 Fire Hazard: Flame spread and smoke developed ratings in accordance with applicable code.

.8 Patching Materials: Latex filler.

.9 Fastener Head Cover Materials: Latex filler.

2.3 FINISH AND COLOUR

.1 Finish: To MPI Premium Grade finish requirements.

.2 Colours: Refer to Schedule - Paint Colours at the end of this section.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as the sheen rating of applied paint with the following values: Gloss Level Description Gloss @ 60 degrees Sheen @ 85 degrees G1 Matte Finish (flat) 0 to 5 10 max. G2 Velvet-Like Finish 0 to 10 10 to 35 G3 Eggshell Finish 10 to 25 10 to 35 G4 Satin-Like Finish 20 to 35 35 min. G5 Traditional Semi-Gloss Finish 35 to 70 G6 Traditional Gloss 70 to 85 G7 High Gloss Finish More than 85

.2 Gloss/sheen schedule as follows:

Item	Gloss/sheen level
Woodwork	To be determined by Architect
Gypsum board and plaster walls	G3
Gypsum board and plaster ceilings	G1
Concrete masonry	G3
High traffic metal surfaces including doors, frames, guards, handrails etc. Applies to both galvanized and un-galvanized metals.	G3

2.5 MANUFACTURERS AND PRODUCTS

.1 Paint Manufacturers:

.1 Benjamin Moore.

.1 'Ultra Spec 500' series

.2 'HP3420' (epoxy)

.2 Sherwin Williams.

.1 'ProMar 200' series

.2 'Pro Industrial' Pre-Catalyzed Waterbased Epoxy Eg-Shel K45-2150 Series

.3 Substitutions: Not permitted.

.2 Block Fillers:

.1 Benjamin Moore.

.1 'Ultra Spec 500' series

.2 Sherwin Williams.

.1 'ProMar 200' series

.2 'Pro Industrial Block Filler' (epoxy)

.3 Traffic Coatings:

.1 ICI Paints 460000 Line Quick Alkyd Lead Free Traffic Paint.

.2 Substitutions: Section 01 23 00 - Alternatives.

2.6 INTERIOR PAINT SYSTEMS

.1 Paint interior surfaces in accordance with the following MPI Painting Manual requirements.

.2 Refer to to section 05 00 00 - Metal Fabrications for powder coatings.

.3 Notwithstanding the requirements of the Master Painters Institute, all paint systems shall consist of at least one primer coat and two finish coats.

.4 Concrete Masonry Unit

.1 INT 4.2J: Epoxy-modified latex finish, refer to gloss/sheen schedule 2.4.2 for finish.

.5 Structural Steel and Metal Fabrications: (columns, beams, joists, etc.).

.1 INT 5.1N: Water based light industrial (over epoxy primer), refer to gloss/sheen schedule 2.4.2 for finish.

.6 Galvanized Metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.).

.1 INT 5.3M: High performance architectural latex, refer to gloss/sheen schedule 2.4.2 for finish.

.7 Plaster and Gypsum Board: (gypsum wallboard and textured finishes).

.1 INT 9.2M: Institutional low odor/low VOC, refer to gloss/sheen schedule 2.4.2 for finish.

2.7 EXTERIOR PAINT SYSTEMS

.1 Paint exterior surfaces in accordance with the following MPI Painting Manual requirements.

.2 Refer to to section 05 00 00 - Metal Fabrications for powder coatings.

.3 Notwithstanding the requirements of the Master Painters Institute, all paint systems shall consist of at least one primer coat and two finish coats.

.4 Structural Steel and Metal Fabrications:

.1 EXT 5.1S: Epoxy (over self-priming epoxy).

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

.3 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

.4 Test shop applied primer for compatibility with subsequent cover materials.

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

3.2 PREPARATION

.1 Prepare surfaces in accordance with MPI requirements.

.2 Remove and store or mask miscellaneous hardware and surface fittings such as electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to painting. Clean and replace upon completion of painting Work in each area. Remove doors before painting to paint bottom and top edges and re-hung.

.3 Protect adjacent surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, from painting operations with drop cloths, shields, masking, templates, or other suitable protective means.

.4 Correct defects and clean surfaces which affect work of this section. Start of finish painting of defective surfaces indicates acceptance of substrate and making good defects will be at no cost to Owner.

.5 Confirm preparation and primer used with fabricator of steel items.

.6 Seal with shellac and seal marks which may bleed through surface finishes.

.7 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

.8 Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

.9 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

.10 Concrete Floors: Remove contamination; acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

.11 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

.12 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

.13 Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a

solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

.14 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

.15 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

.16 Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

.17 Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

.18 Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

.1 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.

.2 Apply products to adequately prepared surfaces, within moisture limits and acceptable environmental conditions.

.3 Apply paint finish in areas where dust is no longer being generated or when wind or ventilation conditions will not affect quality of finished surface.

.4 Apply each coat to uniform finish.

.5 Tint each coat of paint progressively lighter to enable confirmation of number of coats.

.6 Unless otherwise approved, apply a minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.

.7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm.

.8 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.9 Allow applied coat to dry before next coat is applied.

.10 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

.11 Continue paint finish behind wall-mounted items such as chalk and tack boards.

.12 Prime concealed surfaces of interior and exterior woodwork with primer paint.

.13 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25% with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to Mechanical and Electrical specifications for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Unless otherwise specified, paint all unfinished conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces in the following areas:

.1 Exposed-to-view exterior and interior areas.

.2 High humidity interior areas.

.3 Boiler room, mechanical and electrical rooms.

.3 In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish; touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Paint inside of ductwork and convector and baseboard heating cabinets where visible behind louvers, grilles and diffusers for a minimum of 460 mm or beyond sight line, whichever is greater, with primer and one (1) coat of matt black (non-reflecting) paint.

.7 Paint the inside of light valances gloss white.

.8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.9 Paint red or band all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.

.10 Paint yellow or band all natural gas piping in accordance with mechanical specification requirements.

.11 Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Paint exterior steel electrical light standards. Do not paint outdoor transformers and substation equipment.

.13 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.5 CLEANING

.1 Section 01 74 10: Cleaning installed work.

.2 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE - PAINT COLOURS

.1 Paint colours as follows:

Drawing Tag	Manufacturer	Colour Number	Colour Name
PTD1	Benjamin Moore	858	Athena
PTD2	Benjamin Moore	2121-70	Chantilly Lace
PTD3	Benjamin Moore	2039-70	Refreshing Teal
PTD4	Benjamin Moore	2058-20	Slate Teal
PTD5	Benjamin Moore	2134-30	Iron Mountain
PTD6	Benjamin Moore	CC-34	Jester

END OF SECTION

Section 10 10 00
Miscellaneous Specialties

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements for solid wood blocking in stud partitions.

.2 Specifications for miscellaneous specialties.

1.2 RELATED SECTIONS

.1 Section 09 65 00 - Resilient Flooring: for installation of tactile warning studs

.2 Division 26 - Electrical: For products requiring electrical connections.

1.3 ALTERNATIVES

.1 Products specified under this section shall be the standard of acceptance. Refer to section 01 23 00 - Alternatives.

.2 Alternatives will not be accepted where noted in this section.

1.4 DEFINITIONS

.1 Delegated Design Professional: The specialist or supporting design professional contracted to the contractor, fabricator or manufacturer to design and/or review specific building components or sub-components, and provide Shop Drawings and Delegated Design Submittals to meet the requirements of authorities having jurisdiction.

1.5 SUBMITTALS FOR REVIEW

.1 Submit manufacturer documentation for each product including dimensionned drawings of the specified model, specified options, mounting hardware and finishes.

.2 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.3 Submit duplicate samples of each specified colour and finish for review. Where colours and finishes are noted as 'selected by Architect', submit manufacturer's range of samples as noted.

.4 Where a custom colour or finish is noted submit duplicate samples of the custom finish on the same base material as the specified product for review.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Protect products from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store products off floor, in accordance with manufacturer's recommendations. Products shall remain packaged or crated until time of installation.

.3 Once installed, protect products from scratches and other damage with traps, adhesive film or other means.

1.7 WARRANTY

.1 All products specified in this section shall be supplied with a minimum 1 year manufacturer's warranty unless otherwise noted.

Part 2 Products

2.1 SOLID WOOD BLOCKING

.1 Materials per Section 06 10 53 - Miscellaneous Rough Carpentry.

.2 Incorporate solid wood blocking reinforcing, fastenings and anchorage required products.

.3 Solid wood blocking for stud walls shall consist of a minimum of two (2) layers of 19mm plywood fastened into the stud cavity to the dimensions recommended by the manufacturer. Should there be no recommended dimensions, solid wood blocking shall be a minimum of 300mm high spanning full stud cavities.

2.2 WASHROOM ACCESSORIES

.1 Soap dispensers: Bobrick B-2111, stainless steel.

.2 Mirror: Bobrick B-1658, 460x760mm. TDSB

.3 Toilet paper holders at walls: Bobrick B-4388, recessed, stainless steel. TDSB

.4 Toilet paper holders at washroom partitions: Bobrick B-4288, surface-mounted, stainless steel. TDSB

.5 Shelf: Bobrick B-298x18, stainless steel. TDSB

.6 Coat hook: Bobrick B-983, stainless steel, 1 for each toilet stall, barrier free/universal washroom, and shower stall. TDSB

.7 Sanitary napkin/tampon dispenser: Bobrick B370634, semi-recessed, stainless steel. Include conversion kit for token operation. TDSB

.8 Sanitary napkin disposal: Bobrick B-3513, recessed, stainless steel. TDSB

.9 Paper towel dispenser: Bobrick B-359033, recessed, stainless steel. TDSB

.10 Hand Dryer: Bobrick B-750, recessed. TDSB

.11 Or approved equivalent alternatives.

2.3 TOILET PARTITIONS

.1 Toilet Partitions shall be Hadrian ‘Phenolic Toilet Partitions’ headrail-braced with stainless steel hardware and continuous hinges. Colour selected by Architect from manufacturer's standard range.

.2 Colour:

.1 315 'Dark Grey'

.3 Or approved equivalent alternatives.

2.4 COAT HANGING SYSTEM

.1 Coat hanging system shall be ASI Visual Display Products ‘Student Line’ with adjustable height brackets.

.2 Colours:

.1 Selected by Architect from manufacturer's standard range.

.3 Or approved equivalent alternatives.

2.5 LOCK-DOWN SHADES

.1 Lockdown shades shall be School Safety Solutions ‘Hideaway Helper’ black nylon shade conforming to NFPA 701.

.2 Size: Length and width to suit each door light noted in drawings.

.3 Colour:

.1 Selected by Architect from manufacturer's standard range.

.4 Or approved equivalent alternatives.

2.6 WHITE BOARDS AND CORK BOARDS

.1 White boards: Architectural School Products (ASI), magnetic surface with Series 200 extruded clear anodized trim, rail and cork tack strip at top. Sizes as noted on drawings, direct adhered or concealed fastened to walls.

.2 Cork boards: Architectural School Products (ASI) natural cork on particle board backing with Series 200 extruded clear anodized trim and rail. Sizes as noted on drawings, direct adhered or concealed fastened to walls.

.3 Or approved equivalent alternatives.

Part 3 Execution

3.1 PREPARATION

.1 Verify that installed products function properly, and adjust them accordingly to ensure satisfactory operation.

.2 Refinish damaged or defective Work so that no variation in surface appearance is discernible.

3.2 INSTALLATION

.1 Provide manufacturer’s information and templates required for installation of work of this Section, and assist or supervise, or both, the setting of anchorage devices, and construction of other work incorporated with products specified in this Section in order that they function as intended.

.2 Install work to meet manufacturers’ specifications and installation instructions, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.

.3 Include reinforcing, anchorage and mounting devices required for the installation of each product.

.4 Fit joints and junction between components tightly and in true planes, conceal and weld joints where possible.

END OF SECTION

CONTENTS

SECTION	TITLE
20 05 10	Demolition
20 05 11	Mechanical General Requirements
20 05 31	Pipe Hangers and Supports
20 05 32	Access Doors
20 05 33	Identification
20 05 49	Vibration Control Measures
20 05 60	Piping Insulation
20 06 11	Testing, Adjusting and Balancing
22 11 16	Domestic Water Piping
22 13 13	Drainage Piping and Vent
22 44 13	Plumbing Fixtures and Trim
22 44 14	Plumbing Specialties and Accessories
23 05 12	Electric Motors for HVAC Applications
23 05 14	Variable Speed Drives
23 07 13	Ductwork Insulation
23 08 11	Training and Demonstration
23 11 23	Natural Gas Piping
23 21 11	Hydronic Piping & Equipment
23 25 13	Chemical Treatment
23 31 13	Metallic Ductwork
23 33 14	Dampers – Balancing
23 33 15	Dampers – Operating
23 33 19	Duct Silencer
23 33 46	Flexible Ducts
23 34 00	HVAC Fans
23 34 50	Unit Ventilators
23 37 13	Grilles and Diffusers
23 37 20	Louver and Vents
23 51 00	Breeching Chimneys and Stacks
23 52 25	Hot Water Condensing Heating Boilers
23 74 00	Packaged Outdoor HVAC Equipment – AHU-1
23 74 01	Packaged Outdoor HVAC Equipment – RTU-1
23 74 03	HVAC Pumps
23 82 29	Convectors, Cabinet Heaters and Radiant Panels
25 20 11	Building Automation Systems and Controls

END OF SECTION

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION

.1 Refer to drawings for detailed demolition scope of work.

.2 All existing building services not affected by this work shall be maintained in operation during and after the demolition work is complete. Any accidental interruption of existing building services not required by this project will be promptly repaired at no additional cost to the Board.

.3 Prior to removing any piping, ensure the system is completely isolated and is not live.

.4 Complete all work impacting existing Building Operations after hours only.

1.2 QUALIFICATIONS

.1 Work of this section shall be executed by trades personnel having a minimum of five years' experience in the demolition field and capable to deploy adequate equipment to complete the work in an efficient and orderly manner.

1.3 EXAMINATION

.1 Examine existing property. Determine the nature of materials to be removed.

1.4 SALVAGE

.1 The Board Representative will review the Site prior to commencement of demolition and instruct the Contractor, in writing, as to the items to be retained for re-use or be turned over to the Board. In the absence of such specific instructions, materials from demolition shall become property of Mechanical Contractor who shall promptly remove all salvageable material and debris from Site.

.2 Remove and store indicated items for future use by the Board. Remove, handle and transport such items to storage area designated by the Board Representative. Perform such work carefully and with diligence to prevent any damage to the items during removal and in storage. Store material to be salvaged, neatly on wooden pallets, where directed by Board.

1.5 MAINTAINING TRAFFIC

.1 Maintain and preserve Board's access requirements within, to and from existing building in areas where demolition and removal work is being carried out.

.2 Do not close, obstruct, place or store material in Board's driveways and passageways. Conduct operations with minimum interference with roads, streets, driveways, user traffic and passageways.

1.6 HAULING OPERATIONS

.1 Maintain roadways and paving in the hauling areas clean on a daily basis and as required by Municipal Authorities.

1.7 INTERRUPTIONS TO BOARD'S OPERATIONS

.1 There will be absolutely no interruptions to the School schedule during demolition work. Therefore, it is imperative that operations and machine and equipment movements, deliveries and removals are executed at time or times that will permit uninterrupted Board's operations in and around the school, including parking, receiving areas, deliveries and site and access and egress.

.2 Where interruptions of domestic cold and hot water are necessary, coordinate with the School Representatives the timing and duration of such interruptions.

1.8 SAFETY REQUIREMENTS

.1 Coordinate posting of danger signs conspicuously around property. Close doorways and thoroughfares giving access to area of demolition with barricades.

.2 Provide a competent, experienced supervisor in charge of the Work and on Site while work is in progress.

.3 Should any suspect designated substance not already identified, be encountered, cease work in the immediate area and immediately report, to the Board. Board is responsible for removal of designated substances.

1.9 PROTECTION

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, parts of existing building to remain. Make good any collateral damage caused by demolition.

.2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify Board.

.3 Prevent debris from blocking drainage systems (floor drains) or other mechanical and electrical systems that must remain in operation.

.4 Protect building floors against damage from demolition work. Use ½" plywood covers over floor where lifting, moving, rolling of removed equipment is anticipated. Be responsible for repairing any damage to flooring caused by the work defined in this section. Execute repairs to the satisfaction of the Board at no cost to the Board.

PART2 - PRODUCTS

Not applicable

PART3 – EXECUTION

3.1 DEMOLITION

.1 At the end of each day's work, leave site in a safe condition and erect safety barriers and lights as required. Ensure that no parts of the existing building are in danger of collapsing.

.2 Review the requirements of new equipment to be installed. Perform all demolition work required to allow for the new equipment to be installed, whether shown on the drawings or not.

.3 Control dust and dirt produced during demolition.

.4 Provide any additional labour, materials and services not specifically indicated on the drawings but required to complete the work.

.5 Dispose of demolished materials in accordance with the requirements of Authorities Having Jurisdiction.

.6 At the end of demolition work, leave site in broom-clean condition. Clean existing surfaces specified to receive new applied finishes to ensure proper adherence.

.7 Do not disturb adjacent structures or equipment designated to remain in place.

.8 Confine operations and workers to those parts of the building which are defined on the drawings and exercise great care not to damage existing construction beyond that necessary for the carrying out of new work. Make good any such damage in every respect, to the satisfaction of the Board.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification is an integral part of the Contract Documents and shall be read accordingly.

.2 Where applicable, all portions of the Mechanical Supplementary Tender Form shall be submitted by bidders.

1.2 DUTIES OF MECHANICAL CONTRACTOR

.1 The mechanical contractor shall assume the responsibilities and duties including but not limited to the ones described below:

.2 Superintendence

.1 Provide full time on-site superintendent personnel and supporting staff with proven experience in project of similar value and complexity.

.2 Site superintendent shall have over-all authority to speak for and represent the mechanical contractor.

.3 Coordination

.1 Coordinate the work with all the sub-trades involved to ensure that the work will be carried out on schedule and in proper sequence.

.2 Take complete responsibility for all remedial work that results from failure to coordinate any aspect of the mechanical work prior to its fabrication and/or installation.

.3 Take responsibility for the delivery of equipment necessary to complete the work in accordance with the approved schedule.

.4 Staffing and Scheduling

.1 Within seven days after the award of the contract, the Mechanical Contractor shall provide to the Owner's representative the following information:

1 Appointment of official representatives in the project.
2 Schedule of work.
3 Delivery schedule for specified equipment.
4 Requirements for temporary facilities, site signs, storage, etc.

.5 Work Completion Meeting

.1 Prior to application for Substantial Performance of the Work, the mechanical contractor

shall participate in the take-over meeting. Agenda to include the following:

1 Review of outstanding deficiencies.
2 Submission of maintenance manuals, warranties and as-built drawings.
3 Results of performance tests and described further in this section.
4 Scheduling of training to Owner's personnel.

1.3 INTENT

.1 Bidders for this work shall include for all labor, material, equipment and all other related cost including all applicable taxes (except HST) and fees to provide the work as indicated on the drawings.

.2 Misinterpretation of any requirement of the drawings and specifications will not relieve the Mechanical Contractor of responsibility. If in any doubt, the Mechanical Contractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.

.3 Supplementary to definitions established are:

1. "Concealed" means hidden from normal sign in furred spaces, shafts, ceiling spaces, walls, or partitions.

2. "Exposed" means work normally visible, including work in equipment rooms, tunnels, and similar spaces.

3. "Provide" (and all tenses) means supply and install for a complete, operational, and code-compliant system, including all devices, equipment, materials, accessories and/or components as specified or as otherwise required for a complete, operational, and code-compliant installation.

4. "Install" (and all tenses) means secure in position, connect as specified, test, and verify.

5. "Supply" means to supply all devices, equipment, materials, accessories and/or components to the responsible trade.

6. "Remove" means to isolate, disconnect, disassemble, remove, and dispose of all devices, equipment, materials, accessories and/or components. Patch and make good all surfaces affected by the removal. Remove and dispose of all redundant material off site.

.4 Where used, wordings such as "approved, to approval, as directed, permitted, permission, accepted, acceptance", shall mean: approved, directed, permitted, accepted, by authorized representative of the Owner.

1.4 INTERFERENCES

.1 The mechanical drawings do not show all the architectural and structural details, and any information involving accurate measuring of the building shall be taken from the building drawings or at the building. Make without additional change, any necessary changes or

additions to the runs of drains, pipes, ducts, etc., to accommodate the above conditions. The location of equipment may be altered without charge providing the change is made before installation and does not necessitate major additional material.

.2 Wherever differences occur between specifications, riser diagrams or schematics and drawings, the maximum conditions shall govern and the bid shall be based on whichever information indicates the greater cost.

.3 Field verifications of dimensions on plans shall be made since actual locations, distances, and levels will be governed by actual field conditions.

.4 Discrepancies between different plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Consultant for a decision.

.5 Install all mechanical services including but not exclusive to drains, pipes, and ducts, to conserve headroom and interfere as little as possible with the free use of the space through which they pass. Install as high as possible, unless otherwise directed by the Consultant All drains, pipes, ducts, etc., particularly those which may interfere with the inside treatment of the building, or conflicting with other trades, shall be installed only after the locations have been approved by the Consultant. Special care shall be taken in the installation of all mechanical services including, but not exclusive to drains, pipes, and ducts, which are to be concealed, to see that they come within the finished lines of floors, walls, and ceilings. Where such drains, pipes, ducts, etc., have been installed in such a manner as to cause interference, they shall be removed and re-installed in suitable locations without extra cost to the Owner.

.6 Before commencing work, check and verify all grade and invert elevations, stacks, levels, and dimensions, to ensure proper and correct installation of the work.

.7 In every place where there is space indicated as reserved for future or other equipment, leave such space clear, install blank offs, shut off valves with blind flanges and other work so that the necessary connections can be made without any stoppages to the system. Consult with the consultant whenever necessary for this purpose.

.8 In addition to the work specifically mentioned in the Specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the Authorities Having Jurisdiction over the work.

.9 The mechanical plans show approximate locations for wall mounted devices. Obtain Consultant's approval of mounting heights and locations before commencement of work.

.10 Prepare and submit complete interference drawings (in PDF format) to avoid and/or resolve conflict of trades and to coordinate the work of the Mechanical Division with that of all other Trades. Submission of interference drawings shall be done no later than 10 business days after the Project has officially begun. The cost of producing the interference drawings shall be included for in the Base Tender Price.

.11 Include costs (in the Base Tender Price) for the services of a third-party to 3D scan the entire

area of construction upon completion of demolition. System shall be Matterport or similar. The intent to is capture and submit to the Consultant a full 3D perspective of the space. This model shall be used to identify any potential conflicts ahead of installation and ordering of equipment to allow for quick resolution of site conflicts. 3D Model shall capture all architectural, structural, mechanical and electrical conditions on site and all such conditions shall be part of the model. The model, along with site verifications, shall be used as the basis for interference drawings.

1.5 EXAMINE SITE

.1 Examine the site and the local conditions affecting the work. Examine carefully all drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Consultant.

1.6 SUBCONTRACTOR'S SHOP

.1 Provide Job site office, work-shop, tools, scaffolds, material storage, etc., as required to complete the work.

1.7 CLEANING

.1 During the performance of the work and on the completion, remove from the place of the work all debris, rubbish and waste materials caused by the performance of the work. Remove all tools and surplus materials after completion and acceptance of the work.

.2 All equipment shall be thoroughly vacuumed out at the time of final acceptance of the work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Protection of Equipment:

.1 Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.

.2 Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Consultant. Such repair or replacement shall be at no additional cost to the Owner.

.3 Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

.4 Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

.2 Cleanliness of Piping and Equipment Systems:

.1 Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.

.2 Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

.3 Clean interior of all tanks prior to delivery for beneficial use by the Owner.

.4 Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.9 INSTALLATION OF WORK

.1 Be responsible for:

.1 The layout of the work shown on the drawings and specified herein, and for any damage caused to the Owner by improper location or carrying out of this work.

.2 The prompt installation of the work in advance of concrete pouring or similar work.

.3 The condition of all material and equipment supplied and for the protection and maintenance of work completed.

.2 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract.

.3 Furnish items to be "built-up" in ample time and give necessary information and assistance in connection with the building in of the same.

.4 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule.

.5 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Owner within the time limit stipulated.

.6 Furnish promptly information required for the construction schedule.

.7 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

.8 All new ductwork and piping shall be supported from a secondary structure site supplied and installed by the Contractor consisting of unistruct (or alternate as necessary) structure fastened to the building OWSJ structure. No supporting of piping, conduits ductwork or equipment from the roof deck will be permitted.

1.10 CODES, PERMITS, FEES AND CONNECTIONS

.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By-Laws and Regulations in force in area where the building is to be erected.

.2 Apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the building is to be erected.

.3 In particular, coordinate with and pay for the local gas supply company to adjust/modify/replace the existing gas meter assembly and PRV as required to ensure that the available gas pressure is adequate for all gas fired equipment to operate simultaneously at maximum capacity. The minimum gas pressure at the boiler shall not be less than 8" w.g. under simultaneous maximum operating condition of all gas-fired equipment.

.4 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

.5 When part of equipment does not bear the required CSA label, the contractor shall obtain from CSA or Hydro Electric Power Commission, when that part of the equipment is an electric component, a special approval and pay the applicable fees.

.6 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

1.11 MATERIALS

.1 Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish standards of desired quality style or dimensions and shall be the basis of the Bid. Materials so specified shall be furnished under this Contract, unless changed by mutual agreement. Where two or more designations are listed, the Contractor shall base the submitted Tender Price based on the base specified equipment; any approved alternate will only be entertained after Notification of Award.

1.12 BASE BID SPECIFIED EQUIPENT& SUBSTITUTIONS WITH APPROVED ALTERNATES

.1 Requests for substitutions will not be accepted prior to the Notification of Award. Substitutions will be considered:

1) The proposed substitutions have been investigated and complete data are submitted which clearly includes highlighting all aspects that meet the specifications. Consultant will only review data submitted. Incomplete data will be grounds for non-acceptance.

2) Data relating to changes in the Contract Schedule, if any, and relation to other Work have been submitted.

3) Same warranty is given for the substitution as for the original Product specified.

4) All claims are waived for additional costs related to the substitution which may subsequently arise.

5) Installation of the accepted substitution is co-ordinated into the Work and that full responsibility is assumed when substitutions affect other work. Make any necessary changes required to complete the Work. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.

1.13 MATERIAL SUBSTITUTIONS

.1 After execution of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be approved by the Consultant, subject to owner's review and acceptance of the financial credits involved.

.2 In the absence of such express approval by the Consultant, the Mechanical Contractor will be held to furnish specified items under the base bid.

1.14 SHOP DRAWINGS AND SAMPLES

.1 Submit to the Consultant detailed dimension shop drawings and installation wiring diagrams for all mechanical equipment. Further details and special requirements called for in these specifications shall be shown on the shop drawings.

.2 Ensure that copies of all reviewed shop drawings are available on the job site for reference.

.3 Provide samples of mechanical equipment as requested in the specification at the same time as the shop drawing submission.

.4 **The Mechanical Contractor is responsible for consolidating all Mechanical Shop Drawings and submitted them in no more than three (3) packages as per the following:**

1. HVAC Equipment and Material.
2. Plumbing Equipment, Fixtures and Material.
3. Fire Protection Equipment, Fixtures and Material.

Individual shop drawings not consolidated will not be accepted.

1.15 AS-BUILT DRAWINGS

.1 Maintain up to date "as built" drawings on site.

.2 At the conclusion of the project, the Consultant will forward to the Contractor a set of electronic files of the project. The Contractor shall modify the files as required, to reflect the as-built conditions, mark them conspicuously in the title block as "as-built drawings" and submit the modified files to the Consultant for review. Completion of the As-Built Drawings in AutoCAD

will be the responsibility of the Mechanical Contractor at no extra cost to the project. The Mechanical Contractor is responsible for updating all Architectural Plans based on the Architectural As-Builts while producing the Mechanical As-Builts

.3 Put a digital copy of the as-built files (in AutoCAD 2017 format) as part of the Operations and Maintenance manuals.

.4 Any subsequent changes found by the Consultant shall remain the responsibility of the Contractor at no charge to the Owner.

1.16 TEMPORARY AND TRIAL USAGE

.1 After any part of the work has been completed, the Consultant will make an inspection, and performance tests of such parts shall be carried out under the direction of the Consultant. If deficiencies are found, they shall be immediately rectified to the satisfaction of the Consultant. After such deficiencies have been rectified, the work shall be placed in service at such time and in such order as the Consultant may direct. If, in placing a portion of the equipment in service, it is necessary to make temporary connections in the wiring in order to obtain proper operation, such connections shall be provided to the extent and in the manner required by the Consultant.

.2 Temporary or trial usage of any mechanical devices, machinery, apparatus, equipment or materials shall not be construed as evidence of the acceptance of same.

.3 No claims for damage will be considered for injury to, or the breaking of any parts of such work which may be used.

1.17 CONSULTANT'S INSTRUCTIONS

.1 During construction the Consultant will issue such instructions as may be necessary for verification and corrections of the work. These instructions shall be binding as part of the specification.

1.18 ADDITIONAL WORK AND CHANGES

.1 Unless a written order, reviewed by the Consultant and countersigned or otherwise approved by the Owner Representative, no additional work shall be undertaken by the Contractor.

1.19 WARRANTY

.1 The Mechanical Contractor shall guarantee all work and apparatus installed under his contract against all defects of workmanship and material for a period of one (1) year after the Substantial Performance of the Work , unless otherwise mentioned in the Specifications, and shall make good any and all defects developing during such time without expense to the Owner. Any materials shall be further guaranteed as may be called for in these specifications. Where warranties on equipment extend beyond one (1) year the Mechanical Contractor shall honor the extended warranty.

1.20 SCHEDULING OF WORK

.1 For all work to be performed under this contract, adhere to Construction Schedule agreed upon with the Owner Representative.

1.21 ENERGY CONSUMPTION

.1 The Consultant may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

.2 All equipment installed on the project shall conform to the requirements outlined in ASHRAE 90.1 latest edition.

1.22 ELECTRIC MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install an acceptable motor for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 All motors shall be manufactured and installed in accordance with CSA requirements.

.4 Motor speed shall be 1750 rpm unless otherwise specified.

.5 All motors shall be "T" frame CEMA Standard Design "B" with Class "B" insulation, 40□C ambient, standard drip-proof with a 1.15 service factor, or as otherwise specified. Motors in air stream or exposed shall be TEFC type.

.6 Motors shall be of adequate size to operate associated equipment and drive mechanisms under all conditions of load and service and to bring equipment up to operating speed within 13 seconds without overloading, and be not less than the nameplate HP specified or indicated on the Drawings.

.7 Integral HP motor sizes ½ HP and above shall be squirrel cage induction motors rated 575 volt or 230volt, 3 phase, 60 hertz, unless noted otherwise.

.8 Fractional HP motors up to but not including ½ HP shall be rated 120 volt, single phase, 60 hertz and will be capacitor start, induction motors, with adequate thrust capacity when used with direct mounted equipment, and shall be provided with integral overload and overheating protection. Shaded pole starting devices will not be accepted.

.9 Multi-speed motors and associated switching devices shall be circuited to protect the motor at each speed.

.10 All motors, 1 HP and up shall comply with the Ontario Hydro EnerMark Motor Efficiency Level as tested either CSA 390 M 1985, or IEEE 112B, and be approved under the Canadian Electrical Safety Code.

.11 All starter panels shall be lockable and supplied with locks.

.12 Special Requirements:

.1 Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Owner.

.2 Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.

.13 Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

.1 Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.

.2 Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.

.3 Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

.14 Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

.15 Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

.16 Insulation Resistance: Not less than one half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

1.23 EQUIPMENT REQUIREMENTS AND INSTALLATION

.1 Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping and duct systems and without interference from building structure or other equipment.

.2 Provide accessible means for lubricating equipment including permanent lubricated bearings.

.3 For all base mounted boilers, pumps, compressors, air handling units, fans and other rotating equipment, provide chamfered edge housekeeping pads a minimum of 4" high and 4" larger than equipment dimensions all around. Work shall be performed by the trades specializing in this work.

.4 Pipe drain lines, overflows and safety relief vents to drains. If the horizontal drains present a

tripping hazard, use aluminum checkered plate covers.

.5 Line-up equipment, rectangular cleanouts and similar items with building walls wherever possible.

1.24 LIFTING ATTACHMENTS

.1 Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

1.25 THERMOMETERS AND PRESSURE GAUGES

.1 General:

.1 Locate direct reading thermometers and gauges for reading from floor or platform.

.2 Provide remote reading thermometers and gauges where direct reading instruments cannot be satisfactorily located.

.3 Locate engraved lamacoid nameplate as specified in Section Identification, identifying medium adjacent to thermometers and gauges.

.2 Thermometers:

.1 Industrial, 9" adjustable angle cast aluminum case, CGSB standard CAN/CGSB-14.4-M88 red reading mercury, lens front tube, white scale black embossed figures, clear glass or acrylic window, tapered aluminum stem.

.2 Scale shall be suitable for 2 times the temperature range of service. Scale shall be combined Celsius and Fahrenheit.

.3 Standard of Acceptance: Weiss, Ashcroft, Trerice.

.3 Pressure Gauges:

.1 5" dial, solid front blow out back, fibreglass reinforced polypropylene case, phosphor bronze bourdon tube and brass 1/4" N.P.T. socket, bottom connection, stainless steel rotary type movement, gauge to be registered with the Provincial Boiler and Pressure Vessel Safety Branch with a registration number and conform to ANSI B40.1. Accuracy to be grade "A".

.2 On pumps liquid filled gauges shall be utilized.

.3 Standard of Acceptance: Weiss, Ashcroft, Trerice.

.4 Provide bronze stop cock, bronze bar stock 1/4" N.P.T. bronze porous core pressure snubber for pulsating operation and diaphragm for corrosive service.

.5 Use materials compatible with system requirements.

.6 Gauges shall have combined kilopascal and psi scales.

1.26 PIPE HANGERS AND SUPPORTS

.1 General

.1 Pipe Supports: Comply with MSS SP 58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP 69.

.2 Attachment to Concrete Building Construction:

.1 Concrete insert: MSS SP-58, Type 18.

.2 Self drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Consultant for each job condition.

.3 Power driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

.3 Attachment to Steel Building Construction:

.1 Welded attachment: MSS SP 58, Type 22.

.2 Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C clamp may be used for individual copper tubing up to 23mm (7/8 inch) outside diameter.

.4 Attachment to Metal Pan or Deck:

.1 As required for materials specified Steel Decking section of the specification.

.5 Attachment to Wood Construction:

.1 Wood screws or lag bolts.

.6 Hanger Rods

.1 Hot rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP 58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn buckles shall provide 38 mm (1 1/2 inches) minimum of adjustment and incorporate locknuts. All thread rods are acceptable.

.7 Hangers Supporting Multiple Pipes (Trapeze Hangers):

.1 Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by

41 mm (1 5/8 inches by 1 5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

.2 Allowable hanger load: Manufacturers rating less 91kg (200 pounds).

.3 Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

.8 Supports for Piping Systems:

.1 Select hangers sized to encircle insulation on insulated piping.To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.

.9 Piping Systems (MSS SP 58):

.1 Standard clevis hanger: Type 1; provide locknut.
.2 Riser clamps: Type 8.
.3 Wall brackets: Types 31, 32 or 33.
.4 Roller supports: Type 41, 43, 44 and 46.
.5 Saddle support: Type 36, 37 or 38.
.6 Turnbuckle: Types 13 or 15. Preinsulate.
.7 U bolt clamp: Type 24.
.8 Copper Tube:

1 Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.

2 For vertical runs use epoxy painted or plastic coated riser clamps.

3 For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

.9 Insulated Lines:

1 Provide pre-insulated calcium silicate shields sized for copper tube.

.10 Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

.10 Piping with Vertical Expansion and Contraction:

.1 Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.

.2 Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator. //

.11 Heat Exchanger and Expansion Tank Hangers:

.1 May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.

1.27 PIPE PENETRATIONS

.1 Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

.2 To prevent accidental liquid spills from passing to a lower level, provide the following:

.1 For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.

.2 For blocked out floor openings: Provide 40 mm (1 1/2 inch) angle set in silicone adhesive around opening.

.3 For drilled penetrations: Provide 40 mm (1 1/2 inch) angle ring or square set in silicone adhesive around penetration.

.3 Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Consultant.

.4 Sheet Metal: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

.5 Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

.6 Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms. Except in mechanical rooms, connect sleeve with floor plate.

.7 Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

.8 Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

.9 Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

1.28 SPECIAL TOOLS AND LUBRICANTS

.1 Furnish, and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

.2 Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

.3 Tool Containers: Hardwood or metal, permanently identified for in tended service and mounted, or located, where directed by the Owner

.4 Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.29 WALL, FLOOR AND CEILING PLATES

.1 Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

.2 Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch pipe), 0.89 mm (0.035-inch) for larger pipe.

.3 Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

1.30 EXCAVATION AND BACKFILL

.1 Grade the bottom of the pipe trench excavation as required.

.2 In firm, undisturbed soil, lay pipes directly on the soil, and shape soil to fit the lower one-third segment of all pipes and pipe bells. Ensure even bearing along the barrels. Backfill excess excavation with 25 mPa concrete.

.3 Where rock or shale is encountered, arrange to have this excavated and removed. After excavation, backfill with a bedding of 10 mm crushed stone.

.4 Prepare new bedding under the pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, at manholes and catch basins. Compact to maximum possible density and support the pipe by 200 mm (8 inches) thick firm supports. Install reinforcing steel in cradle or construct piers every eight feet or closer, down to solid load bearing strata. Provide a minimum of one pier per length of pipe. Use same method where pipes cross.

.5 Where excavation is necessary in proximity to and below the level of any footing, backfill with

25 mPa concrete to the level of the highest adjacent footing. Proximity is determined by the angle of repose as established by the consultant.

.6 Provide support over at least the bottom one third segment of the pipe in all bedding methods.

.7 Do not open trench ahead of pipe laying and backfilling more than weather will permit. Keep walls of trenches straight to at least 450 mm (18") above the top of the pipe to keep the diameter load within the pipe design limits. Have excavations inspected at least once a week by authorities. .

.8 Before backfilling, obtain approval. Remove all shoring during backfill.

.9 Backfill trenches within building, with clean sharp sand or gravel in individual layers of maximum 150 mm (6") thickness, compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum 300 mm (12") above the top of pipe. Hand or machine compact the balance up to grade, using approved equipment.

.10 Backfill trenches outside buildings, not under roads, parking lots, or traffic areas, up to a compacted level of 450 mm (18") above the pipes with individual layers of material 150 mm (6") thick, hand compacted to a density of 95% Standard Proctor, using approved 10 mm (3/8") crushed stone. Backfill the balance with 150 mm (6") layers of approved excavated material, compacted to 95% Standard Proctor, using approved equipment.

.11 Backfill all other trenches outside buildings with 150 mm (3/8") crushed stone in layers not exceeding 6" thickness, compacted to 100% Standard Proctor density up to grade level. Manual compaction up to 450 mm (18") above the pipe with approved equipment for the balance.

.12 Fill all depressions to a correct grade level with appropriate material. After a period has passed adequate to reveal any settlement, use maximum possible compaction. Pay all costs required to make good all damages caused by settlement.

.13 Dispose of excavated materials in accordance with the requirements of the Authorities having Jurisdiction.

1.31 TESTS

.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.2 Conduct tests in presence of Consultant.

.3 Bear costs including retesting and making good.

.4 Pipe pressure:

.1 Hydraulically test piping systems at 1.5 times system operating pressure or minimum 125 psi, whichever is greater.
.2 Maintain test pressures without loss for 4 hours unless otherwise specified.
.3 Test natural gas systems to requirements of authorities having jurisdiction and as per

Ontario Gas Utilization Code O.Reg. 452/89.

.4 Test drainage, waste and vent piping to code.

.5 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.32 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

.2 Touch-up paint all damaged equipment with products matching original finish in quality and appearance.

.3 Paint the entire gas line where with two coats of yellow paint.

1.33 SPECIAL TOOLS AND SPARE PARTS

.1 Furnish spare parts as follows:

.1 One set of packing for each pump.
.2 One glass for each gauge glass installed.
.3 One set of v-belts/bolts for each piece of machinery.
.4 One spare set of filters for each filter bank installed.

.2 Upon completion of project and immediately before hand-over, replace all filters.

1.34 DIELECTRIC COUPLINGS

.1 Provide wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes larger than 2" diam. and under; same for flanges of pipe sizes over 2" diam.

.3 Cast brass adapters may be used on domestic water systems and where approved by the Consultant.

.4 Provide rubber gaskets to prevent dissimilar metals contact.

1.35 INSTRUCTION OF OPERATING STAFF

.1 Supply certified personnel to instruct Owner operating staff on operation of new mechanical equipment. Supply maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.2 Provide min. 6 hrs of instruction time during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn manuals over to the Consultant.

.4 Scheduling of the timing for the training of the operating staff shall be arranged 10 days prior to the completion of the project.

.5 For training on controls, refer to section 15900

1.39 MAINTENANCE MANUALS

.1 Provide minimum of one (1) hard (hard cover binder) and three (3) soft (USB's) copies of Mechanical Maintenance Manuals, in accordance to the following:

.1 Mechanical Maintenance Manuals to be delivered to the Consultant's office 10 days prior to the substantial completion of the Contract.

.2 Manuals to be bound in a hard cover neatly labeled: "OPERATING AND MAINTENANCE INSTRUCTIONS".

.3 The Maintenance Manuals shall be divided into sections with neatly labeled and tabbed dividers between each section. The sections to be included in the manual are:

.1 Section I - General.
.2 Section II - Piping and Pump Systems, Plumbing Fixtures and Accessories.
.3 Section III - Boilers, Heat Exchangers, Pool Filters and Accessories
.4 Section IV - Automatic Controls
.5 Section V - Air and Water Balancing

.4 The following information shall be contained within the sections:

.1 SECTION I: A list giving name, address and telephone number of the Consultant, Engineers, General Contractor, Mechanical Trade and Controls Trade. Written guarantees for the Mechanical Systems. A copy of the Valve directory giving number, valve location, normal valve position, and purpose of valve (a framed copy of Valve Directory to be hung in Boiler Room). Equipment lists and certificates shall be provided - certificates shall be signed and sealed by the appropriate suppliers.

.2 SECTION II, III: A copy of all pressure tests and operational tests. A copy of Gas Operational Tests for gas fired equipment. A list giving name, address and telephone number of all suppliers. Details of chemical treatment equipment and substances. A copy of all reviewed Shop Drawings for all mechanical equipment and ancillary devices (valves, expansion tanks, pumps, strainers, plumbing, etc). Copies of warranties.

.3 SECTION IV: Complete Control Diagrams, Wiring Diagrams and description of Control system and the functioning sequence of the system. Also refer to section 15900.

.4 SECTION V: For balancing reports and formats, refer to section 15015 of these specifications.

1.40 CONCRETE

.1 All concrete work required to complete this project, whether shown on the drawings or not, shall be the Contractor's responsibility.

.2 Refer to this specification section for requirements for housekeeping pad.

1.41 METALS

.1 All steel construction required for the completion of this project, whether shown on the drawings or not, shall be the Contractor's responsibility.

1.42 CUTTING, PATCHING, ROOFING AND X-RAY

.1 All cutting, patching, roofing and X-Rays required for the completion of this project whether shown on the drawings or not, shall be the Contractor's responsibility. The cutting and patching work shall be performed in accordance with the following:

.1 All cutting and patching shall be done by the trades specializing in the materials to be cut.

.2 All flashing and equipment supports on the roof shall be done in strict accordance with the Owner standards by Owner-approved roofing contractors only.

.2 Should any cutting, roofing and/or repairing of finished surfaces be required, the Sub-trade contractor for the Contractor shall employ the particular trades engaged on the site for this type of work to do such cutting and/or repairing. Obtain the approval of the Consultant before doing any cutting. In the event that tradesmen required for particular cutting and/or repairing are not already on the site, bring to the site tradesmen to do this work.

.3 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Consultant.

.4 Where slabs in the portions of the building which are existing must be saw-cut or core drilled, all locations shall be x-rayed prior to saw-cutting or core-drilling. All x-raying shall be done by personnel qualified in the use of the type of equipment required to x-ray the saw-cuts shall be permitted to perform this work on the site. No allowance will be made later for expenses incurred through the failure of performing these x-rays.

1.43 INTERFERENCE DRAWINGS

.1 The Mechanical Contractor is responsible for preparing detailed interference drawings once demolition work has proceeded to the point where all existing conditions are visible. Provide 2D plan view and 3D isometric view layouts for all project areas depicting site measurements of all floor areas, height, width and depth of all existing structural elements, new architectural walls, ceilings and floor assemblies, new structural elements and new mechanical ductwork and piping plans. Prior to proceeding with new work, ensure that any concerns of interference are alleviated; consult with the Engineer as necessary. Provide written notice to the Engineer of any potential interferences of concerns with existing conditions based on the site findings

after demolition.

1.44 MECHANICAL PROJECT COMPLETION

.1 10 (ten) days prior to substantial performance of work obtain documentation and/or prepare certification of the following items and submit them to the Owner's representative.

.1 All inspection certificates including drainage, Plumbing, and refrigeration.
.2 Guarantee certificates as called for under "Warranty".
.3 Record drawings.
.4 Operating and Maintenance Manuals.
.5 Test certifications as called for under "Testing".
.6 Provide a signed statement to the effect that all tests for mechanical systems and equipment have been completely carried out in the Trade Sections of these Specifications and to the manufacturer's recommendations, and in accordance with the requirements of all authorities having jurisdiction.

1.45 PERFORMANCE TESTS AND EQUIPMENT START-UP

.1 After all equipment has been installed, adjusted, balanced and started up, subject equipment to a series of performance tests, as soon as conditions permit.

.2 The timing of the tests shall be arranged to suit the convenience of the Consultant, and the manner and duration shall be as the Consultant deems necessary. Record the daily start and stop times, operating hours and functions performed. Ensure that the performance tests are witnessed by the Consultant.

.3 All major equipment including but not limited to boilers, pumps, sand filters are to be inspected by the manufacturer to ensure that the equipment has been installed in accordance with their recommendations.

.4 Operate equipment under varying load conditions, demonstrate start-up sequence, normal shutdown, simulated emergency shutdown, operation of temperature, etc., and safety controls. Operate switches and electrical devices for correct wiring sequences. Adjust components to achieve a proper functional relationship among all the components of all the systems. Repeat these functions as many times as deemed necessary by the Consultant to achieve reliable operation.

.5 Repair defects and repeat tests as necessary. During test maintain lubrication schedule, set, align and tension drives.

.6 At the successful completion of Performance Tests and all testing and balancing, make the systems ready for final inspection and subsequent acceptance of the Owner. Replace and clean filters, flush out lines and equipment, remove and clean strainers, fill liquid systems and purge air. Provide water treatment to pipes and report in accordance to Section 15602. Disinfect all domestic water as required by current by-laws and Authorities Having Jurisdiction.

.7 Conduct tests to demonstrate operation and ability to meet requirements of all equipment and freedom from undue noise and vibration at the time of final inspection, having ensured that it has previously been subjected to Performance Tests.

1.46 PROJECT SPECIFIC NOTES

1. Obtain all approvals from public authorities having jurisdiction prior to commencing any work. Include, in the tender price, for all permit and inspection fees required by Authorities having Jurisdiction. Arrange for and attend all inspections required as per requirements of the Building Department or an Authority having Jurisdiction.

2. Examine architectural drawings and specifications and all contract documents before proceeding with the work. Any discrepancies between the drawings and specifications of all disciplines must be referred to the architect before any affected work is commenced.

3. The Mechanical Contractor shall furnish all labour, material, tools, equipment, etc. required to complete all work shown on the drawings and as specified in the contract documents. The work shall be performed in accordance with rules and regulations of all authorities having legal jurisdiction over the work. This Contractor shall provide any small items of work not specifically called for but required to complete the intended installation and/or required to achieve the desired intent or functional utility.

4. Perform all work in full accordance with the Ontario Building Code, All Applicable Codes, TDSB standards and good practices and the requirements of all other Authorities Having Jurisdiction. All work performed by this division shall be done in accordance with all manufacturer's recommendations. Obtain all available manufacturer's recommendations and comply.

5. All cutting, patching, coring, scanning, xraying, making good and fire stopping required for the work of this division shall be carried out by this division. The Mechanical Contractor is responsible for and shall pay for any and all damage to the building and/or surrounding area incurred by work of this division.

6. Review the designated substances survey provided by the board in detail prior to commencing any work.

7. The Mechanical Contractor must review and submit shop drawings for all materials to be supplied as a part of the Contract in conjunction with the General Contractor to the Architect and Mechanical Consultant prior to ordering. Order only upon receipt of approval. Order, supply and install as per all comments. The Shop Drawings must be reviewed and ensured for compliance with the Contract Documents by the Mechanical Contractor and General Contractor prior to submission; confirmation of review and confirmation that the submittal is in compliance with the Contract Documents is the responsibility of the Mechanical Contractor and General Contractor to include in writing with each Shop Drawing Submittal. Any non-conformance of the Submittal with the Contract Documents identified by the Mechanical Consultant will require a resubmission of the Shop Drawing Submittal by the Mechanical Contractor prior to review. The

Mechanical Contractor shall bear all costs of any review by the Mechanical Consultant beyond the Original Shop Drawing Submission at a cost of $250.00 CAD + HST per resubmission.

8. All access panel ratings shall match that of the surface in which it is being installed. All access panels requiring supply/install as a part of the project work shall be included for in the Base Tender Price.

9. Coordinate with all other trades present on site throughout the full course of construction. Lay out of all work so as not to conflict with the work of other trades. Carry out work promptly which may interfere with the work and/or schedule of any other trades.

10. Cleanup and garbage: the contractor is responsible for maintaining as clean of a work area as possible during construction. The contractor is responsible to clean-up and remove tools from the site at the end of every working day. Disposal of all redundant materials, devices, and equipment is the responsibility of the contractor on a daily basis.

11. All work shall be done with minimum possible interruption to the existing building systems and in the time schedule permitted by the school board. Consult with the project supervisor prior to pricing. Complete the project within the allocated schedule.

12. Unless otherwise explicitly stated in writing in the Contract Documents, all materials, labour, scope and descriptions of work described in the Contract Documents is the responsibility of the Mechanical Contractor to supply and install as a part of the Base Tender Price. No materials and/or labour is to be completed under the Project Allowances unless explicitly noted as such in the Contract Documents.

13. All demolition and new work shall be completed in strict accordance with the Contract Documents with no deviations unless instructed by the Mechanical Consultant in writing prior to execution of the work. The Mechanical Consultant is not responsible, nor required, to accept any work (regardless of its compliance with code) not completed in accordance with the Contract Documents. The Mechanical Contractor will be responsible, at his/her cost, of furnishing a Sealed Letter from a Professional Engineer licensed in the Province of Ontario to accept and assume responsibility for all work not completed in accordance with the Contract Documents. The cost of obtaining this letter and the retaining of the Engineer, including all associated inspection charges, is the sole responsibility of the Contractor.

14. Unless otherwise noted, all devices, equipment, material, supplies, etc. shown on the drawings or otherwise required for a fully operational system as described/illustrated on the Drawings shall be supplied and installed under this Project. It shall not be assumed that any of the devices, equipment, material, supplies, etc. shown on the Drawings are to be provided (in part or in whole) by any other Party.

15. The Mechanical Contractor is responsible for taking pictures of work completed at the end of each week for record purposes. Pictures shall be taken throughout the work space and shall demonstrate all work completed that past week. When requested, share the pictures with the Mechanical Consultant. Pictures may be used for review of the monthly

draws, conflicts identified on site, etc.

1.47 CLOSEOUT DOCUMENTS

.1 Coordinate with the General Contractor to submit a comprehensive Closeout Document Package incorporating documents from all trades in one consolidated package. Closeout Documents shall consist of one (1) 3-ring binder hard copy and 3 USBs/CDs. The Mechanical Section of the Closeout Documents shall consist of the following:

(a) Mechanical Contractor Warranty Letter, signed and dated. Warranty shall be for a period of twelve (12) months starting on the Date of Substantial Completion.
(b) Project Shop Drawings, in consecutive order of the Consultant's number scheme.
(c) O&M Manuals for all equipment supplied on the project.
(d) AHJ Inspection Certificates & All Test Certificates.
(e) Fire Damper installation letter from the Sheet Metal Contractor stating 'All fire dampers and fire flaps have been installed in strict accordance with the Manufacturer's recommendations and requirements as well as Code Requirements.'
(f) Start-Up Reports for all Equipment.
(g) Red-Line As-Builts and CAD As-Builts (both completed by the Mechanical Contractor).

1.48 PROJECT PROGRESS THROUGHOUT CONSTRUCTION

.1 The Mechanical Contractor is responsible for taking photos of all existing conditions and mechanical systems on site being affected by the Project at the onset of construction. All photos shall be date stamped.

.2 The Mechanical Contractor is responsible for taking photos of the project's progress throughout the construction site every two weeks. All progress photos shall be shared and sent electronically to the Mechanical Consultant on the 15th and 30th of every month. Photos are meant to illustrate the progress of the project and correction of any deficiencies identified in routine site reviews and review of progress photos.

.3 The Mechanical Consultant will, from time-to-time, visit the Project Site and issue a Field Review Report. The Mechanical Contractor is obligated to rectify any deficiency identified within 7 working days of receipt of the Report. The Mechanical Contractor is responsible for signing the Field Review Report upon 72 hours of the report being sent to the General Contractor, acknowledging receipt of the report. The Mechanical Contractor must take photos of all remedial work within 7 working days of receipt of the Report and distribute to the Consultant.

END OF SECTION

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.1.1 Conform to Section 20 05 11 Mechanical General Requirements as applicable.

1.2 RELATED SECTIONS

1.2.1 Installation of inserts, sleeves and anchors supplied by this Section: Section 04200, Masonry.

1.3 REFERENCES

ANSI B31.1 to B31.9 inclusive: Piping

CAN/CGSB-1.40-97	Primer, Structural Steel, Oil Alkyd Type
CSA B51-03	Boiler, Pressure Vessel, and Pressure Piping Code
CSA B52-99	Mechanical Refrigeration Code
CAN/CSA-G40.20/G40.21-98	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
CAN/CSA-S16-01	Limit States Design of Steel Structures
CSA W47.1-92(R2001)	Certification of Companies for Fusion Welding of Steel Structures
CAN/CSA W48-01	Filler Metals and Allied Materials For Metal Arc Welding.
CSA W59-M1989(R2001)	Welded Steel Construction (Metal Arc Welding)
CAN/CSA W117.2-01	Safety in Welding, Cutting and Allied Processes

1.4 SUBMITTALS

1.4.1 **Shop Drawings:** Prepare and submit shop drawings for equipment covered by this Section including upper, middle and pipe attachments, riser clamps, shields and saddles, and sway braces.

2 PRODUCTS

2.1 MATERIALS

2.1.1 **Welding Studs**

-Graham
-Omark
-Nelson

2.1.2 **Concrete Inserts and Anchors**

-Readhead by ITW
-SSS by Star
-Parabolt by USM
- Kwik-Bolt by Hilti

2.1.3 **Beam Clamps**

-Grinnell
-Myatt
- Hilti

2.1.4 **Concrete Grout:**

-Sikagrout 212 by Sika Canada Inc.
-Embeco 636 Grout by Master Builders
-Sealtight V-3 Grout by W.R. Meadows

2.1.5 **Pipe Hangers:**

- Grinnell
- Myatt
- Hilti

2.1.6 **Zinc-Rich Paint:** Galvafroid by W.R. Meadows.

2.1.7 **Primer**: CAN/CGSB-1.40-M.

3 EXECUTION

3.1 GENERAL CONSTRUCTION REQUIREMENTS

3.1.1 **Attachment to Building Construction**

3.1.1.1 Use welding studs of size not larger than 10 mm (3/8") for attaching miscellaneous materials and equipment to building steel. If weight of materials or equipment require bolts or studs larger than 10 mm (3/8") dia, use steel clips or brackets, secured to building steel by welding or bolting method of attachment as approved by Consultant.

3.1.1.2 Use self drilling expansion type concrete inserts for securing miscellaneous equipment and materials to masonry or concrete construction already in place, of sufficient number and size to prevent concrete from breaking away. Use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from Consultant.

3.1.1.3 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.

3.1.1.4 Provide beam clamps of 2-bolt design and of such type that rod load is transmitted only concentrically to beam web centreline. Use of "C" and "I" beam side clamps and other similar items will not be allowed without written consent of Consultant.

3.1.1.5 Where roof or floor framing consists of open web or long span steel joists, ensure that hangers are located at or within 150 mm (6") of joist top or bottom chord panel points, otherwise

provide additional structural steel as required where hanger spacing does not coincide with joist spacing. Design suspension assembly such that hanger load is transmitted only concentrically to supporting joist. Do not use "C" and "I" beam side clamps, brackets and other similar, without written consent of Consultant.

3.1.1.6 Locate secondary structural steel members between joists at or within 150 mm (6") of top or bottom chord panel points. Where secondary structural steel member cannot be located at or near joist panel point, provide additional diagonal structural steel web member(s) designed for applicable load to nearest panel point in opposite chord member. This condition may be waived if load to be suspended between panel points is not in excess of 45 kg (100 lbs). Diagonal hangers which will induce lateral stresses in chord members of joist will not be permitted. Submit shop drawings of suspension assembly indicating location of suspension or support points, max load at each suspension point, location and size of hangers, brackets and intermediate framing members when required, and also details of connection to building structure.

3.2 PIPING CONSTRUCTION METHODS

3.2.1 General

3.2.1.1 Unless specified otherwise herein, construct and install piping in accordance with ANSI Sections B31.1 to B31.9 as applicable to service, except that soldered joints will not be permitted in compressed air piping.

3.2.1.2 To avoid unnecessary cutting of masonry, provide inserts, sleeves and anchors to other trades for building in as Work proceeds. Arrange with other trades to leave openings, slots and chases to accommodate later installation of mechanical work.

3.3 PIPE HANGERS AND SUPPORTS

3.3.1 General

3.3.1.1 Support or suspend piping with necessary hangers, structural supports and/or brackets as indicated on Drawings and/or as required, to prevent sagging, warping and vibration and to allow for movement due to expansion and contraction. Place hangers and supports close to fittings, valves and/or other heavy parts.

3.3.1.2 Do not allow loads of any nature to be transmitted through piping connections to equipment not specifically designed for such loads. Where flexible connections are not called for at connections to equipment, support pipe by stands attached to both pipe and supporting structure so that force in any direction is not transmitted to equipment.

3.3.1.3 Provide suitably dampened spring hangers for first 3 supports from equipment connection on piping subject to excessive movement or shock from any source, thermal expansion and contraction, selected in accordance with ANSI B31.1. Where it is evident that no undue loads will be transmitted to equipment by system concerned, i.e. small bore connections to comparatively large equipment, cold service piping not subject to shock, etc., then spring hangers may be omitted and standard hangers used.

3.3.1.4 Use trapeze type hangers where pipes are grouped together, unless specifically indicated otherwise on Drawings. Suspend horizontal member by adjustable rods with locking feature for maintaining level and slope. Space trapeze type hangers based on closest interval required by any pipe supported thereon. Provide any auxiliary steel required to support trapeze between building steel.

3.3.1.5 Do not hang any pipe from another pipe unless specifically indicated on Drawings.

3.3.2 **Saddles and Roller Supports**

3.3.2.1 Provide saddles at roller supports for piping carrying liquids at 10.5 deg C (51 deg F) or higher. Weld saddles to black or galvanized steel piping. Refinish galvanized surfaces destroyed by welding with zinc rich paint.

3.3.3 **Hangers**

3.3.3.1 For insulated piping up to NPS 4 carrying liquids at temperatures 10.5 deg C (51 deg F) and higher, use standard weight clevis hangers with level adjustment and locknut.

3.3.3.2 For insulated lines of NPS 4 dia and larger carrying liquids at temperatures 10.5 deg C (51 deg F) or higher, use adjustable roller type hangers with locknuts, and rollers of sufficient width to clear outside diameter of insulation on piping. Support rollers at both ends, either by yoke, swivel type hanger or by 2 adjustable rods with locknuts.

3.3.3.3 For insulated piping carrying liquids at temperature of 10 deg C (50 deg F) or less, use elongated clevis type hangers, with clevis of sufficient width to fit over insulation bearing plate.

3.3.3.4 Provide insulation protection bearing plates at hangers and supports for piping carrying liquids at temperature of 10 deg C (50 deg F) or less. Install temporary spacers between plate and pipe equal to thickness of insulation specified. (Refer to Section 15081, Piping Insulation).

3.3.3.5 Bearing plates may be either shop fabricated, or manufactured plates of size required to properly fit outside diameter of pipe insulation.

3.3.3.6 Fabricate bearing plates conforming to following table for various pipe sizes:

Pipe Size (NPS) P	Length of plate mm (in)	Thickness of Plate mm (ga)
1/2 thr. 1-1/2	130 (5)	1.2 (18)
2	150 (6)	.52 (16)
2-1/2	200 (8)	1.52 (16)
3	230 (9)	1.52 (16)
4 and up	250 (10)	1.52 (16)

3.3.3.7 Form bearing plates to outside diameter of adjoining pipe insulation and extend plate up to

horizontal centre line of pipe.

3.3.3.8 For non-insulated piping use clevis type of wrought steel construction with adjustable rod, level locking feature and backnuts.

3.3.3.9 For copper tubing provide copper coated hangers. Regulations of some municipalities require that copper tubing be taped with plastic tape at hanger location, or hanger be provided with plastic insert. Meet these requirements when required, in which case copper coating may be omitted on hanger.

3.3.3.10 Attach hanger rods to building structure by means of malleable iron beam clamps, concrete inserts, and/or approved anchors as hereinbefore specified.

3.3.4 **Hanger Spacing**

3.3.4.1 For horizontal runs of plumbing and drainage piping comply with hanger spacing requirements of OBC.

3.3.4.2 For horizontal runs of black or galvanized steel pipe, other than for plumbing service, do not exceed max distances between supports and with min dia rods as follows:

Pipe Size (NPS)	Distance m (ft)	Dia. of Rod mm (in)
Up thru 1-1/4	1.8 (6)	10 (3/8)
1-1/2	1.8 (6)	10 (3/8)
2	3.05 (10)	10 (3/8)
2-1/2 & 3	3.66 (12)	12 (1/2)
4	4.27 (14)	16 (5/8)
6	5.18 (17)	19 (3/4)
8	5.79 (19)	22 (7/8)
10 & 12	6.71 (22)	22 (7/8)

3.3.4.3 Provide additional hangers in locations where there are concentrated loads such as valves, specialties and other such items.

3.3.4.4 For horizontal runs of copper tubing for services other than plumbing, do not exceed 1.8 m (6 ft) between hangers for lines up to and including NPS 3/4 and 2.4 m (8 ft) for lines of NPS 1 and larger.

3.3.4.5 For horizontal runs of piping fabricated of PVC, use hanger spacing as recommended by manufacturer.

3.3.5 **Vertical Piping Supports**

3.3.5.1 Support vertical plumbing and drainage piping as required by OBC, unless more stringent requirements are specified herein.

3.3.5.2 Support cast iron soil pipe at every floor and other piping at every other floor unless otherwise required by expansion conditions or otherwise specified.

3.3.5.3 Support bottom of riser with base fitting set on concrete pier or by hanger located at top of riser pipe as close to riser as possible.

3.3.5.4 For supports at intermediate floors, use Grinnell Fig. 261 or approved equal steel extension pipe clamp, bolted securely to pipe. Rest ends of clamp on pipe sleeve or on floor.

3.3.5.5 Provide lateral stability of vertical piping by fabricated brackets or malleable iron, extension type split hangers. Run vertical piping at columns in column webs, on either or both sides of column, unless otherwise directed.

3.3.6 **Anchors and Guides**

3.3.6.1 Supply and install anchors where indicated on Drawings and/or as required to maintain permanent location of pipe lines. Construct anchors for steel or galvanized pipe of approved steel straps and/or rods and for anchoring copper lines use copper plated anchors or provide insulation bands between tubing and clamps if steel straps or rods are used. Install anchors and guides in approved manner.

3.3.6.2 Acceptable Materials: Grinnell #256 or Myatt.

3.4 **MISCELLANEOUS STEEL**

3.4.1 **General**

3.4.1.1 Supply and install miscellaneous structural supports, platforms and braces as may be required to hang or support piping unless Drawings or other Sections of Specifications state otherwise.

3.4.1.2 Submit detailed shop drawings to structural engineer for review before commencing fabrication.

3.4.2 **Materials and Fabrication**

3.4.2.1 Conform to CAN/CSA-S16 for materials, design of details and execution of work.

3.4.2.2 Conform to CAN/CSA-G40.20/G40.21, grade 300W for structural shapes, plates, and other similar items.

3.4.2.3 Use welded construction wherever practicable, with bolted joints allowed for field assembly using high strength steel bolts. Chip welds to remove slag, and grind smooth.

3.4.2.4 Conform to latest issue of following CSA Specifications.

CSA W47.1, for qualification of welders
CSA W48.1-M, for electrodes (only coated rods allowed)

CSA W59-M, for design of connections and workmanship
CSA W117.2, for safety

3.4.3 **Painting and Cleaning**

3.4.3.1 Touch up minor damage to finish on equipment with standard factory applied baked enamel finish. If, in Consultant's opinion, damage is too extensive to be remedied by touch up, replace damaged equipment.

3.4.3.2 Clean steel by scraping, wire brushing or other effective means to remove base scale, rust, oil, dirt or other foreign matter.

3.4.3.3 Apply 1 coat of zinc chromate iron oxide primer, conforming to CAN/CGSB-1.40-M to miscellaneous steel.

3.4.3.4 In field, touch up bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as herein before specified.

3.4.3.5 Give 2 coats of primer to surfaces which will be inaccessible after erection.

3.4.3.6 Remove foreign matter from steelwork on completion of installation.

3.4.4 With exception of prime painting of miscellaneous steel or any other specific requirements as specified above or under respective Sections of the Mechanical Contractor, or equipment otherwise factory painted, painting will be provided under Division 9, Finishes.

3.5 **CONCRETE INSERTS**

3.5.1 Install inserts required for attachment of hangers, either for suspension of piping or equipment.

3.5.2 For masonry or poured concrete construction use expansion type units. Insert into concrete after concrete has cured. Anchors or inserts installed by explosive means shall not be used.

3.6 **SEALED (STAMPED) SHOP DRAWINGS FOR PIPE SUPPORT SYSTEM**

3.6.1 The Mechanical Contractor, as part of the Base Tender Price, is responsible for retaining the services of a Professional Engineer licensed in the Province of Ontario to prepared detailed support drawings (sealed by the Professional Engineer), with the drawings outlining the following information:

.1 Floor Plans depicting support types being proposed in each area of work for each type of piping system (plumbing, drainage, heating, etc.). The support types are to be reviewed and approved by the Engineer for use in this application.

.2 Floor Plans depicting attachment method of attaching the supports to the Building Structures.

.3 Floor Plans depicting the maximum span of the supports in each area of work.

The Professional Engineer is responsible for overseeing the construction and supply/installation of the supports and provide a Letter of Completion at the end of the

work confirming that all work has been completed in accordance with the Engineered Plans.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS

1.2.1 Submit shop drawings in accordance with 20 05 11 Mechanical General Requirements.

1.2.2 Submit for approval, manufacturer's catalogue literature related to installation and fabrication.

PART 2 - PRODUCTS

2.1 GENERAL

2.1.1 Supply access doors to the relevant building trade to provide access in furred ceilings for the following:

.1 Servicing equipment

.2 Access to plumbing cleanouts

.3 Access to shut off valves.

.4 Inspection of life safety equipment.

.5 Service of operating devices

.6 All locations where periodic maintenance is required.

2.1.2 Access door sizes shall be as follows:

.1 Body Entry: 24" x 24" (600 x 600 mm)

.2 For Hand Entry: 18" x 18" (450 x 450 mm)

.3 For Viewing Only: 12" x 12" (300mm x 300mm)

2.1.3 All doors shall open 180 degrees and have rounded safety corners

2.1.4 For fire rated ceilings or wall provide a fire rated access door that will match the fire rating of the wall that the access door is installed in. The Mechanical Contractor shall be responsible for reviewing the drawings and providing fire rated access doors where they are required.

2.1.5 Where body access is possible the access doors shall be provided with a releasing mechanism on both sides of the door.

2.1.6 Provide access panels in all ductwork where fire dampers or combination fire/smoke dampers are shown on the Drawings to allow for inspection of the dampers.

2.1.7 Provide access panels at all balancing damper locations to allow access to the damper in the future.

2.2 RECESSED ACCESS DOOR FOR DRYWALL APPLICATIONS

2.2.1 Door shall be 16 gauge steel. Mounting frame shall be 14 gauge galvanized steel.

2.2.2 Door shall be provided with a 25 mm (1") recess or 14mm (5/8") to suit the thickness of the drywall ceiling.

2.2.3 The frame shall be provided with a galvanized steel drywall taping bead on all sides.

2.2.4 The hinge shall be a concealed pivoting rod.

2.2.5 The latch shall be a flush to the surface, screwdriver operated cam latch.

2.2.6 The steel finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.2.7 Standard of Acceptance: Acudor DW-5015, Mifab, Zurn, Watrous, Williams Brothers

2.3 RECESSED ACCESS DOOR FOR PLASTER APPLICATIONS

2.3.1 Door shall be 16 gauge steel. Mounting frame shall be 14 gauge galvanized steel.

2.3.2 Door shall be provided with a 14mm (5/8") recess and shall be lined with self furring galvanized lath.

2.3.3 The frame shall be provided an expansion casing bead with 75 mm (3") wide galvanized lath, recessed 20mm (3/4") to receive plaster.

2.3.4 The hinge shall be a concealed pivoting rod.

2.3.5 The latch shall be a flush to the surface, screwdriver operated cam latch.

2.3.6 The steel finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.3.7 Standard of Acceptance: Acudor AP-5010, Mifab, Zurn, Watrous, Williams Brothers

2.4 FLUSH ACCESS DOORS FOR TILED WALL APPLICATIONS

2.4.1 For doors 400mm x 400mm (16" x 16") and smaller the door shall be 16 gauge with 18 gauge mounting frame.

2.4.2 For doors over 400mm x 400mm (16" x 16") the door shall be 14 gauge with 16 gauge mounting frame.

2.4.3 Door shall be flush to frame with rounded safety corners.

2.4.4 The frame shall be one piece welded to the mounting frame.

2.4.5 The hinge shall be a continuous concealed hinge.

2.4.6 The latch shall be a stainless steel screwdriver cam latch.

2.4.7 The finish shall be type 304 #4 satin polish stainless steel.

2.4.8 Standard of Acceptance: Acudor UF-5000, Mifab, Zurn, Watrous, Williams Brothers

2.5 FIRE RATED ACCESS DOOR

2.5.1 Door shall be constructed of 20 gauge steel with a 16 gauge mounting frame.

2.5.2 Door shall be filled with 50mm (2") thick fire rated insulation.

2.5.3 The door frame shall be provided with a 25mm (1") wide flange and mounting frame to have anchor straps.

2.5.4 The hinge shall be concealed and shall be provided with a spring closer.

2.5.5 Door shall be UL/ULC rated for 1 ½ hour "B" label with 250 degree F temp rise in 30 minutes.

2.5.6 The latch shall be a universal self latching bolt, operated by either a knurled knob.

2.5.7 The steel finish shall be 5 stage iron phosphate prepared with a prime coat of grey baked enamel.

2.5.8 For drywall applications provide a galvanized steel drywall taping bead flange.

2.5.9 Standard of Acceptance: Acudor FB-5050, Mifab, Zurn, Watrous, Williams Brothers

2.6 FIRE RATED ACCESS DOOR WITH INSIDE LATCH RELEASE

2.6.1 Door shall be constructed of 16 gauge steel with a 16 gauge mounting frame.

2.6.2 Door shall be flush to frame with reinforced edges.

2.6.3 The door frame shall be provided with a 25 mm (1") wide flange and shall be provided with anchor straps.

2.6.4 The hinge shall be concealed and shall be provided with a spring closer.

2.6.5 The door shall be UL/ULC rated for 1 ½ hour "B" label or 2 hour "B" label as required where temperature rise is not a factor.

2.6.6 The latch shall be a universal self latching bolt, operated by either a knurled knob.

2.6.7 The steel finish shall be 5 stage iron phosphate prepared with a prime coat of grey baked enamel.

2.6.8 Door shall be provided with an interior latch release.

2.6.9 For drywall applications provide a galvanized steel drywall taping bead flange.

2.6.10 Standard of Acceptance: Acudor FB-5060, Mifab, Zurn, Watrous, Williams Brothers

2.7 VALVE BOX – SURFACE MOUNT

2.7.1 Door shall be stainless steel in public areas and steel in mechanical rooms and service areas.

2.7.2 Door and box shall be 16 gauge steel.

2.7.3 The door shall overlap the box, providing a tight and secure fit.

2.7.4 The box shall be fully enclosed, attached to the door.

2.7.5 The hinge shall be a continuous piano hinge.

2.7.6 The door shall be provided with a cylinder lock and key.

2.7.7 For steel doors the finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.7.8 Stainless steel doors shall be #4 satin finish.

2.7.9 Standard of Acceptance: Acudor ASVB, Mifab, Zurn, Watrous, Williams Brothers

2.8 VALVE BOX – RECESSED

2.8.1 Door shall be stainless steel in public areas and steel in mechanical rooms and service areas.

2.8.2 Door and box shall be 16 gauge steel.

2.8.3 The door shall be flush to the frame with rounded safety corners.

2.8.4 The box shall be fully enclosed, completely attached to the frame.

2.8.5 The hinge shall be a continuous concealed hinge.

2.8.6 The door shall be provided with a cylinder lock and key.

2.8.7 For steel doors the finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.8.8 Stainless steel doors shall be #4 satin finish.

2.8.9 Standard of Acceptance: Acudor ARVB, Mifab, Zurn, Watrous, Williams Brothers

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 On some drawings, access door locations have been indicated for coordination. The drawings do not show all access doors required.

3.1.2 The Mechanical Contractor shall provide a set of drawings showing locations and types of all access doors located in public areas to the Consultant for approval, prior to commencing the installation of any piping or ductwork within these areas.

3.1.3 Access doors shall be turned over to the building trade that is responsible for finishing the wall or ceiling where the access door is required.

3.1.4 The Mechanical Contractor shall be responsible for providing the access doors required to be installed in ductwork. Refer to other sections for requirements.

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 Section Includes:

.1 Valve Tags.
.2 Pipe Markers/Arrow Tape Above Ground.
.3 Underground Piping Warning Tape.
.4 Mechanical Equipment and HVAC Controls Identification.
.5 Safety Signs.
.6 Isolation Valves Numbering.

1.2 DEFINITIONS

.1 Exposed Areas

.1 Finished areas and other areas used by personnel in normal use of building, such as equipment rooms and storage rooms.

.2 Concealed Areas

.1 Duct or pipe tunnels, duct or pipe chases, spaces above accessible ceilings, and crawl spaces.

2 PRODUCTS

2.1 STANDARD OF ACCEPTANCE

.1 W. H. Brady Co. catalogue numbers are used as a basis of identification.

.2 Stock catalogue numbers are listed in these specifications. Subcontractor is responsible to review schedules and provide required markers. In some instances, "non-stock" markers (special) may be required.

2.2 MANUFACTURER'S NAMEPLATES

.1 Manufacturer's nameplates:

.1 Provide metal nameplate on each piece of equipment, mechanically fastened with raised or recessed letters.
.2 Provide Underwriters' Laboratories or CSA registration plates, as required by respective agency.
.3 Manufacturers nameplate to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.
.4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

2.3 VALVE TAGS

.1 Metal Tags: Brass or aluminium with stamped or engraved letters; tag sizes minimum 2 inches (round, square, or rectangle) with smooth edges. Thickness 19 gauge (.040 inches) minimum.

.2 Beaded Chain: Size 6, brass or aluminium, 4 1/2 inches long with locking link.

2.4 PIPE MARKERS/ARROW TAPE ABOVE GROUND

.1 Colour: Conform to ANSI A13.1.

.2 Self-Sticking Pipe Markers/Arrow Tape: Material B-946, flexible, vinyl film tape with pressure sensitive permanent adhesive backing and printed markings.

.3 Suitable for indoor/outdoor application.

.4 Temperature range: Minus 40 degrees to 180 degrees F.

2.5 UNDERGROUND PIPING WARNING TAPE

.1 Tracer wire and test station(s) required when burying cast iron, ductile iron, or non-metallic piping.

.2 Tracer Wire: #10AWG THHN/THWN, yellow, solid copper.

.3 Tracer Wire Test Station: C.P. Test Services. Test Station: Plastic Pipe, cast iron cover, 2-point terminal box.

2.6 CONTROLS IDENTIFICATION

.1 Refer to section 25 20 11.

2.7 EQUIPMENT IDENTIFICATION

.1 Labelling shall be furnished and installed by the contractor

.2 Engraved signs shall be dark letters on light background.

.3 Identify mechanical equipment and HVAC controls, e.g., air handling units, pumps, heat transfer equipment, water treatment devices, controls instruments, stationary tanks/containers, and similar items, with nameplates or tags.

.4 Provide engraved nameplates made of rigid plastic laminate in which colored top and bottom layers of the material are thermoset with a contrasting color core. Minimum thickness 0.062 inch.

.5 Size: min. 1" x 3".

.6 Material Colour: White background/ black lettering.

.7 Manufacturer: Brady, No. B-1

.8 Provide lettering as follows:

.1 Size: 10 point minimum
.2 Spacing: 1/4 inch from top, 1/8 inch from bottom, 1/16 inch between lines.
.3 Provide nameplate with component nomenclature as noted in the Equipment Schedules. Coordinate with the controls sub-contractor.

.9 As a minimum, identify the system, e.g., HVAC (heating, ventilating, and air conditioning), the component, e.g., FGF (furnace, gas fired), and the sequence number.

2.8 SAFETY SIGNS

.1 Colors associated with specific words such as "Danger," "Warning," "Caution," or "Notice" shall conform to ANSI Z35.1.

2.9 DUCTWORK IDENTIFICATION

.1 Provide labels on the two sides and the bottom of all ductwork at intervals of every 5' to note the System Type ('Fresh Air Supply', 'Return', 'Exhaust') and directional arrows.

3 EXECUTION

3.1 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

.1 Valve Tags:

.1 Install with brass beaded chain.
.2 Steel stamp or engrave valve tag in accordance with schedule herein.
.3 Letter style block, 1/4-inch height minimum.
.4 Tag all valves in concealed or exposed areas except isolation and by-pass valves installed adjacent to the equipment they serve.
.5 Provide typewritten letter size list of applied tags and location. Frame under glass and hang where directed.

.2 Pipe Markers Above Ground:

.1 Install in accordance with manufacturer's instructions.
.2 Seal markers with clear lacquer.
.3 Identify piping in exposed or concealed areas in accordance with schedule herein.
.4 Pipe marker consists of pipe contents identification with flow direction arrow tape. Provide consistent color scheme, unless otherwise noted.
.5 Wrap arrow tape completely around pipe at both ends of pipe markers.

.6 Install in clear view and align with axis of piping.

.7 Label piping at intervals of not more than 20 feet on horizontal and vertical runs, at each branch connection, and where pipe penetrates walls, ceilings and floors (both sides).

.8 Size of label depends on outside diameter (OD) of pipe. Pipe OD includes insulation or protective coating.

.9 Minimum length of marker including arrows:

(a) 2" diam. pipe or smaller:	8"
(b) 2" to 8"	12"
(c) 8" to 10"	24"
(d) Over 10":	32"

.3 Safety Signs

.1 Install in clear view.

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 11.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

.3 Submit type of isolator, size, height when uncompressed and maximum allowable static deflection weight of all isolated equipment, loads on each isolator and static deflection of each isolator under the specific design load.

.4 Submit marked up plans indicating all locations where pipes are to be isolated in mechanical rooms and as specified.

2 PRODUCTS

2.1 GENERAL

.1 Vibration isolator sizes and layout shall be determined by the vibration isolator supplier.

.2 Elastomeric elements that will be exposed to temperatures below freezing shall be fabricated from natural rubber instead of neoprene.

.3 All isolators to be installed outdoors or exposed to weather shall be hot dipped galvanized and shall be furnished with neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

.4 Standard of Acceptance: Kinetics Noise Control, Vibro-Acoustics.

2.2 FLEXIBLE PIPE CONNECTORS

.1 Flexible pipe connectors shall be used on all piping connected to rotating equipment (Chiller, pumps, air handling equipment) to reduce the transmission of noise and Vibration, and to eliminate stresses in piping systems due to misalignment and thermal movement of the piping.

.2 Flexible connectors shall be of the single- or double-sphere molded joint configuration and shall meet or exceed specifications of the Rubber Expansion Joint Division, Fluid Sealing Association.

.3 Connectors shall be made of molded neoprene reinforced with nylon tire cord and shall have mild steel floating flanges or female union ends.

.4 Control rods shall be used with unanchored systems or with spring-mounted equipment where the pressures and movements exceed those the connectors are designed to withstand.

.5 Standard of acceptance: Kinetics model Kinflex

2.3 FLEXIBLE DUCT CONNECTORS

.1 Flexible Connections

.1 Where duct connections are made to fans and air handling units (not internally isolated), install a non combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack during operation to insure that no vibration is transmitted.

.2 Length of connection: 6"

.3 Minimum distance between metal parts when system in operation: 3"

.4 Install in accordance with recommendations of SMACNA.

2.4 ELASTOMERIC PADS

.1 Neoprene waffle or ribbed; 9mm minimum thick; 50 durometer; maximum loading 350kPa. Mason type W

.1 Application: between all floor-mounted pumps supports and the house-keeping pads

2.5 ELASTOMERIC MOUNTS

.1 Neoprene, moulded from oil-resistant compounds, with a cast-in-top steel load transfer plate for bolting to supported equipment and a bolt-down plate with holes provided for anchoring to the supporting structure. Isolator shall provide lateral load resistance for loads applied parallel to mounting surface. Neoprene vibration isolators shall be Model RQ, by Kinetics Noise Control, Inc.

.1 Application: between boilers and domestic hot water heaters support frames and house-keeping pads.

2.6 PIPE HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Swivel arrangement topermit hanger box or rod to move through a 30 deg. arc without metal to metal contact. Unless specified otherwise, the static deflection shall be 9mm, with a strain not exceeding 15%, and spring hangers to have minimum static deflection of 2". A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19mm larger than the diameter of the hanger rod.

.2 Standard of acceptance: Kinetics model SRH

3 EXECUTION

3.1 INSTALLATION

.1 Provide vibration isolation for new equipment as noted in the specification, listed in the schedule and shown on the drawings.

.2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.3 Ensure piping and electrical connections to isolated equipment do not reduce system flexibility.

.4 All suction and discharge from the pumps shall be provided with flexible pipe connections.

.5 Unless indicated otherwise, support all piping connected to the pumps and boilers with spring equipped hangers as described in these specifications, as follows:

.1 First 3 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 2".

.6 Unless specified otherwise, all pump supports will be mounted on elatomeric pads.

.7 Unless specified otherwise, the boilers, indoor air handlers, indoor chillers will be mounted on elastomeric mounts

.8 All wiring connections to the pumps shall be made in a 360 degree loop; minimum conduit length: 3 ft. Cut any ties used to install this loop prior to adjusting the isolators.

.9 Provide suitable supports for all equipment which does not have a frame with adequate rigidity.

.10 There shall be a minimum of 4" clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.

.11 Piping, ductwork, conduit or mechanical equipment shall not be hung from or supported on other equipment, pipes or ductwork installed on vibration isolators. Such elements shall be supported on or suspended from building structure**.**

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 QUALITY ASSURANCE

.1 Comply with OBC and NFPA 90A requirements, particularly paragraphs pertaining to the maximum flame spread index (currently set at 25) and maximum smoke development index (currently set at 50).

.2 All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

.3 Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.3 SUBMITTALS

.1 Submit in accordance with Section 20 05 11 shop drawings and product data

.2 Provide the following:

.1 Insulation materials: Specify each type used and state surface burning characteristics.
.2 Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
.3 Insulation accessory materials: Each type used.
.4 Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.

1.4 STORAGE AND HANDLING OF MATERIAL

.1 Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.5 STANDARDS OF ACCEPTANCE

.1 Knauf Fiber Glass
.2 Owens/Corning Fiberglass
.3 Armstrong
.4 Johns Manville
.5 Rockwool Manufacturing

2 PRODUCTS

2.1 GENERAL

.1 K-factors (thermal conductivity) shown are expressed in BTU•in/hr•ft2•F.

2.2 FIBERGLASS PIPE INSULATION

.1 Insulation:

.1 Rigid molded in compliance with ASTM C547, Class 1, minimum density 3.5 pounds/cubic foot, K-factor of approximately 0.24 at 75 degrees F, suitable for temperatures from minus 20 degrees F to 450 degrees F.

.2 Vapor Barrier

.1 Factory applied vapor barrier all-service type with self-sealing lap and butt strips.

.3 Valves and Fitting Covers

.1 Pre-molded PVC covers with fiber glass insert. Manufacturers: Proto Corp., Ceelco.

.4 Applications

.1 All domestic cold water piping.
.2 All domestic hot water and recirculation piping.
.3 All hot water heating piping.
.4 All glycol heating piping
.5 All condensate piping.
.6 All horizontal and vertical sections of storm drainage.
.7 All horizontal and vertical sections of sanitary drainage.

2.3 INSULATION THICKNESS

.1	Hot water heating, all piping sizes:	1”
.2	Domestic hot water less than 2"	1"
.3	Domestic hot water larger than 2"	1½”
.4	Domestic cold water, all piping sizes:	1"
.5	Condensate, all piping sizes:	1”
.6	Storm & Sanitary Piping, all piping sizes:	1”

2.4 ADHESIVE, MASTIC, CEMENT

.1 ASTM C449: Mineral fiber hydraulic setting thermal insulating and finishing cement.

.2 Other: Insulation manufacturers' published recommendations.

2.5 MECHANICAL FASTENERS

.1 Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
.2 Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.6 CANVAS JACKETING

.1 Apply in concealed areas, compact, firm ULC listed heavy plain weave, cotton fabric at 220 g/m sq.

2.7 PVC JACKETING

.1 Apply in exposed areas on piping with operating temperatures less than 180°F. (80°C.).

.2 Piping: ULC listed PVC moulded type jacketing material, gloss white complying with 25 Flame Spread and 50 Smoke Developed ratings.

.3 Fittings: ULC listed PVC, gloss white, 1-piece, pre-moulded fittings complying with 25 Flame Spread and 50 Smoke Developed ratings.

.4 PVC Application: strictly in accordance with the requirements of Authorities having jurisdiction.

.5 Ultraviolet resistant.

.6 Fastenings: To manufacturer's standard(s).

2.8 METAL JACKETING

.1 At all locations where the pipe is located outdoors or in heavy abuse areas, use metal jacketing to protect piping or ductwork insulation.

.2 Jacketing: Aluminum, 0.016 inches thick, embossed surface, with factory bonded moisture barrier.

.3 Valve and Fitting Insulation Covers: Fabricate from same material as jacketing or use prefabricated insulation covers made in two matching halves.

.4 Metal Jacketing Bands: 1/2 inch wide, aluminum or stainless.

2.9 PROTECTION SADDLES AND SHIELDS

.1 Provide factory engineered galvanized steel hanger shields on horizontal insulated pipe complying with MSS SP-58 and MSS SP-59 standards for gauge and length of saddle.

2.10 SADDLES (PIPING/TUBING UP TO 2 INCHES)

.1 Use 180 degree saddle on systems utilizing teardrop type hangers.

.2 Use 360 degree saddle on systems utilizing trapeze hangers or clamps.

2.11 INSERTS AND SHIELDS (PIPING/TUBING OVER 2 INCHES)

.1 Use 360 degree calcium silicate insert with a 180 degree shield on systems utilizing clevis or teardrop type hangers.

.2 Use 360 degree calcium silicate with a 360 degree shield on systems utilizing trapeze hangers or clamps.

.3 The unit shall have an integral moisture barrier consisting of a tri-laminate All-Service Jacket equal and similar to the jacketing on the adjoining insulation.

.4 Insert: Calcium silicate, minimum density 9 pounds/cubic foot.

3 EXECUTION

3.1 EXAMINATION

.1 Verify that items to be insulated have been pressure tested and approved before applying insulation material.

.2 Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION - GENERAL

.1 Install materials in accordance with manufacturer's instructions.

.2 Required pressure tests of piping joints and connections shall be completed and the work approved by the Consultant for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

.3 Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories). Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

.4 Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

.5 Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

.6 Insulation on hot piping and equipment shall be terminated square at items not to be insulated, such as access openings and nameplates. Cover all exposed raw insulation with white sealer or

jacket material.

.7 Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

.8 Piping work not to be insulated:

.1 In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.

.9 Plumbing work not to be insulated:

.1 Piping and valves of fire protection system.
.2 Chromium plated brass piping.
.3 Piping in pipe basement serving wall hydrants.
.4 Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).

.10 Work shall be performed by qualified insulation journeymen.

.11 Apply insulation and coverings on hot piping while surface is between 50 to 60^{O}C

.12 Vapor barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, and without interruption at sleeves, pipe and fittings.

.13 Do not insulate factory-insulated equipment.

.14 Do not insulate nameplates.

.15 Fit insulation tightly against surface to which it is applied.

.16 For non-fire rated barriers (e.g., wall, floor, ceiling, or roof) continue insulation and vapor barrier through penetrations. For fire rated barriers, provide ULC/FM approved through penetration stop systems.

.17 Weatherproof outdoor installations of piping or ductwork covered with aluminum jacket. Provide watershed lap joints and seal with mastic as required.

.18 Do not install metal jacketing with raw edges; provide a safety edge.

3.3 INSTALLATION - PIPING

.1 On exposed piping located in finished areas, locate cover seams in least visible area.

.2 Provide continuous insulation through pipe hangers or supports. Do not notch insulation. Provide shields or saddles to prevent crushing insulation.

.3 Where insulation terminates, taper to pipe and finish with insulating cement or acrylic mastic.

.4 Cover insulated pipes located outdoors or in utility tunnels with aluminum jacket. Secure with aluminum bands and screws as required.

.5 Tape circumferential joints of pipe insulation with 3 inch wide white vinyl tape.

.6 Insulate fitting and valves where required with same material thickness as specified for adjacent pipe.

.7 Insulate potable and non-potable cold water piping within walls, chases, or ceiling plenums where return air is present.

.8 Insulate potable and non-potable cold water piping in equipment rooms.

.9 Do not insulate unions, flanges and valves in potable or non-potable piping systems of 140 degrees F or less, except for chilled water.

.10 Vertical pipe over 3" diameter: use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter locate on 12 ft centers and at each valve and flange.

.11 Expansion joints: Terminate single layer and each layer of multiple layers in straight cut. Leave space of 1" between terminations. Pack void tightly with glass wool. Protect joints with aluminum sleeves.

.12 Use factory fabricated, easily disassembled insulation, for valves, fittings and process equipment requiring periodic maintenance of parts and sub-assemblies listed or indicated.

END OF SECTION

1 GENERAL

1.1 DESCRIPTION

.1 Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

.1 Systems Inspection report.
.2 Duct Air Leakage test report.
.3 Balancing air and water distribution systems; adjustment of total system to provide design performance;
.4 Recording and reporting results.

1.2 DEFINITIONS

.1 TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.

.2 CAABC: Canadian Associated Air Balance Council.

.3 Hydronic Systems: Includes heating hot water, domestic hot water recirculation, and glycol water systems, as applicable to the project.

.4 Air Handling Systems: Includes all central and distributed air handling equipment that provide outside air, supply air, return air, exhaust air and relief air to and from the building, as applicable to the project.

.5 Air distribution systems: Includes all grilles, diffusers, terminal units (by pass/VAV).

.6 Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 TAB Agency: The TAB agency shall be a Sub-Contractor of the Mechanical Contractor and shall report to and be paid by the Mechanical Contractor.

.2 The TAB agency shall be one of the following Vendors:

(i) Enviro Balance Inc.
(ii) National Air Balance Inc.

.3 TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency.

.2 TAB Agency shall be identified by the Mechanical Contractor within 15 days after the award of the contract.

.3 The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Consultant. The responsibilities would specifically include:

.1 Shall directly supervise all TAB work.
.2 Shall sign the TAB reports that bear the seal of the TAB Agency. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC.
.3 Would follow all TAB work through its satisfactory completion.
.4 Shall provide final markings of settings of all HVAC adjustment devices.
.5 Permanently mark location of duct test ports.

.4 Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards and or by the instrument manufacturer.

.5 Tab Criteria:

.1 Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90 percent of final values for pre-filters and after-filters.

.2 Flow rate tolerance:

.1 Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0% to plus l0%.
.2 Grilles, diffusers and air terminal units (maximum values): 0% to +l0%.
.3 Exhaust hoods/cabinets: 0 % to + l0 %.
.4 Minimum outside air: 0 % to +10 %.
.5 Individual room air outlets and inlets, and air flow rates not mentioned above: 0% to +l0 % except if the air to a space is 100 CFM or less the tolerance would be 0 to plus 5 %.
.6 Heating hot water pumps and hot water coils: 0 % to +5 %.
.7 Heating hot water convectors, forced flow heaters, unit heaters: 0 % to +5 %.
.8 Chilled water and condenser water pumps: 0% to +5 %.
.9 Chilled water coils: 0 % to +5 %.

1.4 SUBMITTALS

.1 Submit Following for Review to the Consultant:

.1 Systems inspection report on equipment and installation for conformance with design.

.2 Duct Air Leakage Test Report, demonstrating compliance with all ASHRAE 90.1 ductwork sealing requirements.

.3 Final TAB reports covering flow balance and adjustments, performance tests.

.4 Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

1.5 APPLICABLE PUBLICATIONS

.1 The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

.2 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE): HVAC Applications ASHRAE Handbook, Testing, Adjusting, and Balancing

.3 Associated Air Balance Council (AABC): AABC National Standards for Total System Balance

.4 Sheet Metal and Air Conditioning Contractors National Association (SMACNA): HVAC SYSTEMS Testing, Adjusting and Balancing

2 Products

2.1 PLUGS

.1 Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

.1 Coordinate with the mechanical Contractor the TAB activity such that it does take place before the insulation is installed on ductwork and piping.

.2 In the absence of such coordination, the mechanical contractor shall be responsible for the repair to the ductwork and or piping insulation removed for TAB purposes, including the integrity of the vapor barrier material and the insulation jacket.

3 Execution

3.1 GENERAL

.1 Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 SYSTEMS INSPECTION REPORT

.1 Inspect equipment and installation for conformance with design.

.2 The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

.3 Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Consultant.

.4 Reports: Follow check list format developed by CAABC or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals.

Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.3 TAB REPORT

.1 Format to be in accordance with referenced standard listed above, but using design drawing units.

.2 Produce "as-built" full system schematics. Use as-built drawings for reference.

.3 Submit 1 copy of preliminary TAB reports, each in "D" ring binders, complete with index tabs for verification and approval of Consultant.

.4 Submit copies of final TAB reports after approval by the Consultant, to be incorporated into the Maintenance and Operations Manual.

3.4 PROCEDURES

.1 Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified.

.2 Start final TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows and other construction affecting TAB.
.2 Application of sealing, caulking and weather-stripping.
.3 Normal operation of mechanical systems affecting TAB.

.3 General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

3.5 AIR BALANCE AND EQUIPMENT TEST:

.1 Include all air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, as applicable to this project.

.2 Adjust fan speeds to provide design air flow.

.3 Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.

.4 Parameters to be Measured

.1 Air Flow
.2 Air velocity.
.3 Static pressure.
.4 Velocity pressure.
.5 Temperature:
    .1 Wet bulb.

.2 Dry bulb.
.6 Cross sectional area.
.7 Fans RPM
.8 Electrical power:
.1 Voltage
.2 Current draw.

.7 Locations of Measurements

.1 Inlet and outlet of each
.1 Fan.
.2 Coil.
.3 Filter.
.4 Balancing damper.
.5 Other auxiliary equipment.
.2 Main ducts.
.3 Main branch ducts.
.4 Sub-branch ducts.
.5 Each supply, exhaust and return air inlet and outlet.
.6 Before and after the silencers.

3.6 WATER BALANCE AND EQUIPMENT TEST:

.1 Include all circulating pumps, heat exchangers, boilers, coils, as applicable to this project.

.2 Adjust flow rates for equipment to the values indicated on the drawings and schedules. Set balancing valves and circuit setters to the values on indicated on the equipment schedules

.3 Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for heat exchangers. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

.4 Parameters to be Measured

.1 Water/Glycol Flow (as applicable to the project)
.2 Pressure.
.3 Temperature.
.4 Specific gravity.
.5 Pumps RPM
.6 Electrical power:
.1 Voltage
.2 Current draw.

.5 Locations of Measurements

.1 Inlet and outlet of each
.1 Pump.
.2 Coil.

.3 Boiler.
.4 Balancing valve.
.5 Automatic control valves
.6 Chiller.

3.7 VERIFICATION

.1 Reported measurements shall be subject to verification by Consultant. Provide instrumentation and manpower to verify results of up to 30 % of all reported measurements. Number and location of verified measurements to be at discretion of Consultant.

.2 Bear costs to repeat TAB, as required, to satisfaction of Consultant.

3.8 MARKING OF SETTINGS

.1 Following approval of TAB final Report, the setting of all HVAC adjustment devices including balancing valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Consultant.

3.9 CONDUCTING THE TESTING AND BALANCING PROCEDURE

.1 Part 1 - The Mechanical Contractor is responsible for conducting testing and balancing of all new mechanical systems and equipment as specified on the Drawings, Specifications and/or other Contract Documents and providing the comprehensive report to the Engineer.

.2 Part 2 - The Contractor shall include for a repeat of all testing procedures to be conducted in witness of the Consultant on site after the completion of Part 1 (see .1). This is intended to demonstrate the operating characteristics of all mechanical systems once balancing has been complete and once the Engineer has had a chance to review the comprehensive report. The TAB Agency shall include for additional balancing during this Part as advise by the Engineer on site.

3.10 IDENTIFICATION OF TEST PORTS

.1 The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 20 05 11 Mechanical General Requirements.

1.1.2 All valves must have a valid CRN Number. Statutory declaration must be provided on request.

1.1.3 NO USE OF VICTAULIC OR 'GROOVED END' PRODUCTS WILL BE ALLOWED.

1.2 REFERENCE STANDARDS

1.2.1 Do the work in accordance with the Ontario Building Code Plumbing Code and local authority having jurisdiction.

1.2.2	ASTM B62-09	Specifications for Composition Bronze or Ounce Metal Castings.
1.2.3	ANSI/ASME B16.5-2005	Pipe Flanges and Flanged Fittings.
1.2.4	ANSI/ASME B16.11-2009	Forged Fittings, Socket Welding.
1.2.5	ASTM B88-03	Specifications for Seamless Copper Water Tube.
1.2.6	CSA B242-M80	Groove and Shoulder Type Mechanical Pipe Couplings.
1.2.7	MSS SP 67-2002	Butterfly Valves
1.2.8	MSS SP 70-2006	Cast Iron Gate, Globe, Angle and Check Valves
1.2.9	MSS SP 71-2005	Cast Iron Swing Check Valves Flanged and Threaded Ends.
1.2.10	MSS SP 80-2003	Bronze Gate, Globe, Angle and Check Valves

1.3 SHOP DRAWINGS

1.3.1 Submit product data in accordance with Section 20 05 11.

1.3.2 Indicate following: valves.

PART 2 - PRODUCTS

2.1 PIPING

2.1.1 Domestic hot, cold and recirc tubing, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 Buried: copper tube, soft annealed, type K: to ASTM B88M.

2.1.2 All piping shall have certification markings for compliance with ASTM B88.

2.2 FITTINGS

2.2.1 Brass or bronze flanges and flanged fittings: to ANSI B16.24.

2.2.2 Brass or bronze threaded fittings: to ANSI B16.15.

2.2.3 Cast bronze to ANSI B16.18- 1984 or wrought copper and bronze to ANSI B16.22.

2.3 JOINTS

2.3.1 Rubber gaskets, 0.063" (1.6 mm) thick: to AWWA C111 -95.

2.3.2 Bolts, nuts, hex head and washers: to ASTM A307-92a-07b, heavy series.

2.3.3 For installation of the potable water system only lead free solder shall be used in accordance with Ontario Building Code Standards.

2.3.4 Solder, tin antimony, 95:5: to ASTM B32.

2.4 GATE VALVES

2.4.1 Gate valves shall only be utilized where specifically noted on the drawings. For all other shut off valve applications utilize ball valves for 2" (50 mm) or smaller and butterfly valves for 2.6" (65 mm) and larger.

2.4.2 NPS 2 and under, soldered:

.1 Non-rising stem to MSS SP-80, Class 125, 860 kPa, bronze body, screw-in or bolted bonnet.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 281, Kitz 41, Grinnell

2.4.3 NPS 2 and under, screwed:

.1 Rising stem: to MSS SP-80, class 125, 860 kPa, bronze body, solid wedge disc.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 293, Kitz 24, Grinnell

2.4.4 NPS 2-1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS SP-70, class 125, 860 kPa, FF flange, cast-iron body, OS&Y bronze trim.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 421, Kitz 72, Grinnell

2.4.5 NPS 2-1/2 and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS SP-70, class 125, 860 kPa, FF flange, cast-iron body, bronze

trim, bolted bonnet.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 415, Kitz 75, Grinnell

2.5 GLOBE VALVES

2.5.1 NPS 2 and under, balancing, soldered:

.1 To MSS SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: as indicated.

.3 Standard of Acceptance: Jenkins, Crane, Toyo 222, Kitz 10, Grinnell

2.5.2 NPS 2 and under, balancing, screwed:

.1 To MSS SP-80, class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc.

.2 Lockshield handles: as indicated.

.3 Standard of Acceptance: Jenkins, Crane, Toyo 220, Kitz 09, Grinnell

2.6 SWING CHECK VALVES

2.6.1 NPS 2 and under, soldered:

.1 To MSS SP-80, class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 237, Kitz 23, Grinnell

2.6.2 NPS 2 and under, screwed:

.1 To MSS SP-80, class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 236, Kitz 22, Grinnell

2.6.3 NPS 2-1/2 and over, flanged:

.1 To MSS SP-70, class 125, 860 kPa, cast iron body, FF flange, regrind renewable seat, bronze disc, bolted cap.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 435, Kitz 78, Grinnell

2.7 BALL VALVES

2.7.1 NPS 2 and under, branch isolators, screwed:

.1 600 WOG, bronze body, solid chrome plated bronze ball, with Teflon seal.

.2 Ball valves shall have full port opening.

.3 Standard of Acceptance: Jenkins, Crane, Toyo 5044A, Kitz 58, Grinnell, Apollo.

2.8 AUTOMATIC CIRCUIT BALANCING VALVES

2.8.1 Circuit balancing valves shall be of the automatic variety. Manual circuit balancing valves will not be accepted.

2.8.2 Circuit Balancing Valves are required on the domestic hot water recirculation system.

2.8.3 Provide the following sizes:

.1 Provide 0.032 l/s (0.5 gpm) for 12 mm pipe size.

.2 Provide 0.063 l/s (1.0 gpm) for 20 mm pipe size.

2.8.4 Product Warranty and Performance Guarantee

.1 Valves shall be warranted by the manufacturer to be free of defects in material and workmanship for a period of five years.

.2 Valves shall control flow to within plus/minus 5 percent of design over an operating differential range of at least 14 times the minimum required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 3 psid to actuate the mechanism.

.3 The valve flow curve shall be smooth over its entire nominal control range. Gaps, bumps and dips in flow curves shall not be acceptable.

2.8.5 Shop Drawing Submission

.1 The Balancing Valve Manufacturer shall submit a complete list of balancing valves, their location and their performance.

.2 The Balancing Valve Manufacturer shall mark up a set of full size plans showing the location of each balancing valve and assign an appropriate identification tag for the balancing valve.

.3 The Balancing Valve Manufacturer shall submit these drawings for the Consultant to review, incorporate any comments from the Consultant and then submit copies of this drawing to the Mechanical Contractor, Mechanical Consultant, Architect and Construction Manager.

.4 All balancing valves shall be shipped to site with this tag number firmly attached to the

valve and the full size drawings shall be utilized to identify the location where they are to be installed.

2.8.6 Valve Flow Control Cartridge (Typical for all valves)

.1 The non adjustable flow control cartridge shall be 100% stainless steel. Parts made of soft metals such as brass with only a coating of hard metal such as nickel shall not be allowed. Rubber based materials whose properties change with temperature and pressure shall not be allowed.

.2 The cartridges shall have segmented ports through which water can pass, rather than a continuous large port, to eliminate noise and full travel linear coil spring.

.3 The cartridge movement shall result in a shearing action that will dislodge or shear any particle that may tend to get stuck in a port.

.4 Cartridge shall be removable from the housing and shall be held in place in the housing without adhesive.

.5 All flow control cartridges shall be warranted by the manufacturer for five years from the date of sale.

2.8.7 Sizes 40mm and smaller

.1 Valves shall have forged brass bodies and stainless steel cartridge assembly rated for a minimum of 230 psi/250F.

2.8.8 Valve end connections shall be either female sweat or FPT.

2.8.9 Valves shall be provided with two pressure/temperature taps.

2.8.10 Valves shall be provided with a union tailpiece and built in isolation valve.

2.8.11 The body design shall allow for inspection or removal of the cartridge without disturbing piping connections.

2.8.12 The valve shall come fully assembled and shall be permanently marked to show direction of flow and shall have a body tag to indicated flow rate and model number.

2.8.13 Provide a shut off valve upstream of the valve to allow the system to be shut off and the balancing valve to be removed without shutting down the entire heating system.

2.8.14 Standard of Acceptance: Griswold Isolator R valve.

PART 3 - EXECUTION

3.1 INCOMING WATER MAIN

3.1.1 The products utilized to build the meter assembly shall be in accordance with the Local Authorities requirements.

3.1.2 Where the Local Authority requires that this assembly use gate valves with all soldered connections the Mechanical Contractor shall solder all of the joints and use gate valves as specified above.

3.2 INSTALLATION

3.2.1 Connect to fixtures and equipment in accordance with manufacturers instructions.

3.2.2 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

3.2.3 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

3.2.4 Lay buried tubing in accordance with AWWA Class "B" bedding.

3.2.5 Isolate equipment, fixtures and branches with ball valves.

3.2.6 New or repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority having jurisdiction or in the absence of a prescribed method as follows:

.1 The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

.2 The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200mg/l) of chlorine and allowed to stand for three (3) hours.

.3 Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

.4 The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

3.2.7 Compression fittings are not acceptable.

3.2.8 All valves packing shall be asbestos free.

3.2.9 Provide isolation valves on all main branch feeds to each washroom group.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 20 05 11 Mechanical General Requirements of the specification.

1.2 REFERENCE STANDARDS

1.2.1 Do the work in accordance with the Ontario Building Code Plumbing Code and local authority having jurisdiction.

1.2.2	CSA B70 - 2006	Specifications for Cast Iron Soil Pipe Fittings and Means of Joining.
1.2.3	CSA B125 - 2005	Specifications for Plumbing Fittings
1.2.4	ASTM B32 - 2008	Specifications for Solder Metal
1.2.5	ASTM B306 - 2009	Specifications for Copper Drainage Tube (DWV)
1.2.6	ANSI B16.29	
1.2.7	ASTM B88, ASTM B88M - 2003	Specifications for Seamless Copper Water Tube
1.2.8	ASTM A74 - 2009	Specification for Cast Iron Soil Pipe and Fittings
1.2.9	ASTM C564 -2009	Specification for Rubber Gasket for Cast Iron Soil Pipe and Fittings

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

2.1.1 For all above grade vent, sanitary and storm piping, Type DWV to:

.1 ASTM B306 - Specification for copper drainage tube (DWV).

.2 CSA B158 for cast brass fittings.

.3 ANSI B16.29 for wrought copper fittings.

.4 Solder: tin-lead, 50:50, to ASTM B32, type 50A - Specification for solder metal.

.5 ASTM B88.

.6 ASTM C564

2.2 CAST IRON PIPING AND FITTINGS

2.2.1 For above grade storm, sanitary and vent piping, minimum NPS 3, to CSA B70, ASTM A74 with heavy bituminous coating.

2.2.2 For above grade storm, sanitary and vent piping 4" (100 mm) size and larger: Cast iron.

2.2.3 For storm, sanitary and vent piping joints.

.1 Mechanical joints.

.1 Neoprene of butyl rubber compression gaskets for all pipe connections.: to ASTM C564-2009.

.2 SS clamps.

2.2.4 Provide PVC piping for Urinals in accordance with OBC for above-grade drainage in lieu of Cast Iron.

2.3 PUMPED DRAINAGE

2.3.1 Pumped drains shall be galvanized steel.

2.4 DRAINAGE AND VENTS

2.4.1 Piping And Fittings

2.4.2 For buried sanitary, storm and vent piping:

.1 ASTM D2665, ASTM D2949, ASTM B251

.2 ASTM D3034, ASTM F891

.3 CAN/CSA- B181.2 for PVC DWV or

.4 CAN/CSA B182.1- for plastic DWV.

2.4.3 Joints

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

.3 For sizes above 4" (100mm).

Provide Ring-Tite joints Canron Ring-Tite joints PVC DR35 gravity sewer pipe, with locked in rubber ring sealing feature providing tight flexible seal.

Spigot ends to be supplied complete with bevel.

2.4.4 All PVC piping below grade shall be a minimum of SDR 35.

2.5 CONDENSATE DRAIN PIPING

2.5.1 All condensate piping shall be Copper water tube, ASTM B88, Type L for runouts and Type M for mains.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install piping parallel and close to walls to conserve space, and to grade indicated, and to suit installation of related work.

3.1.2 Apply two coats of asphalt paint to pipe laid in, or passing through concrete.

3.1.3 Where piping passes through floor or wall below grade pack and seal in concrete complete with Link Seal in accordance with Specification Section 20 05 11.

3.1.4 PVC piping shall not be utilized above grade. PVC piping is acceptable for below grade piping where permitted by Code. The PVC piping shall convert to cast iron prior to the point where it penetrates the floor slab.

3.1.5 Provide venting to plumbing fixtures and fixture groups in accordance with the Ontario Building Code Plumbing Code and local authorities having jurisdiction.

3.1.6 Install buried pipe on 6" (150 mm) bed of clean sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with clean sand.

3.1.7 Install piping parallel and close to walls to conserve space and to grade indicated, and to suit the installation of related work.

3.1.8 Apply solvent to male end of joints only.

3.1.9 Pipe installation: Pipe shall be installed as specified and indicated on the drawings.

3.1.10 The piping system shall be installed in accordance with the manufacturers current published installation procedures.

3.1.11 PVC piping shall not be utilized above grade. PVC piping is acceptable for below grade piping where permitted by Code. The PVC piping shall convert to cast iron prior to the point where it penetrates the floor slab.

3.1.12 Where piping passes through floor or wall below grade pack and seal in concrete in accordance with Mechanical General Requirements.

3.1.13 Provide venting to all plumbing fixtures and fixture groups in accordance to the Ontario

Building Code - Plumbing Code and local authorities having jurisdiction.

3.1.14 If tests are required by an authority having jurisdiction, perform tests in presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.

3.1.15 Test pressure shall not exceed 1-1/2 times the maximum rated pressure of the lowest related element in the system.

3.1.16 Remove all fittings which do not withstand test pressure, replace and retest.

3.1.17 Eliminate leaks, or remove and refit defective parts.

3.2 TESTING

3.2.1 The drainage and vent system shall be tested in accordance with the Ontario Building Code - Plumbing Code and tested in accordance with the requirements of the authority having jurisdiction, perform tests in the presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.

3.2.2 Perform tests before piping is covered or concealed.

3.2.3 Remove all fittings which will not withstand test pressure, and replace after test.

3.2.4 Eliminate leaks, or remove and refit defective parts.

END OF SECTION

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.1.1 Conform to General Mechanical Requirements, Section 20 05 11 Mechanical General Requirements as applicable.

1.1.2 All plumbing fixtures depicted on the Drawings with a "Fixture Tag" ('WC-1' or WC-1) is a new plumbing fixtures and to be supplied and installed by the Mechanical Contractor in full complete with all necessary cold/hot water supply, drainage and vent piping.

1.2 REFERENCES

ANSI/ARI	Drinking Fountains and Self-Contained, Mechanically Refrigerated Drinking Water Coolers.
ANSI/ARI 1020	Application and Installation of Drinking Fountains and Drinking Water Coolers.
CAN/CSA-B45 Series-02	CSA Standards on Plumbing Fixtures.
CAN/CSA-B125-01	Plumbing Fittings.

1.3 SUBMITTALS

1.3.1 Product Data

1.3.1.1 Submit product data in accordance with the Mechanical General Requirements.

1.3.1.2 Indicate dimensions, construction details and roughing-in dimensions for all fixtures and trim.

1.3.2 Maintenance Data

1.3.2.1 Provide maintenance data for incorporation into manual specified in the Mechanical General Requirements.

1.3.2.2 Data to include:

- Description of plumbing fixtures and trim giving manufacturers name, type, model, year capacity and flow.
- Details of operation, servicing and maintenance.
- Recommended spare parts list.

1.4 FIXTURES AND TRIM

1.4.1 Manufacture plumbing fixtures in accordance with CAN/CSA-B45 Series. Conform to latest code requirements for water saving features noted in the Ontario Building Code.

1.4.2 Manufacture plumbing fittings in accordance with CAN/CSA-B125.

1.4.3 Architectural drawings to govern in determination of number and location of fixtures.

1.4.4 Fixtures in any one washroom or location to be product of one manufacturer and of same type, unless otherwise noted.

1.4.5 Trim in any one washroom or location to be product of one manufacturer and of same type, unless otherwise noted.

1.4.6 Exposed plumbing brass to be chrome plated.

1.4.7 The type number and letter allocated to each style of fixture identifies that particular fixture on Mechanical Drawings.

2 PRODUCTS

2.1 FLOOR-MOUNTED, FLUSH-VALVE WATER CLOSET, "WC-1"

2.1.1 Water Closet: American Standard "Madera" elongated # 3451.128 vitreous china floor mounted elongated syphon jet action bowl, 1-½" (38mm) top spud, bolt caps.

2.1.2 Flush Valve: Flush Valve & Supplies: Sloan Regal #111-XL-CP, exposed manual Flushometer for Top Spud toilet, chrome plated, 6L (1.6 US Gal) factory set flow, quiet action diaphragm type, non-hold open feature, A. D. A oscillating handle, back-check angle stop (screwdriver operated), flush tube for 292mm (11-1/2") rough-in, vacuum breaker.

2.1.3 Seat: Centoco #500STSCC, elongated heavy duty solid plastic open front less cover with check hinges and chromated steel posts, washers and nuts

2.1.4 Coupling: Mission Heavy Weight #HW Coupling, couplings, constructed of four extra wide corrugated type 304 stainless steel bands, connect from 100mm (3-15/16") MJ to 100mm (3-15/16") MJ, from cast iron to cast iron, heavy duty worm drive clamps.

2.2 FLOOR-MOUNTED, FLUSH-VALVE WATER CLOSET, "WC-2"

2.2.1 Water Closet: American Standard "Madera" elongated # 3451.128 vitreous china floor mounted elongated syphon jet action bowl, 1-½" (38mm) top spud, bolt caps.

2.2.2 Flush Valve: Flush Valve & Supplies: Sloan Regal #111-XL-CP, exposed manual Flushometer for Top Spud toilet, chrome plated, 6L (1.6 US Gal) factory set flow, quiet action diaphragm type, non-hold open feature, A. D. A oscillating handle, back-check angle stop (screwdriver operated), flush tube for 292mm (11-1/2") rough-in, vacuum breaker.

2.2.3 Seat: Centoco #500STSCC, elongated heavy duty solid plastic open front less cover with check hinges and chromated steel posts, washers and nuts

2.2.4 Coupling: Mission Heavy Weight #HW Coupling, couplings, constructed of four extra wide corrugated type 304 stainless steel bands, connect from 100mm (3-15/16") MJ to 100mm (3-15/16") MJ, from cast iron to cast iron, heavy duty worm drive clamps.

2.3 **WALL-HUNG, FLUSH-VALVE WATER CLOSET, "WC-3"**

2.3.1 Water Closet: Wall hung exposed flush valve - American Standard "Afwall Elongated" low consumption toilet #3351.101 "Low Consumption", wall hung for flush valve, vitreous china, elongated syphon jet flush action bowl, fully glazed 2-1/8" (54 mm) internal trap way, 10"x12" (254 mm x 305 mm) large water surface 1.6 gal (6 L) flush, 1-1/2" (38 mm) top spud.

2.3.2 Flush Valve: Flush Valve & Supplies: Sloan Regal #111-XL-CP, exposed manual Flushometer for Top Spud toilet, chrome plated, 6L (1.6 US Gal) factory set flow, quiet action diaphragm type, non-hold open feature, A. D. A oscillating handle, back-check angle stop (screwdriver operated), flush tube for 292mm (11-1/2") rough-in, vacuum breaker.

2.3.3 Seat: Centoco #AM820STS toilet seat, elongated heavy duty plastic open front with cover, reinforced S.S. check hinge, post, washers and nuts. Power for device by electrical trade. Ensure that sensor clear seat cover.

2.3.4 Coupling: Mission Heavy Weight #HW Coupling, couplings, constructed of four extra wide corrugated type 304 stainless steel bands, connect from 100mm (3-15/16") MJ to 100mm (3-15/16") MJ, from cast iron to cast iron, heavy duty worm drive clamps.

2.3.5 Floor Supported Carrier: Jay R. Smith #0208Y single, horizontal carrier, 3" (75 mm) drain, all duco coated cast iron fittings, rear anchor bolt, face plate, heavy duty legs, adjustable nipple, plated hardware, cap nuts, test plug and protection cap.

2.4 **URINAL - TYPE "UR-1"**

2.4.1 Urinal: American Standard Washbrook Flowise #6590.001, vitreous china, operates in the range of 0.5 L to 3.8 L (0.125 US Gal to 1.0 US Gal) per flush, wall hung, extended sides for privacy, washdown action, flushing rim, 19 mm (3/4") dia. Top spud, elongated rim, integral P-trap, outlet connection 51 mm (2"), 2 wall hangers, #7301242-100 chrome plated, non-metallic strainer.

2.4.2 Flush Valve: Delta Commercial Model 81T231, Quiet action, Teck® exposed diaphragm flush valve, For flushing urinals with 19 mm (3/4") top spud, maximum 330 mm (13") from centreline of valve inlet to top of urinal, except -1 trap seal models which are maximum 315 mm (12.4"), external water conserving flush volume adjustment, polished chrome plated finish, vandal resistant cover screw, metal "non-hold-open" ADA Compliant oscillating handle, 1" FIP / 19 mm (3/4") Copper sweat inlet adaptor, adjustable 121 mm (4-3/4") plus or minus 11 mm (7/16") inlet/valve outlet centres, vacuum breaker, cover tube and wall flange, renewable seat, *Chloramine resistant diaphragm attached to guide with forged metal retainer, spud flange and concealed spud nut, pressure loss check angle stop with protecting cap, Factory Set For 2.7 Litre (0.70 US GAL.) Flush-Field Adjustable (Please note: volume must be adjustable).

2.4.3 Fixture Carrier, Watts #CA-321, mounted on concrete floor, epoxy coated top and bottom universal steel hanger plates, heavy gauge epoxy coated steel offset uprights with welded feet supports. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

2.4.4 Urinal Wall Access Cleanout, Watts #WUCO, two (2) piece expandable plug with 102 mm (4") diameter stainless steel access cover, secured with vandal proof stainless steel screw.

2.5 LAVATORY, "LV-1" (BARRIER FREE DESIGN)

2.5.1 Lavatory: American Standard "Murro" #0954.123EC - 22" x 21" x 5-7-1/2" deep, wall hung, vitreous china, rear overflow, for concealed arm carrier. American Standard #0059 020EC shroud/knee contact guard to cover exposed piping. Provide RH Hole for new Soap Dispenser (soap dispenser is to be supplied and installed by the Architectural Division).

2.5.2 Faucet: Chicago Faucets No. 420-E2805ABCP, Deck Mounted 4" Fixed Centers Single Lever Hot and Cold Water Mixing Sink Faucet, Chrome Plated solid brass construction. 4 5/8" Center to Center Rigid Cast Brass Spout. 0.5 GPM (1.9 L/min) Pressure Compensating Econo-Flo Vandal Proof Non-Aerating Spray. 1/2" NPSM Supply Inlets for 3/8" or 1/2" Flexible Riser. ECAST® construction with less than 0.25% lead content by weighted average. CALGreen Compliant. Secondary Control Valve: 4 5/8" Center to Center Rigid Cast Brass Spout.

2.5.3 Balancing Valve: Supply to hot water side of faucet and cold water supply to cold water side of faucet. Mechanical mixing valve with thermostatic limit stop by Lawler model TMM-1070 with temperature adj. dial & with integral back checks. Set valve temperature at 115F, shut-off at 120F. ASSE1070 approved. Provide tee, adaptor and flex copper tubing to suit installation.

2.5.4 Supplies: McGuire #H170BVRB supplies, C.P., polished brass, rigid short horizontal integral copper sweat tube nipples 1/2"x5" long, all brass ¼ turn ball valve angle stops with combination V.P. loose key, and handles, escutcheons and S.S. braided flexible risers. McGuire #8872C-17T 'P' trap, C.P. brass adjustable body, 17 gauge, 1-1/4" and escutcheon.

2.5.5 Carrier: Jay R. Smith #0700-Z-M basic carrier, with concealed arms and block base feet support with semi-pedestal supported plate.

2.6 LAVATORY, "LV-2"

2.6.1 Lavatory: Vitreous china, wall hung, front overflow, self-draining faucet ledge, contoured back and side splash shield. Model:0356.421 (Lucerne) By: American Standard

2.6.2 Faucet: Delta, Metering faucet, slow close cartridge, single hole mount faucet, polished chrome plated finish, vandal resistant brass handle activator, two body mounted stainless steel anti-rotation locking pins, mixing tee and inlet checks, vandal resistant spout outlet total flow not to exceed 0.25 gallon per handle activation Model:87T111 with lever handle By: Delta Faucet

2.6.3 Tempering Valve: Tempering valve, HydroGuard T/P series e480 Under-the-Counter Combination Tempering Valve, solid brass body, corrosion-resistant, temperature adjustment stem with lock nut to prevent tampering, integral checks with screens to prevent cross flow, factory set at 105F.

2.6.4 Drain: open grid drain, chrome plated cast brass one piece top, 1.5mm (1/16") tubular 32mm (1-1/4") tailpiece. Model:155AC By: McGuire

2.6.5 Supplies: chrome finish polished brass Faucet Supplies, heavy duty angle stop, 10mm (3/8") I. P. S. Inlet x 76mm (3") long rigid horizontal nipple, V. P. Loose key, escutcheon and flexible copper riser. Model:H165LKN3 By: McGuire

2.6.6 P-trap: P-Trap, 32mm (1-1/4") inlet, shallow wall flange and seamless tubular wall bend. Model:8872C By: McGuire

2.6.7 Carrier: Single Carrier, mounted on concrete floor, heavy duty one piece construction steel pipe legs welded to narrow block base feet support, concealed arms, locking device and leveling screws. Minimum space required: for one unit: 102mm (4") for two to six units in a row: 152mm (6") finished metal stud wall to back of pipe space. Model:0700-Z By: Jay R. Smith

2.7 **STAINLESS STEEL SINK-SINGLE COMPARTMENT "SS-1"**

2.7.1 Sink: One compartment S.S. Sink – Franke Commercial #LBS6408P-1300G/2 sink, holes to suit faucet, 20-1/2"x16-1/8"'x8", counter mounted, back ledge, grade 18-8 type 302 stainless steel, satin finish rim and bowl, self-rimming, with crumb cup strainers centre back and sound deadening.

2.7.2 Faucet: Delta Faucet #27C3942, 8" cast sink deck mounted, vandal resistant 4" hooded blades, solid cast brass lead-free body, CER-TEK cartridges, gooseneck spout with vandal resistant 1.5 GPM flow aerator outlet and cast brass 4" blade handles.

2.7.3 Supplies: McGuire #H165LKN3 supplies with angle stops, escutcheons and flexible copper risers. McGuire #8912CB cast brass 'P' trap, 1-1/2" with cleanout, unions and escutcheon.

2.7.4 Provide Franke 'Washroom System' offset strainer.

2.7.5 Mixing Valve: Mechanical mixing valve with thermostatic limit stop by Lawler Model TMM-1070 with temperature adjust dial & with integral back checks. Set valve temperature at 115 deg. F, shut-off at 120 deg. F. ASSE1070 approved. Tempered water supplied by mixing valve located below sink. Connect tempered water supply to hot water side of faucet and cold water supply to cold water side of faucet. Provide tee, adaptor and flex copper tubing to suit installation. Deck mounted soap dispenser to be specified by architect and provided & installed by the general contractor

2.8 **STAINLESS STEEL SINK-DOUBLE COMPARTMENT "SS-2"**

2.8.1 Sink: Double compartment S.S. Sink – Franke #LBD6408-1, holes to suit faucet, 31-1/4"x20-1/2"x8", counter mounted, back ledge, grade CNS 18/8 type 302 stainless steel, satin finish rim and bowl, self-rimming, with crumb cup strainers centre back and sound deadening.

2.8.2 Faucet: Delta Faucet #26C3942, 8" cast sink deck mounted, vandal resistant 4" handles with sanitary hood, solid cast brass lead-free body, CER-TEK cartridges, gooseneck spout with vandal resistant 1.5 GPM flow aerator outlet and cast brass 4" blade handles.

2.8.3 Supplies: McGuire #H165LKN3 supplies with angle stops, escutcheons and flexible copper risers. McGuire #8912CB cast brass 'P' trap, 1-1/2" with cleanout, unions and escutcheon.

2.8.4 P-trap: Provide P-Trap, 38mm (1-1/2") inlet.

2.9 **STAINLESS STEEL SINK-TRIPLE COMPARTMENT "SS-3"**

2.9.1 Sink: Triple Compartment Stainless Steel Franke LBT6407CB-1.

2.9.2 Faucet: Delta Faucet #26C3942, 8" cast sink deck mounted, vandal resistant 4" handles with sanitary hood, solid cast brass lead-free body, CER-TEK cartridges, gooseneck spout with vandal resistant 1.5 GPM flow aerator outlet and cast brass 4" blade handles.

2.9.3 Supplies: McGuire #H165LKN3 supplies with angle stops, escutcheons and flexible copper risers. McGuire #8912CB cast brass 'P' trap, 1-1/2" with cleanout, unions and escutcheon.

2.9.4 P-trap: Provide P-Trap, 38mm (1-1/2") inlet.

2.10 **TROUGH SINK "TS-1" & "TS-2"**

2.10.1 Sink: Ardec Group Model AET-3U Vironne AET Sink

2.10.2 Faucet: 3 x Delta, Metering faucet, slow close cartridge, single hole mount faucet, polished chrome plated finish, vandal resistant brass handle activator, two body mounted stainless steel anti-rotation locking pins, mixing tee and inlet checks, vandal resistant spout outlet total flow not to exceed 0.25 gallon per handle activation Model:87T111 with lever handle By: Delta Faucet.

2.10.3 Supplies: McGuire #H165LKN3 supplies with angle stops, escutcheons and flexible copper risers. McGuire #8912CB cast brass 'P' trap, 1-1/2" with cleanout, unions and escutcheon.

2.10.4 P-trap: Provide P-Trap, 38mm (1-1/2") inlet.

2.11 **EYEWASH STATION, "EW-1"**

2.11.1 Haws Model 7260BT-7270BT wall-mounted eye and face wash. Round 11" green ABS plastic receptor, aluminum bracket and tailpiece and trap. Mesh in-line strainer to collect line debris, and ball valve with stainless steel ball and stem for durability. Certified to CSA to meet the ANSI Z358.1 Standard for Emergency Eyewash and Shower Equipment.

2.11.2 Install c/w Thermostatic Mixing Valve Model 9201EW AXION.

2.12 **DISHWASHER, "DW-1"**

2.12.1 To be supplied by the School and installed by the Mechanical Contractor (include for installation in the base tender price).

3 EXECUTION

3.1 FIXTURE INSTALLATION

3.1.1 Install wall hung lavatory and urinal hanger brackets supplied with fixtures to wall by means of a manufactured chair carrier of MIFAB, Smith, Watts or Zurn.

3.1.2 Install wall-hung water closets with chair carriers of MIFAB, Smith, Watts or Zurn manufacture, and of type and model recommended by manufacturer for each particular installation with due regard to construction and piping details.

3.1.3 Prior to commencing any work, refer to Architectural Drawings for exact placement location and mounting height of all plumbing fixtures. Failure to do so resulting in an install not complying with the Architectural Drawings or code compliance shall require the Mechanical Contractor to rectify the installation at no extra cost.

3.1.4 Insulate indirect waste of handicapped usage lavatory with 25 mm (1") thick insulation as described in Piping Insulation Specification.

3.1.5 Adjust flush valves to limit the quantity of water per flush cycle allowed by code. Consult manufacturer for adjustment procedures.

3.1.6 Provide institutional grade caulking (clear colour) of all plumbing fixtures at all surfaces where the plumbing fixture interfaces with the wall or floor. Review extent of caulking with the Architect prior to commencing work. Any damage, discolouration or build up of dust resulting in subsequent construction activities by any trade prior to handing over of the Spaces to the Owner shall require removal of the caulking and installation of new. Caulking shall be done in a neat manner.

3.2 ADJUSTMENT

3.2.1 Verify maximum settings of thermostatic mixing valves.

3.2.2 Adjust stream regulator of drinking fountains as necessary to ensure proper operation.

3.2.3 Clean out aerator screens and strainers after lines have been flushed.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 Conform to Sections of Division 1, as applicable.

.2 Conform to Section 20 05 11 Mechanical General Requirements as applicable.

1.2 RELATED SECTIONS

.1 Plumbing Fixtures and Trim: Section 22 44 13.

1.3 REFERENCES

CAN3-B79-94	Floor Drains and Trench Drains
PDI-G101	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
PDI-WH201	Water Hammer Arrestors

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 20 05 11 - Mechanical General Requirements.

.2 Indicate dimensions, construction details and materials for the following: floor drains, cleanouts, water hammer arrestors, strainers, traps, trap seal primers.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in the Mechanical General Requirements.

.2 Data to include:

1. Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

2. Details of operation, servicing, and maintenance.

3. Recommended spare parts list.

PART 2 PRODUCTS

2.1 GENERAL

.1 Furnish plumbing and drainage specialties. Ancon catalogue numbers are specified to indicate quality and features required. Furnish sizes as shown on Drawings.

.2 Acceptable Manufacturers: Ancron, Zurn, Empoco.

2.2 FLOOR DRAINS

.1 General: all floor drains to be provided with trap primer tapping.

.2 Floor Drains - (Mech. Rooms/Unfinished Areas)

Duco coated cast body and flashing collar, with 200 mm (8") round cast iron vandalproof top grate and sediment bucket. Complete with trap priming connection. Outlet size: as indicated on the drawings.

Standard of Acceptance: JR Smith 2220 series

.3 Funneled Floor Drains - Mechanical and Service Rooms

Duco cast iron flanged receptor, bar grate and funnel, c/w vandal-proof secured grate and sediment bucket. Used to receive the drip, condensate or waste water from indirect waste lines. The funnel prevents splashing and directs the waste into the drain. The exposed portion of grate serves as drain for any other waste on the floor. The funnel is attached to the grate by means of concealed screws and it may be moved to any grate location desired. Outlet size: as indicated on the drawings.

Standard of Acceptance: J R Smith 3750 series.

.4 Floor Drains (Finished Areas, Washrooms, Janitor)

Duco coated cast iron body with flashing collar and adjustable strainer head, 150 mm (6") round or square top strainer head. The round top strainer may be used in all poured finished floors. Square top strainer shall be used in all tiled areas - aligned with the tile pattern. Refer to architectural floor material schedules. Floor drains c/w trap primer connection, vandal proof screws, sediment bucket. Reversible flashing collar permits adjustment of the strainer to meet finished floor level.

Standard of Acceptance: JR Smith 2005 series.

.5 Hub Drains (Condensate Drain)

Duco Cast Iron Body with 5" Adjustable Cast Iron Strainer Head and Grate, with Oval Funnel Assemble

Standard of Acceptance: JR Smith SQ-4-1753-A

2.3 FLOOR DRAIN TRAPS AND PRIMERS

.1 Furnish each floor drain installation with a deep seal "P" trap unless otherwise shown.

.2 Furnish trap seal primer valves Ancon No. M3-810 with cast brass body, vacuum breaker and NPS 1/2 sweat connections.

.3 Where a floor drain trap is not within a reasonable distance from a plumbing fixture, furnish an automatic flush tank for priming of trap, Crane No. 7-170 1/2 L, or American Standard No. AF-4104L, complete with automatic syphon, tank liner, concealed top cover, bottom supply and screw driver stop.

.4 As an alternative to automatic flush tanks for remote floor drains, furnish ZURN Model Z1022 trap primers and distribution units, as supplied by S-M-S Ltd.

2.4 DRAINAGE CLEANOUTS

.1 Stack Cleanout - Exposed Drains
1. In base of cast iron stacks with neoprene gasketed secured cover. Duco Cast Iron Cleanout Tee and Countersunk Plug
2. Standard of Acceptance: JR Smith 4510 series

.2 Stack Cleanout - Drains Behind Finished Walls.
1. In base of cast iron stacks with neoprene gasketed secured cover. Duco cast iron cleanout tee and countersunk plug with chrome plated bronze square frame and secured cover.nickel bronze frame with stainless steel cover.
2. Standard of Acceptance: J R smith 4550 series.

.3 Floor Cleanouts
1. In Ceramic Tiled Areas

    .1 Duco cast iron cleanout with square 6"x6" adjustable scoriated secured nickel bronze top. Vandal proof top, flashing flange and clamp. Gasket seal, bronze plug
    .2 Standard of Acceptance: J R Smith 4052 series.

2. In Vinyl Tiled Areas
    .1 Duco Cast Iron Cleanout with Square Adjustable Secured Nickel Bronze Top with 1/8" Tile Recess. Vandal proof top, flashing flange and clamp. Gasket seal, bronze plug
    .2 Standard of Acceptance: J R Smith 4172 series

3. In Terrazzo Areas
    .1 Floor cleanout, above with square nickel bronze cover and frame recessed for terrazzo. Cover can be adjusted to suit floor lines when installing finished floor.
    .2 Standard of Acceptance: JR Smith 4180.

4. Carpeted and Other Finished Areas
   .1 Duco cast iron cleanout with round adjustable scoriated secured nickel bronze top. Vandal proof top, flashing flange and clamp. Gasket seal, bronze plug
   .2 Standard of Acceptance: JR Smith 4032

5. In Unfinished Areas and Outside Area.
   .1 Epoxy coated cast body with integral clamp device, and removable positive seal cleanout plug and heavy duty scoriated safety finish adjustable cover secured with stainless steel screws.
   .2 Standard of Acceptance: JR Smith 4232

6. For Heavy Traffic Areas
   .1 Floor cleanout, above with extra heavy nickel bronze cover and frame. Gasket seal, bronze plug
   .2 Standard of Acceptance: JR Smith 4112

2.5 SHOCK ABSORBERS

.1 Size shock absorbers in accordance with P.D.I.-WH201.

Ancon	"Shok-Gard"
Zurn	Z-1700
Enpoco	HT Series

.2 Provide shock absorbers for all new plumbing piping.

2.6 NON-FREEZE WALL HYDRANT (HOSE BIBB):

.1 Encased recessed non-freeze wall or ground hydrant with NPS 3/4" hose outlet with vacuum breaker. Bronze quarter turn non-freeze hydrant with hose connection, integral vacuum breaker, "T" handle key, and stainless steel box with full 180 deg. cover opening. Meets ANSI A112.21.3

.2 Standard of Acceptance: JR Smith 5509 QTNB.

2.7 ROOF DRAINS

.1 Roof Drains - Controlled Flow

Duco cast iron body with combined flashing clamp and gravel stop with adjustable "flow rate control" assembly and aluminium dome, trapezoidal weirs limit the flow to the leaders. Adjustable to provide various flow rates as required. Outlet diameter as indicated on the drawings.

Standard of Acceptance: J R Smith 1083 series.

.2 Roof Drains – Standard Un-Controlled Flow

FLOFORCE™ High efficient flow performing roof drain. Roof drain engineered to evacuate water off of roof structure by incorporating a smooth funnel shaped interior surface, providing a seamless transition to outlet connection, and eliminating internal obstructions. Complete with Dura-Coated cast iron body with combination membrane flashing clamp/gravel guard and low silhouette Poly-Dome. Flashing clamp/gravel guard provided to prevent debris from entering the drain while allowing water to immediately pass through at zero head level. Poly-dome designed to maximize effective open area and promote efficient flow.

Standard of Acceptance: Zurn Z100F complete with large sump, roof membrane waterproof flange, under-deck clamp, sump extension, roof sump receiver, cast iron dome strainer and vandal-proof secured top. Provide all accessories necessary to install the roof drain with the proposed roofing type (see Architectural Drawings).

2.8 ELECTRONIC TRAP SEAL PRIMER

.1 Provide a 120V, manifold trap seal primer system to provide trap seal primer to all floor drains. Provide an Electronic Trap Seal Primer on each floor – for a total of 3. Coordinate with Electrical for receptacle location.

.2 System shall be Zurn Z1020 or equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, provincial codes and local authority having jurisdiction except where specified otherwise.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks and rainwater leaders and where indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.3 WATER HAMMER ARRESTORS

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

.2 Hot and cold water fixture outlets provided with a vertical air chamber, a minimum of 450 mm long. Air chamber of the same pipe dimension as the branch pipe diameter leading to the fixture, and located as close to the fixture as possible.

.3 Hot and cold water main branches 75 mm (3") diameter and under to 25 mm (1") diameter: Provided with vertical air chambers of sizes and dimensions specified above, located at points where the pipe line changes direction through 90 degrees in horizontal plane, and at the top of all hot and cold water risers.

3.4 TRAP SEAL PRIMERS

.1 Install trap seal primer valve in cold water supply line to nearest plumbing fixture (preferably a water closet) and run NPS 1/2 Type K copper piping to primer connection on floor drain body. Obtain Minister's Designee's approval for location of primer valves prior to installation.

.2 Install trap primer tank in truss space or other suitable location as directed by ORC Designee, or as shown on Drawings.

.3 (Install in access pit as indicated).

3.5 COMMISSIONING

.1 After start-up, test, adjust and prove operation as indicated, to suit conditions.

.2 Clean out strainers periodically until clear.

.3 Clean out and prime all floor drain traps using trap seal primers or other means acceptable to the Canadian Plumbing Code.

.4 Prove freedom of movement of cleanouts.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION:

1.1.1. This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

1.2. RELATED WORK:

1.2.1. Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION.
1.2.2. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
1.2.3. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1.2.4. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3. SUBMITTALS:

1.3.1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.3.2. Shop Drawings:

1.3.2.1. Provide documentation to demonstrate compliance with drawings and specifications.
1.3.2.2. Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

1.3.3. Manuals:

1.3.3.1. Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.
1.3.3.2. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:
1.3.3.3. Certification that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.

1.4. APPLICABLE PUBLICATIONS:

1.4.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

1.4.2. National Electrical Manufacturers Association (NEMA):

1.4.2.1. MG 1-2006 Rev. 1 2009 Motors and Generators

1.4.2.2. MG 2–2001 Rev. 1 2007 Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

1.4.3. National Fire Protection Association (NFPA):

1.4.3.1. 70-latest National Electrical Code (NEC)

1.4.4. Institute of Electrical and Electronics Engineers (IEEE):

1.4.4.1. 112-04 Standard Test Procedure for Polyphase Induction Motors and Generators

1.4.5. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

1.4.5.1. 90.1-latest Energy Standard for Buildings Except Low-Rise Residential Buildings

1.5. **STANDARDS OF ACCEPTANCE**

1.5.1. Baldor Electric Company
1.5.2. Leeson Electric
1.5.3. General Electric
1.5.4. Dayton

PART 2 - PRODUCTS

2.1. **MOTORS:**

2.1.1. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR STARTERS AND CONTROLERS; and Section 26 05 19, POWER CONDUCTORS AND CABLES.

2.1.2. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors as scheduled. Unless otherwise specified for a particular application, use electric motors with the following requirements.

2.1.3. Single phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

2.1.4. Electrically Commutated Motor (EC Type): Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic commutation. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

2.1.5. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.

2.1.6. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

2.1.7. Number of phases shall be as follows:

2.1.7.1. Motors, less than 373 W (1/2 HP): Single phase.
2.1.7.2. Motors, 373 W (1/2 HP) and larger: 3 phase.
2.1.7.3. Exceptions:
2.1.7.3.1. Unless specified otherwise
2.1.7.3.2. Hermetically sealed motors.
2.1.7.3.3. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

2.1.8. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment, where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation. If the motors exceed 40°C (104°F), the motors shall be rated for the actual ambient temperatures.

2.1.9. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

2.2. **MOTOR ENCLOSURES:**

2.2.1. Shall be the NEMA types as specified and/or shown on the drawings.

2.2.2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.

2.2.3. Enclosure requirements for certain conditions are as follows:

2.2.3.1. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.

2.2.3.2. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.

2.2.3.3. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.

2.2.3.4. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

2.2.4. Special Requirements:

2.2.4.1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Board

2.2.4.2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.

2.2.5. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

2.2.5.1. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
2.2.5.2. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
2.2.5.3. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

2.2.6. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

2.2.7. Motors less than 3 HP:

2.2.7.1. Steel or cast iron motor frames, cast aluminum, cast iron, or steel end plates, steel or cast iron terminal box, copper windings. Motor nameplates shall be steel, engraved-type, riveted to motor.
2.2.7.2. Bearings: Regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings, selected for a minimum L-10bearing life of 26,280 hours, for belted and direct drive.

2.2.8. Motors 3 HP and above:

2.2.8.1. Cast iron motor frame and mounting feet, cast iron end plates (bells), steel or cast iron terminal box, copper windings. Motor nameplates shall be stainless steel engraved type, riveted to the motor.
2.2.8.2. Bearings shall be regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings. Rated for an L-10 life of 40,000 hours (belted) or 130,000 hours (direct connected).

2.2.9. Bearing life calculations shall be per ABMA 9, and for belted applications shall be based on the maximum external side load limits for belted applications per NEMA MG-1 Table 14-1A. L-10 life calculations for vertical motors and horizontal motors mounted in the vertical position shall consider the application's thrust loading.

2.2.10. TEFC motors shall also include an external shaft slinger on drive end.

2.2.11. Motors shall not exceed dBA levels listed in NEMA MG-1 54 PART 9 Tables 9-1 and 9-3, at all speeds.

2.2.12. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

2.3. **ENERGY EFFICIENT MOTORS (MOTOR EFFICIENCIES):**

2.3.1. All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table.

2.3.2. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated.

2.3.3. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Premium Efficiencies Open Drip-Proof				**Minimum Premium Efficiencies Totally Enclosed Fan-Cooled**			
Rating kW (HP)	**1200 RPM**	**1800 RPM**	**3600 RPM**	**Rating kW (HP)**	**1200 RPM**	**1800 RPM**	**3600 RPM**
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%

2.3.4. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

PART 3 - EXECUTION

3.1. INSTALLATION:

3.1.1. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2. FIELD TESTS

3.2.1. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.

3.2.2. Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

3.2.3. Insulation Resistance: Not less than one half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

3.2.4. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3. **STARTUP AND TESTING**

3.3.1. The Commissioning Agent will observe startup and contractor testing of all equipment. Coordinate the startup and contractor testing schedules with Project Supervisor and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.4. **DEMONSTRATION AND TRAINING**

3.4.1. Provide services of manufacturer's technical representative for four hours to instruct Client's personnel in operation and maintenance of units.

3.4.2. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 11 – TRAINING AND DEMONSTRATION.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. This specification is to cover a complete Variable Frequency Drive (VFD aka: VSD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.

1.1.2. The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable. Drive manufacturers who do not build their own power boards and assemblies, or do not have full control of the power board manufacturing and quality control, shall be considered as a "brand labeled" drive. All VFDs installed on this project shall be from the same manufacturer.

1.2. QUALITY ASSURANCE

1.2.1. Referenced Standards and Guidelines:

1.2.1.1. Institute of Electrical and Electronic Engineers (IEEE)
1.2.1.2. IEEE 519-1992, Guide for Harmonic Content and Control.
1.2.1.3. Underwriters Laboratories (as appropriate)

1.2.1.3.1. UL508
1.2.1.3.2. UL508A
1.2.1.3.3. UL508C

1.2.1.4. National Electrical Manufacturer's Association (NEMA)
1.2.1.5. ICS 7.0, AC Adjustable Speed Drives
1.2.1.6. International Electrotechnical Commission (IEC)
1.2.1.7. EN/IEC 61800-3
1.2.1.8. National Electric Code (NEC)
1.2.1.9. NEC 430.120, Adjustable-Speed Drive Systems

1.2.2. Qualifications:

1.2.2.1. VFDs and options shall be UL508 listed as a complete assembly. The base VFD shall be UL labeled 100 kA RMS Symmetrical, 600V max. C

1.2.2.2. CE Mark – The base VFD shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2). Base drives that only meet the Second Environment (Category C3, C4) shall be supplied with filters to bring the drive in compliance with the First Environment levels.

1.2.2.3. The entire VFD assembly, including the bypass (if specified), shall be seismically certified and labeled as such in accordance with the 2012 International Building Code (IBC)

1.3. **STANDARD OF ACCEPTANCE:**

1.3.1.1. ABB ACH Series.
1.3.1.2. Danfoss VLT series

1.4. **SUBMITTALS**

1.4.1. Submittals shall include the following information:

1.4.1.1. Outline dimensions, conduit entry locations and weight.
1.4.1.2. Customer connection and power wiring diagrams.
1.4.1.3. Complete technical product description include a complete list of options provided.
1.4.1.4. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.

PART 2 - PRODUCTS

2.1. **VARIABLE FREQUENCY DRIVES**

2.1.1. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility.

2.1.2. The VFD shall provide full rated output from a line of ±10% of nominal voltage. The VFD shall continue to operate without faulting from a line of +30% to -35% of nominal voltage.

2.1.3. VFDs shall be capable of continuous full load operation under the following environmental operating conditions:

2.1.3.1. -15 to 40° C (5 to 104° F) ambient temperature. Operation to 50° C shall be allowed with a 10% reduction from VFD full load current.
2.1.3.2. Altitude 0 to 3300 feet above sea level. Operation to 6600 shall be allowed with a 10% reduction from VFD full load current.
2.1.3.3. Humidity less than 95%, non-condensing.

2.1.4. All VFDs shall have the following standard features:

2.1.4.1. All circuit boards shall be coated to protect against corrosion.
2.1.4.2. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.

2.1.4.3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.

2.1.4.4. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VFD programming shall be held in non-volatile memory and is not dependent on battery power

2.1.4.5. The VFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

2.1.4.6. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required, based on the temperature of and run command to the drive. VFD protection shall be based on thermal sensing and not cooling fan operation.

2.1.4.7. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).

2.1.4.8. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

2.1.4.9. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.

2.1.4.10. VFDs through 200 HP shall have internal swinging (non-linear) chokes providing impedance equivalent to 5% to reduce the harmonics to the power line. Swinging choke shall be required resulting in superior partial load harmonic reduction. Linear chokes are not acceptable. 5% impedance may be from dual (positive and negative DC bus) chokes, or 5% swinging AC line chokes. VFD's with only one DC choke shall add an AC line choke.

2.1.4.11. The input current rating of the VFD shall not be greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.122. Input and output current ratings must be shown on the VFD nameplate.

2.1.4.12. The VFD shall include a coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV's shall have a minimum 125 joule rating per phase across the diode bridge. VFDs that do not include coordinated AC transient surge protection shall include an external TVSS (Transient Voltage Surge Suppressor).

2.1.4.13. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over

the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

2.1.4.14. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.

2.1.4.15. If the input reference is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.

2.1.4.16. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

2.1.5. All VFDs to have the following adjustments:

2.1.5.1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.

2.1.5.2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.

2.1.5.3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.

2.1.5.4. Two (2) programmable analog inputs shall accept current or voltage signals.

2.1.5.5. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.

2.1.5.6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

2.1.5.7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be 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 of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs

are not acceptable. Drives that have only two (2) relay outputs must provide an option card that provides additional relay outputs.

2.1.5.8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.

2.1.5.9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.

2.1.5.10. Seven (7) programmable preset speeds.

2.1.5.11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

2.1.5.12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.

2.1.5.13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.

2.1.5.14. The VFD shall include password protection against parameter changes.

2.1.5.15. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:

2.1.5.15.1. Start-up assistant
2.1.5.15.2. Parameter assistants
2.1.5.15.3. PID assistant
2.1.5.15.4. Reference assistant
2.1.5.15.5. I/O assistant
2.1.5.15.6. Serial communications assistant
2.1.5.15.7. Option module assistant
2.1.5.15.8. Panel display assistant
2.1.5.15.9. Low noise set-up assistant
2.1.5.15.10. Maintenance assistant
2.1.5.15.11. Troubleshooting assistant
2.1.5.15.12. Drive optimizer assistants

2.1.6. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

2.1.6.1. Output Frequency
2.1.6.2. Motor Speed (RPM, %, or Engineering units)
2.1.6.3. Motor Current
2.1.6.4. Motor Torque
2.1.6.5. Motor Power (kW)
2.1.6.6. DC Bus Voltage
2.1.6.7. Output Voltage

2.1.7. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.

2.2. SERIAL COMMUNICATIONS

2.2.1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. [Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.] Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.

2.2.2. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

2.2.2.1. Data Sharing – Read Property – B.
2.2.2.2. Data Sharing – Write Property – B.
2.2.2.3. Device Management – Dynamic Device Binding (Who-Is; I-Am).
2.2.2.4. Device Management – Dynamic Object Binding (Who-Has; I-Have).
2.2.2.5. Device Management – Communication Control – B.

2.2.3. Serial communication capabilities shall include, but not be limited to; run-stop controls, speed set adjustment, and lock and unlock the keypad. The drive shall have the capability of allowing the 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. The BAS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

2.2.4. Serial communication in bypass (if bypass is specified) shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.

2.2.5. The VFD / bypass shall allow the BAS to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the BAS system. This allows for remote monitoring of which (of up to 4) safeties are open.

2.2.6. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.

2.2.7. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2) with up to 100 feet of motor cable. Second environment (Category C3, C4) is not acceptable, no Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment (C2).

2.3. **DRIVE OPTIONS**

2.3.1. Options shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

2.3.2. Circuit Breaker - Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options. Circuit breaker option shall be available with or without systems requiring bypass.

2.3.3. Disconnect Switch with Fuses - Door interlocked, padlockable disconnect switch that will disconnect all input power from the drive and all internally mounted options. Drive input fusing is included.

2.3.4. Fieldbus adapters – The following optional fieldbus adapters shall be available as a plug in modules.

2.3.4.1. LonWorks
2.3.4.2. DeviceNet
2.3.4.3. Ethernet IP
2.3.4.4. ControlNet over Ethernet & ModBus TCP
2.3.4.5. BACnet IP
2.3.4.6. Profibus

2.4. **BYPASS**

2.4.1. Bypasses shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. All VFD with bypass configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

2.4.2. A complete factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.

2.4.3. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the "Off" position before either enclosure may be accessed.

2.4.4. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 Amps and this rating shall be indicated on the UL data label.

2.4.5. Drive Isolation Fuses - To ensure maximum availability of bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted. Third contactor "isolation contactors" are not an acceptable alternative to fuses, as contactors could weld closed and are not an NEC recognized disconnecting device.

2.4.6. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.

2.4.7. Motor protection from single phase power conditions - the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor

in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.

2.4.8. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed. Bypass systems that do not maintain full functionality with the drive removed are not acceptable.

2.4.9. Serial communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP.

2.4.10. Serial communication capabilities shall include, but not be limited to: bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (Amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and / or via a Form-C relay output – keypad "Hand" or "Auto" selected, bypass selected, and broken belt indication. The BAS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.

2.4.11. The bypass serial communications shall allow control of the drive/bypass (system) digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The system digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. All system analog and digital I/O shall be capable of being monitored by the BAS system.

2.4.12. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the BAS and / or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause a warning or system shutdown.

2.4.13. The digital inputs for the system shall accept 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 mA of 24 VDC for use by others to power external devices.

2.4.14. There shall be a coordinated run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open before the motor can run. When the damper is fully open, a normally open

dry contact (end-switch) shall close. The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override / smoke control mode.

2.4.15. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to activate a Form-C relay output, and / or over the serial communications protocol.

2.4.16. The bypass control shall include a programmable time delay bypass start including keypad indication of the time delay. A Form C relay output commands the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.

2.4.17. There shall be a keypad adjustment to select manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will result in an automatic transfer to bypass mode and which faults require a manual transfer to bypass. The user may select whether the system shall automatically transfer from drive to bypass mode on the following drive fault conditions:

2.4.17.1. Over current
2.4.17.2. Over voltage
2.4.17.3. Under voltage
2.4.17.4. Loss of analog input
2.4.17.5. The following operators shall be provided:
2.4.17.6. Bypass Hand-Off-Auto
2.4.17.7. Drive mode selector
2.4.17.8. Bypass mode selector
2.4.17.9. Bypass fault reset
2.4.17.10. The bypass shall include the ability to select the operating mode of the system (VFD/Bypass) from either the bypass keypad or digital input.
2.4.17.11. The bypass shall include a two line, 20 character LCD display. The display shall allow the user to access and view:
2.4.17.12. Energy savings – in US dollars
2.4.17.13. Bypass motor amps
2.4.17.14. Bypass input voltage– average and individual phase voltage
2.4.17.15. Bypass power (kW)
2.4.17.16. Bypass faults and fault logs
2.4.17.17. Bypass warnings
2.4.17.18. Bypass operating time (resettable)
2.4.17.19. Bypass energy (kilowatt hours – resettable)
2.4.17.20. I/O status
2.4.17.21. Parameter settings / programming
2.4.17.22. Printed circuit board temperature
2.4.17.23. The following indicating lights (LED type) or keypad display indications shall be provided. A test mode or push to test feature shall be provided.
2.4.17.24. Power-on (Ready)

2.4.17.25. Run enable
2.4.17.26. Drive mode selected
2.4.17.27. Bypass mode selected
2.4.17.28. Drive running
2.4.17.29. Bypass running
2.4.17.30. Drive fault
2.4.17.31. Bypass fault
2.4.17.32. Bypass H-O-A mode
2.4.17.33. Automatic transfer to bypass selected
2.4.17.34. Safety open
2.4.17.35. Damper opening
2.4.17.36. Damper end-switch made

2.4.18. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS system even with the VFD removed.

2.4.19. The on-board Form-C relay outputs in the bypass shall programmable for any of the following indications:

2.4.19.1. System started
2.4.19.2. System running
2.4.19.3. Bypass override enabled
2.4.19.4. Drive fault
2.4.19.5. Bypass fault
2.4.19.6. Bypass H-O-A position
2.4.19.7. Motor proof-of-flow (broken belt)
2.4.19.8. Overload
2.4.19.9. Bypass selected
2.4.19.10. Bypass run
2.4.19.11. System started (damper opening)
2.4.19.12. Bypass alarm
2.4.19.13. Over temperature

2.4.20. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

2.4.21. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFD's analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps.

2.4.22. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat", "FreezStat", "Over

pressure" and "Low suction". The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.

2.4.23. Smoke Control Override Mode (Override 1) – The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire / Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User's Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties. All keypad control, serial communications control, and normal customer start / stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.

2.4.24. Fireman's Override Mode (Override 2) – the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the local Authority Having Jurisdiction (AHJ) requires. The Override 2 action may be programmed for "Run-to-Destruction". The user may also force the unit into Override 2 via the serial communications link.

2.4.25. Class 10, 20, or 30 (programmable) electronic motor overload protection shall be included.

2.4.26. Drive Service Switch – Drive service switches shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. VFD/Bypass configurations that utilize contactors as a means to remove VFD input power for the purpose of VFD servicing are not acceptable. NEC Code does not recognize a contactor as a means of disconnect in a motor control circuit.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.

3.1.2. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2. START-UP

3.2.1. Factory start-up shall be provided for each drive by a factory authorized service center. A start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3. PRODUCT SUPPORT

3.3.1. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line connected to factory support personnel located in the US shall be available. Technical support offered only through the local sales office is not acceptable.

3.3.2. Training shall include installation, programming and operation of the VFD, bypass and serial communication. Factory authorized start up and owner training to be provided locally upon request.

3.4. **WARRANTY**

3.4.1. The VFD Product Warranty shall be 36 months from the date of factory shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 QUALITY ASSURANCE

.1 Comply with OBC and NFPA 90A requirements, particularly paragraphs pertaining to the maximum flame spread index (currently set at 25) and maximum smoke development index (currently set at 50).

.2 All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

.3 Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.3 SUBMITTALS

.1 Submit in accordance with Section 20 05 11 shop drawings and product data

.2 Provide the following:

.1 Insulation materials: Specify each type used and state surface burning characteristics.
.2 Insulation facings and jackets: Each type used. Make it clear that white finish will befurnished for exposed ductwork, casings and equipment.
.3 Insulation accessory materials: Each type used.
.4 Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.

1.4 STORAGE AND HANDLING OF MATERIAL

.1 Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.5 STANDARDS OF ACCEPTANCE

.1 Knauf Fiber Glass
.2 Owens/Corning Fiberglass
.3 Armstrong
.4 Johns Manville

.5 Rockwool Manufacturing
.6 Armaflex.

2 PRODUCTS

2.1 GENERAL

.1 K-factors (thermal conductivity) shown are expressed in BTU•in/hr•ft2•F.

2.2 MINERAL FIBRE BLANKET WITH VAPOUR BARRIER

.1 Provide external insulation on all new outside air ductwork for its entire length.

.2 Provide external insulation on all exhaust ductwork for its entire length.

.3 Material:

.1 Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, for use to 450 deg. F, with a factory-applied jacket manufactured from foil, reinforcing scrim, and kraft paper (FSK). Minimum density of 3/4 lb./cu.ft., maximum conductivity of 0.43 (BTU-in./hr.-sq.ft.-deg. F) at 200 deg. F.

.2 Acceptable Material: Fiberglas, Knauf, Manson.

.3 Thickness: 1".

2.3 FIBROUS GLASS RIGID WITH VAPOUR BARRIER

.1 Apply on all indoor supply and return rectangular ductwork larger than 30" wide and on all ductwork located outdoors, regardless of size.

.2 Material:

.1 Mineral–Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, for use to 450 deg. F, with a factory-applied jacket manufactured from foil, reinforcing scrim, and kraft paper (FSK). Minimum density of 3 lb./cu.ft., maximum conductivity of 0.40 (BTU-in./hr.-sq.ft.-deg. F) at 300 deg. F.

.2 Acceptable products: Fiberglas AF 530, Manson, Knauf.

.3 Thickness: 1"

2.4 CANVAS JACKETS

.1 Apply in mechanical rooms where rigid insulation is applied: compact, firm ULC listed heavy plain weave, cotton fabric at 220 g/m sq.

2.5 **METAL JACKETING**

.1 At all locations where the ductwork is located outdoors or in heavy abuse areas, use metal jacketing to protect piping or ductwork insulation.

.2 Jacketing: Aluminum, 0.016 inches thick, embossed surface, with factory bonded moisture barrier.

.3 Metal Jacketing Bands: 1/2 inch wide, aluminum or stainless.

2.6 **EXTERIOR INSULATION**

.1 Cover all joints of the rigid insulation and fastener penetration with 3" wide pressure sensitive All Service Jacket (ASJ) tape. Rub tape hard with a nylon sealing tool. Over the entire surface apply a weave glass reinforcing cloth embedded between two 1/8" thick wet coats of Breather mastic, i.e., B. Foster Seal Fast 6 PM 35-00-4500.

2.7 **FASTENINGS**

.1 Tape: self adhesive, 100 mm wide rated under 25 for flame spread and under 50 for smoke development.

.2 Contact adhesive: quick-setting, non-flammable fire resistive adhesive to adhere fibrousglass to ducts. Flame spread 15 smoke development 0.

.1 Acceptable Products Foster 85-20 Asbestos Free, Armstrong 520.

.3 Lap Seal Adhesive: Quick-setting adhesive for joints and lap sealing of vapour barriers. Flame spread 10 smoke development 0.

.1 Acceptable Products Foster 85-75, Asbestos Free, Drion.

.4 For Canvas:

.1 Washable adhesive for cementing canvas lagging cloth to duct insulation.
.2 Acceptable Products: Foster 30-36 Asbestos Free.

.5 Pins:

.1 Weld pins 4 mm diameter, with 1½" diameter head for installation through the insulation. Length to suit thickness of insulation.
.2 Weld pins: If duct is over 24" wide, use on bottom of duct as well.
.3 Acceptable Products: Duro Dyne, Clip-Pin.

3 Execution

3.1 APPLICATION

.1 Apply insulation after required tests have been completed and approved by Consultant. Insulation and surfaces shall be clean and dry when installed and during application of any finish.

.2 Work shall be preformed by insulation journeymen.

.3 Apply insulation and coverings on hot equipment while surface is between 50 to 60°C.

.4 Vapour barriers and insulation to be complete over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves.

.5 Install insulation with smooth and even surfaces.

.6 Apply insulation materials accessories and finishes to manufacturer's recommendations.

.7 Apply 1.0mm thick metal corners to all ductwork in mechanical rooms to a height of 7 ft.

.8 Use stand-offs for all duct mounted accessories.

.9 The last 3.0 meters of all exhaust ductwork shall be insulated, whether shown on the Drawings or not.

3.2 DUCT INSULATION

.1 General:

.1 Adhere and seal vapour barrier using vapour seal adhesives.
.2 Stagger longitudinal and horizontal joints, on multi-layered insulation.

.2 Mechanical Fasteners:

.1 On rectangular ducts, use 50% coverage of insulating cement and weld pins at not more than 14" centres, but not less than 2 rows per side.

3.3 JACKETS

.1 Provide fire retardant coating on canvas jackets.

.2 Fire retardant coating shall be approved by authority having jurisdiction prior to application. Consultant reserves right to remove sample of covering for testing.

.3 Coat canvas covering exposed in finished spaces with diluted coat of lagging adhesive. As recommended by insulation manufacturer for priming. Dilution: 2 parts of water to 3 parts of lagging adhesive.

.4 For all ductwork externally insulated inside of the building, provide 3M VentureClad Insulation Jacketing.

END OF SECTION

1.1. **REQUIREMENTS INCLUDED**

1.2. Procedures for onsite demonstration and testing of equipment and systems, including temporary facilities.

1.3. **INSTRUCTION OF CLIENT'S OPERATING PERSONNEL.**

1.3.1. All demonstrations, instructions and testing must be completed prior to Client acceptance for beneficial use. All safety devices most pass 100 percent before the mechanical systems can be accepted for beneficial use.

1.3.2. Plumbing and emergency power systems are not included.

1.4. **DEFINITIONS**

1.4.1. Start Up: Initial inspection, cleaning, lubrication, adjustment, and operation of equipment and systems by the contractor with the assistance of the representatives of the equipment manufacturers.

1.4.2. Pre Tests: The final stage of the startup procedure. This occurs after all adjustments have been made except for minor fine-tuning that can be done during the pre test. Serves as verification that the systems are ready for the final test. Witnessing of pre test by the Consultant is not required.

1.4.3. Final Tests: Tests, witnessed by the Commissioning Agent or their representative, which demonstrate that all equipment and systems are in compliance with requirements.

1.5. **QUALITY ASSURANCE**

1.5.1. Experienced, trained technical service personnel who are representatives of the equipment manufacturers and system designers shall demonstrate, provide instructions, pre test and final test, as specified, the following equipment:

1.5.1.1. Boilers and economizers
1.5.1.2. Burners
1.5.1.3. Control systems.
1.5.1.4. Instrumentation.

1.5.2. Experienced technicians shall demonstrate and provide instructions on the following equipment (as applicable to the project):

1.5.2.1. Boilers and Burners
1.5.2.2. Chillers and Cooling Towers

1.5.2.3. Pumps and piping systems
1.5.2.4. Air handling equipment
1.5.2.5. Exhaust/Return Fans
1.5.2.6. Control and safety valves
1.5.2.7. BAS and VFDs

1.5.3. The person responsible for programming the BAS shall demonstrate and provide instructions on hardware, software and programming.

1.5.4. The Board will provide a list of personnel to receive instructions and will coordinate their attendance at agreed upon times.

1.5.5. All safety devices shall comply with the TSSA requirements.

1.6. **SUBMITTALS**

1.6.1. Names and qualifications of personnel performing demonstrations, instructions and tests.

1.6.2. Certification that pre testing is complete.

1.6.3. Preliminary schedule of all demonstrations, instructions and final tests two weeks prior to proposed dates.

1.6.4. Provide reports within three weeks after satisfactory completion of demonstrations, instructions, and tests. List date, type of work, persons participating, amount of time, test results, calculations of test results, test data.

1.6.5. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion,

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1. **PREPARATION FOR FINAL TESTS, DEMONSTRATIONS, AND INSTRUCTIONS**

3.1.1. Verify that equipment and systems are fully operational. Complete all start up and pre test activities for all equipment and systems. Complete all construction and finish work.

3.1.2. Arrange for all test personnel for all equipment to be continuously present during one period of time so that all equipment and systems can be tested in their interrelated functions.

For instance, the burner in a heating system shall be tested during the boiler testing, and instrumentation performance will be evaluated in conjunction with boiler testing.

3.1.3. Deliver maintenance and operating manuals four weeks prior to instruction period.

3.1.4. Furnish all special tools.

3.2. **FINAL TESTS**

3.2.1. Demonstrate proper operation of each equipment and system.

3.2.2. Provide tests on equipment as specified in the individual specification sections.

3.3. **STARTUP AND TESTING**

3.3.1. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contactor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.4. **COMMISSIONING**

3.4.1. Provide commissioning documentation in accordance with the requirements of the Commissioning Agency for all inspection, start up, and contractor testing required above and required by the Systems Readiness Checklist.

3.5. **DEMONSTRATIONS AND TRAINING**

3.5.1. Demonstrate operation and maintenance of equipment and systems to Board personnel no more than two weeks prior to scheduled Board operation of the plant.

3.5.2. Use operation and maintenance manuals as basis of instruction. Review contents of manuals with personnel in detail to explain all aspects of operation and maintenance.

3.5.3. Demonstrate start up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shut down of each item of equipment. Allow Government personnel to practice operating the equipment under supervision of instructors.

3.5.4. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

3.5.5. Submit training plans and instructor qualifications

3.6. **TIME ALLOCATED FOR DEMONSTRATIONS AND INSTRUCTIONS**

3.6.1. At least 8 total instructor hours to include all new building services installed under this project.

3.6.2. At least 4 total instructor hours to include BAS and computer workstation and programs.

3.6.3. Do not exceed three trainees per session, one four hour session, per day, per trainee.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 Fuel gas systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 SUBMITTALS

.1 Submit in accordance with Section 20 05 11 Mechanical General Requirements, shop drawings, product data, and samples.

.2 Manufacturer's Literature and Data:

.1 Piping.
.2 Strainers.
.3 All items listed in Part 2 - Products.
.4 Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

.3 At the onset of the project, the Mechanical Contractor is responsible for doing a thorough survey of the existing School and locating all existing gas-fired appliances (indoors and outdoors) and providing the following information to the Engineer in writing:

.1 Location and type (rooftop unit, gas unit heater, gas-fired domestic hot water heater, boilers, etc.) of each gas-fired appliance. Locations shall be identified on a large-format (36"x48") print-out of the School Floor Plans and marked in red.
.2 Input and output BTU rating of each appliance.
.3 Existing gas pipe sizing and routing to all appliances (including what gas pressure is running in each line).
.4 Existing gas meter rating.
.5 Location of all PRVs.

1.3 APPLICABLE PUBLICATIONS

.1 The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

.1 CAN1-B149.1-M80 for natural gas

.2 Ontario Natural Gas Code

.3 American National Standards Institute (ANSI):

.4 American Society of Mechanical Engineers (ASME): (Copyrighted Society)

.1	A13.1-96	Scheme for Identification of Piping Systems
.2	B16.3 98	Malleable Iron Threaded Fittings ANSI/ASME
.3	B16.9 01	Factory-Made Wrought Steel Butt welding Fittings ANSI/ASME
.4	B16.11 01	Forged Steel Fittings, Socket-Welding and Threaded

ANSI/ASME
.5 B16.15-85(R 1994) Cast Bronze Threaded Fittings ANSI/ASME
.6 B31.8-01 Gas Transmission and Distribution Piping Systems ANSI/ASME

.5 American Society for Testing and Materials (ASTM):
.1 A47-99 Ferritic Malleable Iron Castings Revision 1989
.2 A53-02 Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless
.3 A183-83(R1998) Carbon Steel Track Bolts and Nuts
.4 A536-84(R1999) E1 Ductile Iron Castings
.5 A733-03 Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
.6 B687-99 Brass, Copper, and Chromium-Plated Pipe Nipples

.6 National Fire Protection Association (NFPA)

2 Products

2.1 FUEL GAS PIPING ABOVE-GROUND

.1 Pipe: Black steel, ASTM A53, Schedule 40, seamless as follows:

.1 ½" to 1½" dia., screwed.

.2 2" to 10" welded, plain end.

.2 Nipples: Steel, ASTM A733, Schedule 40.

.3 Pipe fittings, screwed, flanged or welded as follows:

.1 Malleable iron screwed fittings (banded): Class 150 to ANSI B16.3-1977.
.2 Steel pipe flanges and flanged fittings: to ANSI B16.5-1977.
.3 Steel butt-welding fittings: to ANSI B16.9-1978.

.4 Unions, malleable iron, brass to iron, ground seat: to ANSI B16.3-1977.
.5 Bolts and nuts: to ANSI B18.2.1-1972 and ANSI B18.2.2-1972.
.6 Nipples, Schedule 40: to ASTM A53-82.

.4 Joints: Provide welded or threaded joints

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1-1983.

.3 Flange gaskets: to ANSI B16.21-1978, ANSI B16.20-1973 or ANSI A21.11-1979.

2.3 WATERPROOFING

.1 Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.

.2 Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

2.4 STRAINERS

.1 Provide on high pressure side of pressure reducing valves, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

.2 Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.
.3 Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi steel.

2.5 DIELECTRIC FITTINGS

.1 Provide dielectric couplings or unions between ferrous and non ferrous pipe.

2.6 GAS EQUIPMENT CONNECTORS

.1 Flexible connectors with teflon core, interlocked galvanized steel protective casing, AGA certified design.

2.7 GAS PRESSURE REGULATOR VALVE (PRV)

.1 Supply and install Gas PRVs as shown on the drawings. PRVs shall be reduce pressure from the upstream gas pressure noted on the drawings to the downstream gas pressure noted on the drawings. Provide all piping and accessories necessary to suit connection of the piping to the PRV. PRVs shall be located in strict accordance with the Manufacturer's Recommendations in terms of location of adjacent elements.

.2 Provide a gas piping support (see Drawing for support detail) within 8" upstream of the regulator as well as within 8" downstream of the regulator.

3 Execution

3.1 INSTALLATION

.1 General: Comply with the following:

.1 Install natural gas piping in accordance with CAN1-B149.1-M80

.2 Install branch piping for fuel gas and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment.

.3 Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

.4 All pipe runs shall be laid out to avoid interference with other work.

.5 Slope piping down in direction of flow to low points.

.6 Use eccentric reducers at pipe size change installed to provide positive drainage.

.7 Provide clearance for access for maintenance of equipment, valves and fittings.

.8 Ream pipes, clean scale and dirt, inside and out.

.9 Cap open ends during construction to prevent entry of foreign material.

.10 Make connection to equipment with unions or flanges. Install piping to minimize pipe dismantling for equipment removal.

.11 Provide vents for all gas piping shafts in accordance to code.

.12 Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible.

.13 Install union and shut-off valve on pressure piping at connections to equipment.

.14 Provide cathodic protection on jackets for all buried steel pipes, as per local gas supply company.

.15 Subcontractor installing buried gas piping shall be approved by the local gas supply company.

.16 Coordinate with the local gas supply company and the General Contractor the location of gas meter and isolation valves.

3.2 PURGING

.1 Purge after pressure test in accordance with applicable codes.

3.3 PIPE HANGERS, SUPPORTS AND ACCESSORIES

.1 All piping shall be supported AS per Section 20 05 11 and Gas Code recommendations.

.2 Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

.3 Floor, Wall and Ceiling Plates, Supports, Hangers:

.1 Solid or split un-plated cast iron.

.2 All plates shall be provided with set screws.

.3 Pipe Hangers: Height adjustable clevis type.

.4 Adjustable Floor Rests and Base Flanges: Steel.

.5 Concrete Inserts: "Universal" or continuous slotted type.

.6 Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.

.7 Riser Clamps: Malleable iron or steel.

.8 Rollers: Cast iron.

.9 Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.

.4 Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.

.5 Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

.6 Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

3.4 PENETRATIONS

.1 Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stopping materials.

.2 Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant

.3 Piping shall conform to the following:

.1 Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.

.2 Install fuel gas piping with plugged drip pockets at low points.

3.5 GAS PRESSURE

.1 Refer to Section 20 05 11 for gas pressure requirements and associated actions to ensure the adequate operation of the HVAC and heading equipment.

3.6 TESTS

.1 General: Test system either in its entirety or in sections.

.2 Fuel Gas System: NFPA 54.

3.7 PAINTING & LABELING

.1 Paint the entire gas line yellow; where exposed to the outdoors, use outdoor-grade paint. Label the full length of the gas piping as per CSA B149.1-15 Stating 2" PSI gas piping with weatherproof labels.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. Hydronic piping to connect HVAC equipment, including the following:

1.1.1.1. Chilled water, condenser water, heating hot water/glycol as applicable to the project.

1.1.2. NO USE OF VICTAULIC OR 'GROOVED END' PRODUCTS WILL BE PERMITTED. All piping 2" and larger shall be welded.

1.2. RELATED WORK

1.2.1. Section 20 05 11, MECHANICAL GENERAL REQUIREMENTS.
1.2.2. Section 23 05 11, COMMON WORK RESULTS FOR HVAC:
1.2.3. Section 23 74 03, HYDRONIC PUMPS

1.3. QUALITY ASSURANCE

1.3.1. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.
1.3.2. All joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
1.3.3. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.4. SUBMITTALS

1.4.1. Submit in accordance with Section 20 05 11, MECHANICAL GENERAL REQUIREMENTS.

1.4.2. Manufacturer's Literature and Data:

1.4.2.1. Pipe and equipment supports.
1.4.2.2. Pipe and tubing, with specification, class or type, and schedule.
1.4.2.3. Pipe fittings, including miscellaneous adapters and special fittings.
1.4.2.4. Flanges, gaskets and bolting.
1.4.2.5. Valves of all types.
1.4.2.6. Strainers.
1.4.2.7. Flexible connectors for water service.
1.4.2.8. All specified hydronic system components.
1.4.2.9. Water flow measuring devices.
1.4.2.10. Gages.
1.4.2.11. Thermometers and test wells.
1.4.2.12. Air separators.
1.4.2.13. Expansion tanks.

1.5. **APPLICABLE PUBLICATIONS**

1.5.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. American National Standards Institute, Inc.

1.5.2. American Society of Mechanical Engineers/American National Standards Institute, Inc. (ASME/ANSI):

1.5.2.1. B1.20.1-83(R2006) Pipe Threads, General Purpose (Inch)
1.5.2.2. B16.4 06 Gray Iron Threaded FittingsB16.18-01 Cast Copper Alloy Solder joint Pressure fittings
1.5.2.3. B16.23-02 Cast Copper Alloy Solder joint Drainage fittings
1.5.2.4. B40.100-05 Pressure Gauges and Gauge Attachments

1.5.3. American Society of Mechanical Engineers (ASME):
1.5.3.1. B16.1-98 Cast Iron Pipe Flanges and Flanged Fittings
1.5.3.2. B16.3-2006 Malleable Iron Threaded Fittings: Class 150 and 300
1.5.3.3. B16.4 2006 Gray Iron Threaded Fittings: (Class 125 and 250)
1.5.3.4. B16.5-2003 pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard
1.5.3.5. B16.9-07 Factory Made Wrought Butt Welding Fittings
1.5.3.6. B16.11-05 Forged Fittings, Socket Welding and Threaded
1.5.3.7. B16.18-01 Cast Copper Alloy Solder Joint Pressure Fittings
1.5.3.8. B16.22-01 Wrought Copper and Bronze Solder Joint Pressure Fittings.
1.5.3.9. B16.24 06 Cast Copper Alloy Pipe Flanges and Flanged Fittings
1.5.3.10. B16.39 06 Malleable Iron Threaded Pipe Unions
1.5.3.11. B16.42-06 Ductile Iron Pipe Flanges and Flanged Fittings

1.5.4. American Society for Testing and Materials (ASTM):

1.5.4.1. A47/A47M-99 (2004) Ferritic Malleable Iron Castings
1.5.4.2. A53/A53M-07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
1.5.4.3. A126 04 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
1.5.4.4. A183 03 Standard Specification for Carbon Steel Track Bolts and Nuts
1.5.4.5. A536 84 (2004) Standard Specification for Ductile Iron Castings
1.5.4.6. B32 08 Standard Specification for Solder Metal
1.5.4.7. B62 02 Standard Specification for Composition Bronze or Ounce Metal Castings
1.5.4.8. B88 03 Standard Specification for Seamless Copper Water Tube

PART 2 - PRODUCTS

2.1. **PIPE AND TUBING**

2.1.1. Chilled Water/Glycol, Condenser Water, Heating Hot Water/Glycol, as applicable to the project:

2.1.1.1. 38 mm (1-1/2") diam and smaller:

2.1.1.1.1. Schedule 40 continuous weld or electric resistance welded black carbon steel conforming to ASTM A53 84a Grade B, with threaded ends.

2.1.1.1.2. Type "L" hard drawn copper tubing conforming to ASTM B88. Type "L" soft annealed copper tubing may be used only within convector enclosures.

2.1.1.2. 50 mm (2") diam and larger

2.1.1.2.1. Schedule 40 continuous weld or electric resistance welded black carbon steel conforming to ASTM A53 84a Grade B, with bevelled ends.

2.1.2. Pipe supports, including insulation shields, for above ground piping: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2. FITTINGS FOR COPPER TUBING

2.2.1. Joints 50 mm (2") and smaller:

2.2.1.1. *Solder Joints:* Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.

2.2.1.2. *Screwed Joints:* Pipe Thread: ANSI B1.20. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.2.2. Joints 65 mm (2½") and larger:

2.2.2.1. Bronze Flanges and Flanged Fittings: ASME B16.24.

2.2.2.2. Fittings: ASME B16.18 cast copper or ASME B16.22 solder wrought copper.

2.3. FITTINGS FOR STEEL PIPE

2.3.1. 38 mm (1-1/2 inches) and Smaller: Screwed or welded joints.

2.3.1.1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.

2.3.1.2. Forged steel, socket welding or threaded: ASME B16.11.

2.3.1.3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.

2.3.2. 50 mm (2 inches) and Larger: Welded or flanged joints.

2.3.2.1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
2.3.2.2. Welding flanges and bolting: ASME B16.5:
2.3.2.3. Weld neck or slip on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
2.3.2.4. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

2.4. **DIELECTRIC FITTINGS**

2.4.1. Provide where copper tubing and ferrous metal pipe are joined.
2.4.2. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.
2.4.3. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
2.4.4. Temperature Rating, 99 degrees C (210 degrees F).

2.5. **UNION**
2.5.1. 50 mm (2") diam and smaller:
2.5.1.1. All brass construction with ground joint and either solder joint or screwed ends as required.
2.5.1.2. Class 150 black malleable iron construction with brass to iron ground joint and screwed ends, conforming to ASTM A197 and ANSI/ASME B1.20.1.
2.5.1.3. Provide dielectric unions or couplings at all connections between copper tubing and ferrous piping or equipment.

2.6. **FLANGES**
2.6.1. Class 150 forged steel slip-on or weld-neck raised face type conforming to ASTM A181 Grade 1 and ANSI/ASME B16.5. Remove raised face where flanges connect to Class 125 cast iron valves.
2.6.2. Hinged, two piece, shouldered or keyed cast malleable iron
2.6.3. Conforming to ASTM A47 Grade 32510 with elastomeric gasket suitable for service and lock bolt.

2.7. **GASKETS AND BOLTS**

2.7.1. Gaskets
2.7.1.1. 1.6 mm (1/16") Garlock 3200 with SBR binder or equivalent asbestos free material.
2.7.2. Bolts
2.7.2.1. Semi finished hex head machine bolts and semi finished hex nuts, both of carbon steel conforming to ASTM A307 Class A.

2.8. **PLUGS**

2.8.1. 50 mm (2") diam and smaller: Class 3000 screwed, square head, machined from solid steel or forging to ASTM A105 Grade 2.

2.9. **SCREWED JOINTS**

2.9.1. Pipe Thread: ANSI B1.20.
2.9.2. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.10. **VALVES**

2.10.1. Asbestos packing is not acceptable.

2.10.2. All valves of the same type shall be products of a single manufacturer.

2.10.3. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.

2.10.4. *Standard of Acceptance: Apollo, Armstrong, Bell & Gossett, Belimo, Crane, Nibco*

2.10.5. Shut-Off Valves

2.10.5.1. Ball Valves (Pipe sizes 50 mm [2"] and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.

2.10.5.2. Butterfly Valves (Pipe Sizes 65 mm [2½"] and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS SP 67, flange lug type or grooved end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Not permitted for direct buried pipe applications. Construction:

2.10.5.2.1. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65 45 12 electro-plated.
2.10.5.2.2. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
2.10.5.2.3. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.
2.10.5.2.4. Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
2.10.5.2.5. Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain wheel operator.

2.10.5.3. Gate Valves (Contractor's Option in lieu of Ball or Butterfly Valves):

2.10.5.3.1. 50 mm (2 inches) and smaller: MSS SP 80, Bronze, 1034 kPa (150 psig), wedge disc, rising stem, union bonnet.

2.10.5.3.2. 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke. MSS SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.

2.10.5.4. Globe and Angle Valves

2.10.5.4.1. Globe Valves

- 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
- 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 85 for globe valves.

2.10.5.4.2. Angle Valves:

- 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
- 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 85 for angle.

2.10.5.4.3. Check Valves

- *Swing Type Check Valves*
- 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.), 45 degree swing disc.
- 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 71 for check valves.
- *Non Slam or Silent Check Valve*: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
- Body: MSS-SP 125 cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
- Seat, disc and spring: 18 8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

2.10.5.4.4. Water Flow Balancing Valves: For flow regulation and shut off. Valves shall be line size rather than reduced to control valve size. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

- *Valves ½" to 2" diam*:

  Valves are to be of the 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off.
  Valve shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360° handwheel turns. 90° 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced.
  Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, ¼" threaded brass metering ports with check valves and gasketted caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin.

- *Valves 2-1/2" to 12" diam*:
  Valves are to be of the 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off.
  Valve shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360° handwheel turns. 90° 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced.
  Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, ¼" threaded brass metering ports with check valves and gasketted caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The hand wheel shall be high-strength resin.

- *Standard of acceptance: Armstrong, T&A, Bell and Gossett*

2.11. **STRAINERS**

2.11.1. Basket or Y Type.

2.11.1.1. Screens: Bronze, monel metal or 18 8 stainless steel, free area not less than 2 1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter

perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.

2.11.1.2. Suction Diffusers: Specified in Section 23 74 03, HYDRONIC PUMPS.

2.12. **HEAT EXCHANGER FOR HVAC SERVICE (FLUID TO FLUID):**

2.12.1.1. Furnish a plate and frame heat exchanger to meet the operating conditions as indicated in the attached schedule.

2.12.1.2. The exchanger shall be designed, constructed and tested in accordance with Section VIII, Division I of the ASME Pressure Vessel Code, and shall be code stamped. Pressure vessels provided for installation in Canada shall be marked with the appropriate CRN number.

2.12.1.3. Preference will be given to single pass designs with all system connections to be located on the face of the fixed cover plate.

2.12.1.4. The plate and frame heat exchanger's fixed and movable covers shall be designed to provide sufficient uniform thickness to withstand all loading. Stiffeners and welded reinforcements shall not be permitted. Any plate within the exchanger's plate pack shall be replaceable without the need to remove other plates.

2.12.1.5. The heat exchanger plate material shall be stainless steel type AISI 316L.

2.12.1.6. A roller bearing shall be provided on the movable cover for all units with port sizes 3" or larger. The frame assembly shall be of bolted construction. Welding to the pressure retaining components is not permitted.

2.12.1.7. The frame assembly design shall allow the addition of a minimum of 10% additional plates.

2.12.1.8. Each plate shall be pressed from a homogenous metal sheet in one step. Each plate channel shall be designed to allow full design pressure on one side with no pressure on the adjacent plate channel. Contact between adjacent plates is required to optimize structural integrity and elimination of vibration.

2.12.1.9. Gaskets shall be designed to indicate leakage across the sealing gaskets prior to the intermixing of fluids.

2.12.1.10. The suspension and guidance method in the design of the plates, frame, carrying and guide bars shall mechanically align the plates during tightening. Gasket surfaces shall be used for sealing not for plate alignment. The carrying and guide bar surfaces in contact with the plate pack shall be stainless steel. All other carbon steel surfaces except the bolts shall be epoxy painted.

2.12.1.11. An aluminum or optional 304 stainless steel OSHA shroud could be provided. A comprehensive operations and maintenance manual and ASME nameplate shall be attached on the face of the fixed cover.

2.12.1.12. Connections less than or equal to 2-inch shall be NPT type. Connections larger than 2-inch shall be of studded port design. Each studded port shall be lined with a fluid compatible material to prevent process fluid from coming in contact with the painted cover.

2.12.1.13. The exchanger shall be hydrostatically tested in accordance with the requirements of the ASME Code Section VIII Div 1, para. UG-99. A computer generated submittal and specification sheet indicating the criteria used in each unit's selection shall be submitted for approval.

2.13. **HYDRONIC SYSTEM COMPONENTS**

2.13.1. Air Purger: Cast iron or fabricated steel, 861 kPa (125 psig) water working pressure, for in line installation. *Standard of Acceptance: Amtrol, Armstrong*

2.13.2. Tangential Air Separator: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide a removable stainless steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross sectional area of connecting piping. *Standard of Acceptance: Amtrol, Armstrong*.

2.13.3. Diaphragm Type Expansion Tank: Full acceptance type, ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, welded steel shell, rust proof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 116 degrees C (240 degrees F). Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre charged to a minimum of 83 kPa (12 psig). Capacity: as indicated on the equipment schedules. *Standard of Acceptance: Amtrol, Armstrong*.

2.13.4. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F). *Standard of Acceptance: Watts, Bell and Gossett.*

2.13.5. Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, and bear ASME stamp.

2.13.6. Automatic Air Vent Valves: Automatic air vent should be used only on air separators and similar applications in mechanical rooms. When used, pipe outlet to floor drain to prevent damage from leaks. Cast iron or semi steel body, 1034 kPa (150 psig) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

2.13.7. Radiator/Convector Automatic Air Vent: N/A

2.14. **GLYCOL FILL TANK**

2.14.1. Glycol auto fill unit complete with expansion tank to control and provide expansion and maintain the glycol system pressure by providing glycol make-up automatically upon a drop in system pressure

2.14.2. Construction

2.14.2.1. Polypropylene Tank 200 liter (53 gallon) capacity
2.14.2.2. Pump construction: all bronze
2.14.2.3. Water fill connection: ball valve - 304 SS ball, brass body
2.14.2.4. Glycol fill connection: ball valve - 304 SS ball, brass body
2.14.2.5. Contacts for BAS remote indication for: high level/low level/pump run

2.14.3. The glycol autofill shall be provided with the following standard features:

2.14.3.1. The unit shall monitor and maintain the minimum system pressure at all times
2.14.3.2. Low mixture cut-out level switches shall monitor the status of the mixing tank
2.14.3.3. Level switches shall be 24 volt maximum to ensure intrinsic electrical safety
2.14.3.4. Pump suction isolation valve
2.14.3.5. Pump suction strainer
2.14.3.6. Single phase power connection
2.14.3.7. 45 psi (300 kPa) fill pressure

2.14.4. Standard of Acceptance: Armstrong GLA Series

2.15. WATER FILTERS AND POT CHEMICAL FEEDERS

2.15.1. See section 23 25 00, HVAC WATER TREATMENT

2.16. GAGES, TEMPERATURE, PRESSURE AND COMPOUND

2.16.1. See section 23 05 11 COMMON WORK RESULTS FOR HVAC

2.16.2. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.

2.16.3. Range of Gages: Provide range equal to at least 150 percent of normal operating range.

2.17. WATER FILTERS AND POT CHEMICAL FEEDERS

2.17.1. See section 23 25 13, CHEMICAL TREATMENT – CLOSED LOOPS

2.18. PRESSURE/TEMPERATURE TEST PROVISIONS

2.18.1. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordelself closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

2.19. **FIRESTOPPING MATERIAL**

2.19.1. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC

PART 3 - EXECUTION

3.1. **GENERAL**

3.1.1. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the Board. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

3.1.2. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

3.1.3. Support piping securely. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

3.1.4. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

3.1.5. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

3.1.6. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping.

3.1.7. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

3.1.8. Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.

3.1.9. Connect piping to equipment as shown on the drawings and as recommended by the manufacturer.

3.1.10. Install components furnished by others such as:

3.1.10.1. Water treatment pot feeders and condenser water treatment systems.

3.1.10.2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

3.1.10.3. Thermometer Wells: In pipes 65 mm (2 1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

3.1.11. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, INSULATION – HVAC SYSTEMS.

3.1.12. Where copper piping is connected to steel piping, provide dielectric connections.

3.2. **PIPE JOINTS**

3.2.1. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

3.2.2. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

3.2.3. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.2.4. Solvent Welded Joints: As recommended by the manufacturer.

3.3. **BRAZING**

3.3.1. Flux shall not be allowed to penetrate to the inside of the pipe. The outside of the tube and fittings shall be cleaned by washing with hot water in order to remove any residual flux.

3.3.2. During the brazing of the pipe connections, except when performing final connections and emergency repairs, the interior of the pipe shall be maintained with a nitrogen atmosphere. This shall be done by purging the pipe a sufficient number of times to remove all air and oxygen and by maintaining a small purge flow.

3.4. **EXPANSION JOINTS (BELLOWS AND SLIP TYPE)**

3.4.1. N/A

3.5. **LEAK TESTING ABOVEGROUND PIPING**

3.5.1. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.

3.5.2. An operating test at design pressure, and for hot systems, design maximum temperature.

3.5.3. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.6. FLUSHING AND CLEANING PIPING SYSTEMS

3.6.1. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

3.6.2. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.

3.6.3. Cleaning: Using products supplied in Section 23 25 00, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

3.6.4. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.7. WATER TREATMENT

3.7.1. Install water treatment equipment and provide water treatment system piping.

3.7.2. Close and fill system as soon as possible after final flushing to minimize corrosion.

3.7.3. Charge systems with chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

3.7.4. Utilize this activity, by arrangement with the Resident Engineer, for instructing VA operating personnel.

3.8. **OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

3.8.1. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

3.8.2. Adjust red set hand on pressure gages to normal working pressure.

END OF SECTION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

1.1.1. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, and other applicable Specification Sections.

1.2. SUMMARY

1.2.1. Products specified in this section include the following:

1.2.1.1. Chemical Inhibitors for Water and Glycol
1.2.1.2. Chemicals for Inhibitors and cleaning
1.2.1.3. Pot Feeder and Accessories
1.2.1.4. Filtration cartridge housing
1.2.1.5. Piping, fittings and Accessories
1.2.1.6. Glycol Feed System (where applicable to the project)

1.2.2. Provide a Chemical Services Provider (CSP) to perform the services described below.

1.2.3. Provide water treatment products and services including:

1.2.3.1. Chemicals for cleaning, passivation, and treatment of each system.
1.2.3.2. On-going treatment, chemicals, testing, certification, and reports to demonstrate effective water treatment is maintained at all times.
1.2.3.3. Start-up and operation of chemical treatment equipment.

1.2.4. Provide a complete chemical water treatment program during construction for all new and reused piping networks. This program shall begin from the point each system is filled during construction and extend until Substantial Completion or final Board acceptance of each system, whichever occurs later. The program shall include water analysis chemicals, testing equipment, consulting and service for the following systems, as applicable to the project:

1.2.4.1. Heating Hot Water System
1.2.4.2. Glycol System
1.2.4.3. All other closed loop systems

1.2.5. Attend project meetings as required to plan, schedule and coordinate above activities with other project contractors and the Board.

1.2.6. Provide recommended testing procedures and chemical treatment schedule for Board's personnel. This information shall be submitted to the Board in a Program Administration Manual.

1.3. **SUBMITTALS**

1.3.1. Product Data:

1.3.1.1. Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and complete data on furnished products listed below:

1.3.1.1.1. Pot Feeders
1.3.1.1.2. Filtration cartridges and housing
1.3.1.1.3. Glycol Feed System
1.3.1.1.4. Flow Indicators
1.3.1.1.5. Valves
1.3.1.1.6. Product specifications and MSDS's for each chemical used
1.3.1.1.7. Cleaning Procedures
1.3.1.1.8. Passivation Procedures
1.3.1.1.9. Chemical Treatment Procedures

1.3.2. Shop Drawings

1.3.2.1. Shop Drawings to include detailed equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and the location and size of each field connection as necessary to assist the mechanical contractor with proper system installations

1.3.2.2. Service Reports as indicated under Part 2 below.

1.4. **QUALITY ASSURANCE**

1.4.1. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work.

1.4.2. Subject to compliance with all requirements, provide specified products from the manufacturers indicated in the Standard of Acceptance

1.4.3. Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1.4.4. American Society for Testing and Materials (ASTM)

1.4.4.1. D859 – Test Method for Silica in Water
1.4.4.2. D1067 – Test Methods for Acidity/Alkalinity in Water
1.4.4.3. D1068 – Test Methods for Iron in Water
1.4.4.4. D1126 – Test Method for Hardness in Water
1.4.4.5. D3370 – Practices for Sampling Water from Closed Conduits
1.4.4.6. D4012 - Test Method for Adenosine Triphosphate (ATP)
1.4.4.7. Content of Microorganisms in Water
1.4.4.8. D5465 - Practice for Determining Microbial Colony Counts From Waters Analyzed by Plating Methods

1.4.5. Conform to all applicable Codes, Regulations, and Municipal requirements for the use and disposal of chemicals (including cleaning compounds) and waste to public sewer systems.

1.4.6. Wastewater shall be discharged to the sanitary sewer only if it has a pH between 5.0 and 10.0 and meets the requirements of the locality where the work takes place. Glycols (of any type) shall not be discharged to the sanitary sewer.

1.4.7. Wastewater containing any chemical or sediment is prohibited from discharge to the storm water system. No chemical shall contain Chromates or Inorganic Phosphates.

1.5. DELIVERY, STORAGE, AND HANDLING

1.5.1. Package for delivery to best protect finished surfaces while using the least amount of single-use packaging as possible. Deliver equipment and components adequately packaged for lifting, skidding, or rolling into final position, according to manufacturer's instructions. If possible, package and ship products using reusable blankets and fabrics, or reusable cardboard and crate systems.

1.5.2. Store materials and equipment raised off the floor on pallets and protected with coverings to prevent damage due to weather and construction activities. Store in areas that prevent damage due to freezing and extreme temperatures or sunlight. Arrange coverings to provide air circulation to avoid damage from condensation or chemical build-up. Protect from damage, dirt and debris at all times.

1.5.3. Store chemicals in curb protected area. Such secondary containment areas must have the capacity to hold the volume of the largest container or 10% of the combined containers, whichever larger. If room has no floor drains, then the room itself may be considered sufficient secondary containment. If the room is considered the secondary containment ensure there is a lip at the door so no liquids can exit the room in the event of a leak. Verify field conditions before storing any chemicals

1.5.4. Provide temporary containment areas when permanent containment areas do not exist. Remove temporary containment at the end of construction.

1.6. **WARRANTY**

1.6.1. Provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion. This warranty does not include ongoing chemical treatment or monitoring.

1.7. **STANDARDS OF ACCEPTANCE - CHEMICAL SERVICE PROVIDERS (CSPS)**

1.7.1. Control Chem.

1.8. **STANDARDS OF ACCEPTANCE - CHEMICAL TREATMENT HARDWARE**

1.8.1. Neptune
1.8.2. Axiom
1.8.3. Griswald

PART 2 - PRODUCTS

2.1. **CHEMICAL TREATMENT EQUIPMENT**

2.1.1. Piping

2.1.1.1. Chemical feed piping, schedule 80 black steel, crosses at all changes in direction with unconnected ports plugged.

2.1.2. Chemical By-Pass Feeder - Domed Bottom

2.1.2.1. The feeder shall be constructed of min 10 ga carbon steel with interior and exterior epoxy coating.

2.1.2.2. Capacity 17.5 liter (5 gallon) for heating systems smaller than 5,000 gallon water content, 45 liter (12 gallon) for heating systems larger than 5,000 gallon water content.

2.1.2.3. The feeder will be rated for a minimum of 350 psig at 250 degrees F.

2.1.2.4. Tank shall be provided with a wide mouth of not less than 100 mm (4") inside diameter so that chemicals can be introduced without the need of a funnel.

2.1.2.5. Four ¾" access ports for flow, vent, and drain.

2.1.2.6. The enclosure shall be a grooved end cap. The retaining bolts are removable by a small adjustable wrench. Rotating cap closures or closures requiring special wrenches shall not be considered equal.

2.1.2.7. The feeder will include heavy legs, minimum 3/16" thick, welded to the sides of the vessel, with holes in the feet to allow floor mounting with anchor bolts.

2.1.2.8. Options

2.1.2.8.1. Stainless steel basket with 1/8" perforations to hold solid chemicals
2.1.2.8.2. Isolation valve kit includes two ¾" ball valves with integral ¼" drain/vent valves and an integral vent valve to bleed off air or release pressure.
2.1.2.8.3. 250 mm x 250 mm (10"x10" funnel package c/w ball valve

2.1.2.9. Standard of Acceptance: Neptune, Griswold

2.1.3. Filtration Cartridges and Housing

2.1.3.1. Side stream type, complete with necessary shut off valves, drain and air release valves, and system connections. Include one borosilicate sight glass window downstream of the filter to provide flow visibility.

2.1.3.2. All 304 stainless steel filter housing with a mounting bracket, including brass head and two EPDM O rings, brass drain valve with barb fitting and cap

2.1.3.3. The housing is rated for a max pressure of 300 psi and a water temperature of 93 deg C. Size capacity at 5% of total system flow.

2.1.3.4. It also features a corrosion resistant brass sight flow indicator that indicates water flow through the hydronic water filter. Sight flow indicator shall include EPDM O-rings, two tempered borosilicate glass windows, 304SS cage, TPX ball, and cork washers (non-wetted part).

2.1.3.5. The hydronic heating water filter also features 3/4″ female NPT ports and brass inlet and outlet ball valves.

2.1.3.6. Manual balancing valve shall be of brass construction and shall include an integral air vent, memory stop, shall be able to provide flow metering, flow balancing, and filter cartridge isolation. Three brass nipples shall each be 3" in length.

2.1.3.7. Filter cartridge shall be a cotton wound filter cartridge with tin core (5 micron).

2.1.3.8. Standard of Acceptance; Neptune, Griswald, Axiom, RainFresh

2.1.4. Pulse Water Meter

2.1.4.1. Multi-jet principle, suitable for cold or hot water models.Wertted materials: brass; couplings: brass.

2.1.4.2. The impeller is centered in a ring of jets, with inlet jets on one level and outlet jets on another. A gear train drives the register totalizer dials. For pulse output, one of the pointers is replaced by a magnet, which is detected by an encapsulated sensor attached to the outside of the lens. Pulse rate is determined by the dial on which the magnet is placed, and by the number of sensors (single or double).

2.1.4.3. Changing the pulse rate requires no special tools and can be done in the field.

2.1.4.4. Accuracy: +/-2% of nominal flow

2.1.4.5. Electrical rating: 0.01A @ 24VAC/DC

2.1.4.6. Select meter size to suit anticipated flow. 20 mm (3/4") for 20 gpm or less, 25 mm (1") for flows up to 50 gpm.

2.1.4.7. Standard of Acceptance: Neptune, Dwyer

2.2. **CLEANING COMPOUNDS**

2.2.1. Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.

2.2.2. All chemicals to be acceptable for discharge to sanitary sewer. Provide chemicals that comply with provincial regulations.

2.2.3. Chemical inhibitor shall be polymer based and contain azole in an amount appropriate for the percentage of internal copper surface area of the system piping. Provide products with PTSA (pToluenesulfonic acid) florescent tracer dyes. Molybdenum shall not be used as a tracer. Optionally, for hot water heating systems only, nitrite/azole based inhibitors may be used. Inhibitor will not cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.

2.2.4. PH Control: Inhibitor formulation shall include adequate buffer to maintain pH in the range recommended by the boiler manufacturer.

2.2.5. No chemicals shall contain chromates or inorganic phosphates.

2.2.6. Utilize non-oxidizing biocides in the event sterilization is required.

2.2.7. Adjust chemical concentrations as required to achieve the required performance

2.3. **PERFORMANCE REQUIREMENTS - GENERAL**

2.3.1. Cleaning activities shall remove oil, grease, silt, and rust from system. Cleaned metal surfaces shall be well passivated.

2.3.2. The water treatment programs proposed by the CSP shall maintain corrosion rates below 0.5 mils per year for mild steel and 0.1 mils per year for copper and/or brass, with no pitting allowed.

2.3.3. Suspended solids: Nil. Total Iron Concentration: 0.5 mg/L Fe maximum. Total Copper Concentration: 0.2 mg/L Cu maximum.

2.3.4. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005

2.3.5. These rates shall be verified with corrosion coupons provided by the CSP Coupons shall be analyzed in the CSP's analytical laboratory every three months, more often if required, to assure these levels are not exceeded.

2.3.6. Microbiological growth levels shall be maintained below 10,000 cfu's aerobic bacteria and 10 cfu's anaerobic bacteria. The CSP shall perform detailed microbiological culturing at the CSP's company's analytical laboratory monthly, more often if required, to assure these levels are not exceeded

2.3.7. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of not less than 121 degrees C (250 degrees F) and 52 degrees C (125 degrees Fahrenheit) respectively.

2.4. **PERFORMANCE REQUIREMENTS – STAINLESS STEEL CONDENSING BOILERS**

2.4.1. Chemical treatment for multi-metal systems shall meet or exceed the following criteria:

PH	6.5 to 8.5
Alkalinity	<300 ppm
Copper	<3 ppm
Iron	<20 ppm
Aluminum	<3 ppm
TSS	<20 ppm
Chlorides	<100 ppm
Hardness	< 200 ppm
Conductivity	< 3,000 uS/cm
Filtration rate	10 microns

2.5. FLUSHING OF NEW AND REUSED PIPING

2.5.1. Flush and clean all new piping.

2.5.2. Before adding cleaning chemicals to the closed system and subsequent flushing, all air handling coils and fan coil units should be isolated by closing the inlet and outlet valves and opening the bypass valves. This is done to prevent dirt and solids from lodging the coils.

2.5.3. System is operated with a minimum pressure of 35 kPa at highest point and expansion tank level is maintained at 1/3 to ½ full.

2.5.4. Do not valve in or operate system pumps until after system has been cleaned.

2.5.5. Provide a copy of recommended cleaning procedures and chemicals for approval by Consultant.

2.5.6. Prior to chemical cleaning, the systems shall be inspected to ensure removal of heavy debris and excessive dirt and oil. Temporary strainers shall be installed on the suction side of each pump.

2.5.7. Provisions shall be made for temporary connections between the supply and return mains in the system to permit circulation of the cleaner. A 1" pipe connection shall be provided on the suction side of the circulating pumps for introduction of the cleaning solution.

2.5.8. Each system shall be flushed to remove loose dirt and shall be hydrostatically tested to ensure that there are no leaks. Rotation of pumps shall be checked.

2.5.9. The contractor shall introduce a neutral pH cleaner and rust remover into each system at a dosage recommended by the water treatment supplier. The cleaner shall not attack carbon steel, copper, stainless steel, bronze, brass, aluminum, plastics or natural and synthetic

rubbers. "Flash rusting" shall not occur after cleaning.

2.5.10. The cleaner shall be circulated at a temperature of 20^{O}C to 80^{O}C for a period of not less than 72 hours. PH adjustment shall be carried out by the water treatment supplier's representative.

2.5.11. Each system shall be drained, refilled with fresh water, recirculated for a period of 12 hours, drained a second time, and immediately refilled and treated with the recommended corrosion inhibitor.

2.5.12. The water treatment company shall provide the loan of a drum pump and dolly to facilitate the introduction of the cleaner into the system.

2.5.13. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the by-pass valves. Also, clean all strainers.

2.5.14. Provide and later remove all temporary bypasses, drains, vents, etc. required to flush and clean the system. Temporary components for flushing and cleaning are not indicated on the drawings.

2.6. TREATMENT PROGRAM – CHEMICAL TREATMENT AND PASSIVATION

2.6.1. Provide passivation and chemical treatment per the approved chemical treatment procedures. Chemically treat new and reused piping networks using chemicals and treatment procedures compatible with the system being cleaned and the chemical treatment chemicals in existing piping systems being connected to. Test existing piping systems or otherwise determine chemical treatment in existing piping and validate compatibility. Note that existing systems may be silica based, adjust water treatment program accordingly.

2.6.2. When connecting into active existing systems, treat piping networks installed or reused by the project and verify by lab analysis that the treatment levels per the treatment plan have been attained prior to connecting into the existing active system. Submit validating report for approval.

2.6.3. Do not connect into existing active system until report is approved by Board.

2.6.4. Provide temporary valves, piping, and accessories as required to treat the project's piping prior to connection to the active system.

2.6.5. Provide passivation/chemical treatment at system startup or immediately upon operation of a system for temporary cooling and heating, whichever comes first.

2.6.6. Provide chemical treatment immediately after each system has been cleaned and flushed. Thereafter immediately begin the approved water treatment maintenance program to passivate and prevent corrosion, scale, and organic growth and to maintain treatment chemical levels. Note that systems or parts of systems will not typically be started at the same time; adjust treatment strategy accordingly.

PART 3 - EXECUTION

3.1. CHEMICAL SERVICE PROVIDER (CSP) SERVICES

3.1.1. The CSP shall provide all cleaning and treatment chemicals, basic services, testing, equipment and materials necessary for a complete water treatment program.

3.1.2. The CSP shall perform an analysis of the supply water to determine the type and quantities of chemical treatment needed to maintain the required water quality to prevent corrosion, scaling, and biological growth. The CSP will at minimum provide weekly site visits to verify proper water treatment for the first month after any system or part of a system is treated. Provide monthly visits thereafter, or more often if required to assure performance requirements are being met, to analyze water samples, inspect equipment, and add additional chemicals as required to maintain proper water treatment, until final written Board acceptance of the respective system.

3.1.3. At each site visit CSP shall analyze each system for corrosion inhibitors, pH, total iron, total copper, bacteria levels (provide monthly analytical laboratory analysis), and conductivity; inspect loss from corrosion (provide analytical laboratory analysis every three months), record make-up meter readings, and perform any other tests necessary to validate that corrosion, scale, and organic growth is being prevented.

3.1.4. Reports:

3.1.4.1. Submit a written startup test report for each system placed into service. A service report shall be prepared on site by the CSP, submitted at the time of each service visit (with copies immediately provided to the Board), which shall include all required test results and recommendations.

3.1.4.2. Additionally, provide final reports for approval to the Board regarding each site service visit, certified by a representative of the CSP, within one week of any water treatment activity. Such reports shall include the results of any field or lab tests. Reports shall clearly state if the required water quality and maximum corrosion rates are being achieved.

3.1.4.3. At a minimum, each report shall include the following information:

3.1.4.3.1. System Treated
3.1.4.3.2. Date
3.1.4.3.3. Conductivity
3.1.4.3.4. pH
3.1.4.3.5. Total Iron
3.1.4.3.6. Total Copper
3.1.4.3.7. Bacteria(cfu) (monthly analytical laboratory analysis)
3.1.4.3.8. Corrosion Rates (three month analytical laboratory analysis)
3.1.4.3.9. Make-up Water Quantity since Last Visit
3.1.4.3.10. Corrosion Inhibitor level (ppm)
3.1.4.3.11. Silica level (ppm)

3.1.5. Conduct final on-site system turn over meeting with Board and Consultant or Commissioning Agent (as applicable to the project). Present final validation report demonstrating that performance requirements have been achieved and that each system is currently properly treated.

3.1.6. Train Board's maintenance personnel in water treatment procedures.

3.1.7. Program Administration Manual:

3.1.7.1. The CSP shall provide the Owner with two (2) Program Administration Manuals including sections covering program control, testing requirements, in plant logs, safety data and system information. Each section shall include the following:

3.1.7.1.1. *Program Control*: Include a complete program outline with chemical descriptions, control ranges, and required action for "out of range" situations. Also include complete ordering instructions with applicable account numbers and phone numbers.

3.1.7.1.2. *Testing Requirements*: This section will include basic testing practices as well as detailed test instructions for each test to be performed.

3.1.7.1.3. *In-Plant Logs*: Include detailed testing log sheets for each system to be tested including room to record one (1) month's data on one (1) sheet and a section to log chemical inventory.

3.1.7.1.4. *Safety Data*: Include the CSP's 24-hour toll free safety hotline number as well as MSDS sheets for each chemical used.

3.1.7.1.5. *System Information*: Include any equipment manuals and related information.

3.2. **INSTALLATION AND TREATMENT**

3.2.1. Install all required components, and chemically passivate/treat and maintain the system as described in Part 2.

3.2.2. Use and dispose of chemicals and wastewater (including from existing piping networks) per the Quality Assurance section of this specification. All costs of disposal shall be borne by the contractor.

3.2.3. Provide and install all chemicals and all incidental components.

3.2.4. Install equipment at locations shown on the Drawings. Follow the manufacturer's installation and startup instructions.

3.2.5. Passivate and chemically treat each system immediately after it has been cleaned and flushed.

3.2.6. Install pot feeders and filtration cartridges with openings no higher than 1,200 mm (4 ft) above finished floor. Pipe pot feeder drain to nearest floor drain (where glycol is not present).

3.2.7. The treatment program shall begin at system start-up or immediately upon first operation of the system by the contractor for temporary heating and cooling, whichever comes first. Continue the program until Substantial Completion.

3.3. **FIELD QUALITY CONTROL:**

3.3.1. The CSP shall:

3.3.1.1. Verify that systems and equipment have been properly cleaned, flushed, and filled with water, and are fully operational before introducing operational chemicals for water-treatment systems.

3.3.1.2. Introduce and maintain chemical treatment to achieve the specified performance requirements.

3.3.1.3. Submit a written startup test report for each system placed into service.

3.3.1.4. Provide validation testing and required reports.

3.3.1.5. Attend final on-site system turn over meeting with Board and Consultant or Commissioning agent (as applicable to the project). Present final validation report

demonstrating that performance requirements have been achieved and that each system is currently properly treated.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 DESCRIPTION

1.2.1 Ductwork and accessories for HVAC including the following:
1.2.1.1 Supply air, return air, outside air, exhaust, and relief systems.

1.3 DEFINITIONS

1.3.1 SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
1.3.2 Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
1.3.3 Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
1.3.4 Exposed Duct: Exposed to view in a finished room, and/or exposed to weather.

1.4 QUALITY ASSURANCE

1.4.1 Fire Safety Code: Comply with NFPA 90A.
1.4.2 Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
1.4.3 Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.
1.4.4 Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.5 SUBMITTALS

1.5.1 Submit in accordance with the Mechanical General Requirements:
.1 Rectangular ducts:
.1 Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
.2 Sealants and gaskets.
.3 Access doors.
1.5.2 Round and flat oval duct construction details:
.1 Manufacturer's details for duct fittings.
.2 Sealants and gaskets.
1.5.3 Access sections.

1.5.4 Volume dampers, back draft dampers.
1.5.5 Upper hanger attachments.
1.5.6 Fire dampers, fire doors, and smoke dampers with installation instructions.
1.5.7 Sound attenuators, including pressure drop and acoustic performance.
1.5.8 Flexible ducts and clamps, with manufacturer's installation instructions.
1.5.9 Flexible connections.
1.5.10 Instrument test fittings.
1.5.11 Details and design analysis of alternate or optional duct systems.

1.6 APPLICABLE PUBLICATIONS

1.6.1 The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
1.6.2 Air Moving and Conditioning Association (AMCA):
.1 500D 98 Laboratory Method of Testing Dampers for Rating
.2 500L-99 Laboratory Method of Testing Louvers for Rating
1.6.3 American Society for Testing and Materials (ASTM):
.1 A653-01 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
.2 A1011-02 Standard Specification for Steel Sheet and Strip Hot rolled Carbon structural, High-Strength Low- Alloy and High Strength Low-Alloy with Improved Formability
.3 B209 01 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
.4 C1071-00 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
.5 E84-01 Standard Test Method for Surface Burning Characteristics of Building Materials
1.6.4 National Fire Protection Association (NFPA):
.1 90A-99 Standard for the Installation of Air Conditioning and Ventilating Systems
.2 96-01 Ventilation Control and Fire Protection of Commercial Cooking Operations
1.6.5 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
.1 2nd Edition – 1995 HVAC Duct Construction Standards, Metal and Flexible
.2 1st Edition - 1985 HVAC Air Duct Leakage Test Manual
.3 6th Edition – 1992 Fibrous Glass Duct Construction Standards

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

2.1.1 General: Except for systems specified otherwise on drawings, construct ducts, casings, and accessoriesof galvanized sheet steel, ASTM A527, coating G90.

2.2 GALVANIZED STEEL - RECTANGULAR DUCTWORK

2.2.1 G-90 coated galvanized of lock-forming grade conforming to ASTMA653 and A924 Standards. Minimals yield strength for steel sheet and reinforcements shall be 30,000 PSI(207 kPa).
2.2.2 Thickness: to ASHRAE and SMACNA.
2.2.3 Fabrication: to ASHRAE and SMACNA.

2.2.4 Joints: to ASHRAE and SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class B seal.
.1 Standard of Acceptance: Namasco Ductmate; Exanno Nexus.

2.2.5 Fittings
.1 Fabrication: to SMACNA.
.2 Radiused elbows: standard radius.
.3 Square elbows: over 16" with double thickness vanes. Not to be used unless specifically shown on drawings.
.4 Main supply duct branches with splitter damper. If splitter damper is not used, provide branch and main duct balancing damper.
.5 Sub branch duct with 45° entry and balancing damper on branch.

2.2.6 Transitions:
.1 Diverging: 20° maximum included angle.
.2 Converging: 30° maximum included angle.

2.2.7 Offsets: radiussed elbows as indicated.

2.2.8 Obstruction deflectors: maintain full cross- sectional area. Maximum included angles as for transitions.

2.3 SEALING CLASSIFICATION

.1 Sealing classification as follows:

Seal Class	Sealing Requirements	Applicable Static Pressure Construction Class	Allowable Leakage Rate
A	All traverse joints, longitudinal seams and duct wall penetrations	4" w.g. (1000 Pa) -4" w.g. (-1000 Pa)	1% of total system design at system operating pressure 4"(1000 Pa)
B	All transverse joints and longitudinal seams	Up to 3" w.g. (750 Pa) -3" w.g. (-750 Pa) and less	1% of total system design at 3" w.g. (750 Pa)
C	All transverse joints only	Up to 2" w.g. (500 Pa) -2" w.g. (500 Pa) and less	1.5% of total system design at 2" w.g. (500 Pa)
D	Not sealed	Up to 1" w.g. (250 Pa) -1" w.g. (-250 Pa) and less	5% of total system design at 1" w.g. (250 Pa)

2.4 PRESSURE CLASSIFICATIONS

.1 Ductwork material shall be constructed in accordance with SMACNA ratings for the following pressure classifications. Seal classifications shall be in accordance with the following table:

Ductwork	Operating Pressure	Seal Classification	Remarks
All supply ductwork	Up to 2". w.g.	B	

	(500 Pa)		
All return ductwork	Up to 1 " w.g. (250 Pa)	B	
All exhaust ductwork	Up to -1" w.g. (-250 Pa)	B	
All Other Ductwork	Up to 0.5" w.g. (125 Pa)	D	

2.5 SEALANT AND TAPE

2.5.1 Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.

2.5.2 Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.

2.5.3 Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.

2.5.4 Gaskets in Flanged Joints: Soft neoprene.

2.5.5 Approved factory made joints such as DUCTMATE SYSTEM may be used.

2.6 DUCT CONSTRUCTION AND INSTALLATION

2.6.1 Follow SMACNA HVAC Duct Construction Standards.

2.6.2 Where specified, all ductwork shall be made liquid tight with continuous external weld for all seams and joints. Provide neoprene gaskets at flanged connections. Where ducts are not self-draining back to the equipment, provide low point drain pocket with copper drainpipe to sanitary sewer. Provide access door in side of duct at drain pockets.

2.6.3 Casings and Plenums

.1 Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches)wide by 1200 - 1350 mm (48 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

2.6.4 Volume Dampers

.1 Opposed blade, multi louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.

2.6.5 At the onset of the project, the Sheet Metal Contractor shall submit a sketch demonstrating and confirming the ability to transition the ductwork from the unit to the size shown on the Drawing within the Roof Curb. Advise of any issues prior to fabrication.

2.6.6 For all down-discharge rooftop unit, any elbows or transitions within 60' of the unit shall be equipped with turning vanes.

2.7 HANGERS AND SUPPORTS

2.7.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

2.7.2 Hanger configuration: to ASHRAE and SMACNA. Maximum size duct supported by straphanger: 500mm.

2.7.3 Hangers: galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1500	40 x 40 x 3	10
1501 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

2.7.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Standard of Acceptance: Myatt fig 485.

.2 For concrete after concrete pour:

.1 Expanded concrete anchors shall be made of steel.
.2 Powder actuated fasteners shall only be utilized for slabs that are thicker than 100 mm (4") and shall not be utilized in lightweight aggregate concretes.
.3 Holes for expanding fasteners shall be drilled either by a carbide bit or by the teeth on the fastener itself. Expansion shield shall be "set" by driving it into the hole and expanding it with a conical plug.

2.7.3 For steel joist: manufactured joist clamp or steel plate washer.
.1 Standard of Acceptance: Grinnell fig 61 or 86 for joist clamps.

2.7.4 For steel beams: manufactured beam clamps:
.1 Standard of Acceptance: Grinnell fig. 60

2.7.5 For round ductwork the duct shall be supported as follows:
.1 For duct dimensions 900 mm (36") single hangers are acceptable.
.2 For duct dimensions over 900 mm (36") hanger rods shall be provided on both sides of the duct.
.3 Minimum hanger sizes shall be in accordance with table 4-2 of SMACNA.

2.7.6 Loading on trapeze bars shall be in accordance with Table 4-3 of SMACNA.

2.8 DUCT ACCESS DOORS, PANELS AND SECTIONS

2.8.1 Provide access doors, sized and located for maintenance work, upstream and downstream of:
.1 Each duct mounted coil.

.2 Each fire damper (for link service), smoke damper and automatic control damper.
.3 Each duct mounted smoke detector.

2.8.2 Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12inch) minimum where possible. Access sections in insulated ducts shall be double wall, insulated. Transparent shatterproof covers are preferred for un insulated ducts.

2.8.3 For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2 12).

2.8.4 For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure2-11).

2.9 FIRE DAMPERS

2.9.1 Galvanized steel, interlocking blade type, UL listing and label, 1 1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.9.2 Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.

2.9.3 Provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.

2.9.4 Submit manufacturer's installation instructions conforming to ULC rating test.

2.9.5 Combination fire and smoke dampers: Multi louver or curtain type units meeting all requirements of both dampers shall be used where shown and may be used at the Contractor's option where applicable.

2.9.6 Standard of Acceptance: Nailor, Ruskin

2.10 INSTALLATION

2.11.1 Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

2.11.2 Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

2.11.3 Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.

2.11.4 Supply and install volume control dampers on all branch take-offs (applicable to supply, return and exhaust ductwork) whether shown on the drawing or not.

2.11.5 Provide bolted construction and tie rod reinforcement in accordance with SMACNA Standards.

2.11.6 Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

2.11.7 Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.

2.11.8 Install fire dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.

2.11.9 Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

2.11.10 Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

2.11.11 Control Damper Installation:

.1 Provide necessary blank off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.

.2 Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

.3 Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

.4 Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

2.11.12 Air Flow Measuring Devices (AFMD): Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

2.11.13 Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by the Consultant. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

2.11 DUCT LEAKAGE TESTS AND REPAIR

2.12.1 Ductwork leak test shall be performed for the entire air distribution supply and return system including fans, coils and filter section designated as static pressure class 750 Pa (3 inch W.G.) and above.

2.12.2 All supply ductwork less than 500 Pa (2 inch W.G) shall also be tested to the air distribution equipment or terminal device (where applicable).

2.12.3 Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

2.12.4 All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

2.12.5 All tests shall be performed in the presence of the Consultant and the TAB agency. The Test and Balance agency shall measure and record duct leakage and report to the Consultant and identify leakage source with excessive leakage.

2.12.6 If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Consultant.

2.12.7 All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

2.12.8 Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 11 Mechanical General Requirements.

PART 2 PRODUCTS

2.1 SPLITTER DAMPER

.1 Of same material as duct but one sheet metal thickness heavier.
.2 Single thickness construction.
.3 Size and configuration to recommendations of SMACNA.
.4 Control rod with locking device.
.5 Bend end of rod to prevent end from entering duct.
.6 Pivot: piano hinge.

2.2 SINGLE BLADE DAMPER

.1 Of same material as duct. V-groove stiffened.
.2 Size and configuration to recommendations of SMACNA, except maximum height 10"
.3 Locking quadrant.
.4 Inside and outside end bearings.

2.3 MULTI-BLADE DAMPER

.1 Factory manufactured of material compatible with duct.
.2 Opposed blade: configuration to recommendations of SMACNA.
.3 Maximum blade height: 4"
.4 Bearings: pin in bronze bushings.
.5 Linkage: shaft extension with locking quadrant.
.6 Channel frame complete with angle stop.

2.4 DIVERTING DAMPER

.1 Adjustable, curved vanes, mounted in supporting frame.
.2 All aluminum construction.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated on the drawings and identified herein. For ducts concealed behind plaster or drywall ceilings, provide dampers where specifically shown on the drawings.

.2 Provide splitter damper at every main branch take-off from main duct.

.3 Provide balancing damper on all sub-branch ducts.

.4 Install in accordance with recommendations of SMACNA.

.5 Provide balancing dampers on all return air ducts connected to air handling units.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 PRODUCT DATA

.1 Submit shop drawings in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Indicated the following:
   a. Performance curve charts.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 11.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

PART 2 PRODUCTS

2.1 MULTI-LEAF

.1 Opposed or Parallel blade type. Two position dampers to be parallel, modulating dampers to be opposed blade type.

.2 Blades to be of extruded aluminum, internally reinforced air-foil design and connected to linkage with 7/16" hexagon rod.

.3 Blades to be complete with extruded synthetic rubber seals to be secured in an integral slot within the extrusions, spring stainless steel side seals, structurally formed and welded galvanized steel, frame.

.4 All dampers that are in contact with outside air shall be extruded aluminum, internally insulated with non CFC polyurethane foam. Blades shall be thermally broken and connected to linkage with 7/16" hexagon rod. Complete blade shall have an insulating factor of R15.

.5 Bearings to be comprised of celcon inner bearing fixed to a hexagon blade pin rotating within a polycarbonate outer bearing inserted in frame, reuslting in no metal to metal or metal to plastic contact.

.6 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.7 Operator: compatible with damper.

.8 Performance: leakage in closed position to be less than 0.6% of rated air flow at 4" W.G. differential pressure (4 cfm per square foot). Pressure drop at full open position to be less than 0.03 kPa differential across damper at maximum air flow.

.9 Dampers to be suitable for operating in temperatures between -40°F (-40°C) and 212°F (100°C).

.10 Dampers shall be made to size and shall not be limited to standard sizes.

.11 Standard of Acceptance: Tamco Air Foil Series 1000, and Tamco Air Foil Series 9000, Arrow Series AFD-20 and Arrow Series AFD-20 insulated. Ruskin

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install insulated dampers for all dampers directly in contact with outside air.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Seal multiple damper modules with UL listed non-transparent silicon sealant.

.4 Upon system start-up, ensure that dampers operate properly.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Duct silencers.

1.3 REFERENCES

A. ASHRAE Applications Handbook, Chapter 48 "Noise and Vibration Control".

B. ASTM A653 / A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-dip Process.

C. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E477-13 – Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

E. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Performance Data:

1. Silencer manufacturer to provide submittal drawings detailing all duct silencer data specified in the mechanical drawing schedule.

2. Silencer manufacturer shall submit certified laboratory performance obtained using ASTM E477-13. The laboratory must be NVLAP accredited for the ASTM E477-13 test standard and a copy of the accreditation certificate must be included with submittals. Data from non-NVLAP accredited test facilities is not acceptable.
   a. Submitted silencer pressure drops should not exceed those listed in the silencer schedule unless approved by project engineer. Silencer pressure drop measurements shall be made in accordance with ASTM E-477-13.
   b. Submitted silencer dynamic insertion loss and self-noise data should satisfy values listed in the silencer schedule at the project's air distribution system airflow requirements. ASTM E-477-13 tests to obtain this data shall be conducted in the same facility and utilize the same silencer.
   c. Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule unless approved by the project engineer.

d. Silencer generated noise shall not be greater than that listed in the silencer schedule unless approved by the project engineer.

3. The silencer manufacturer shall provide, for approval, acoustic calculations for relevant duct systems with silencers to validate that the submitted silencers will satisfy occupied space design guidelines. Use sound power levels of actual equipment scheduled for installation on project. Acoustic Analysis shall include breakout noise calculations as required. In the absence of specified background noise level criteria, the guidelines outlined in the 2015 ASHRAE Applications Handbook Chapter 48, Table 1 shall apply.

4. Silencer manufacturer shall provide test data for silencer(s) as indicated in the silencer schedule if requested by the project engineer that complies with project criteria.

B. Quality-control Reports:

1. Silencer manufacturer shall provide a copy of their laboratory NVLAP accreditation certificate for the ASTM E-477-13 test standard with the submittals. Data from non-NVLAP accredited test facilities is not acceptable.

C. Stamped (Sealed) Shop Drawings:

1. All silencer shop drawings shall be sealed by a Professional Engineer in the Province of Ontario to affirm:
    a. Silencer will provide the sound characteristic (NC Level – NC 30 unless otherwise noted on the Drawings) desired.
    b. Pressure drop given the proposed ductwork layout and all duct characteristics.
    c. The Manufacturer is responsible for obtaining the latest sound data from the Rooftop Manufacturer via the Mechanical Contractor when performing all calculations.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Silencer performance must have been substantiated in a duct-to-reverberant room test facility according to ASTM E477-13. The test facility must provide airflow in both directions through the test silencer. The test set-up shall eliminate effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption. The aero-acoustic laboratory must be currently NVLAP accredited for ASTM E477-13.

C. Silencer manufacturer must have a minimum ten (10) years of industry experience.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: Silencers shall be Price Industries
   1. Alternate manufacturers must obtain written approval by the project engineer to bid. As a condition of pre-approval, alternate manufacturers must submit to the project engineer HVAC silencer test reports for a silencer tested in accordance with ASTM E-477-13 in a test facility that is NVLAP-accredited for ASTM E-477-13. A copy of the laboratory's current NVLAP accreditation certificate must be included with submitted reports and any changes to the specifications must be submitted and approved in writing by the project engineer prior to the bid due-date.

2.2 DUCT SILENCERS

A. General Requirements:

   1. Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. Silencers shall be fabricated by the same manufacturer.
   2. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings or approved by the project engineer.
   3. Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in other sections are minimums and shall increase as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
   4. Casing seams and joints shall be lock-formed and sealed or stitch welded and sealed except as noted in Section G below, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
   5. Perforated steel shall be adequately stiffened to insure flatness and form. Spot welds shall be painted as needed.
   6. Fire-Performance Characteristics: Silencer assemblies, including acoustic media fill, natural cotton fiber, sealants and acoustical spacers shall have Class 1 flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.
   7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

B. Rectangular Silencers including STC-rated models: Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, 22 gauge.

C. Rectangular Elbow Silencers: Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, 18 gauge. Acoustical splitter/baffles shall be internally radiused and aerodynamically designed for efficient turning of the air.

D. Circular Silencers: Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, gauge as listed below.

1. Sheet metal thickness for units up to 20 inches in Diameter: 22 gauge.
2. Sheet metal thickness for units 21 through 44 inches in Diameter: 18 gauge.
3. Sheet metal thickness for units over 44 inches in Diameter: 16 gauge.

E. Transitional Silencers: Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, 22 gauge. Transitioning shall occur internal to the silencer such that the height of the gap or air passage is changing with the length of the splitters/baffles.

F. Inner perforated metal liner: ASTM A 653/A 653M, G90 galvanized sheet steel.

1. Rectangular Silencers: 26 gauge.
2. Rectangular Elbow Silencers: 22 gauge.
3. Circular Silencers:
   a. Connection diameter up to 18 inches: 26 gauge.
   b. Connection diameter greater than 18 inches: 22 gauge.
4. Transitional Silencers: 22 gauge.

G. Principal Sound-Absorbing Mechanism:

1. No-Media Silencers:
   a. Models shall not contain absorptive media. Attenuation shall be achieved with controlled impedance membranes and broadly tuned resonators.

2. Dissipative and Film Lined Silencers:
   a. Acoustic media. Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool is not permitted as a substitute for glass fiber.
   b. Natural cotton and film lined natural cotton. Media shall be natural cotton fibers treated with an EPA registered, non-toxic borate solution, "flash dried" to actively inhibit the growth of mold, mildew, bacteria and fungi. Media shall not contain formaldehydes, phenolic resins or Volatile Organic Compounds (VOC's) that can off-gas and/or cause health concerns. Media shall be 100% recyclable and comply with UL181 and NFPA 90A. Insulation shall be packed with a minimum of 15% compression during silencer assembly. Media shall not cause or accelerate corrosion of

aluminum or steel. Glass fiber, fiberglass and mineral wool are not permitted as a substitute for natural cotton.

c. Fiber free open cell foam. Media shall be fiber free, open cell melamine-based foam that shall not cause or accelerate corrosion of aluminum or steel.

H. Media Protection:

1. Dissipative silencers: Where indicated on the silencer schedule, media shall be encapsulated in glass fiber cloth to help prevent shedding, erosion and impregnation of the glass fiber. Axial Cone silencers shall have a glass fiber cloth liner.
2. Film Lined silencers: The acoustic media shall be completely wrapped with polymer film to help prevent shedding, erosion and impregnation. The wrapped acoustic media shall be separated from the perforated metal by a factory-installed acoustically transparent spacer. The spacer shall be flame retardant and erosion resistant. Mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer. Silencer manufacturer shall provide a written test report showing silencer assemblies have Class 1 flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.

I. HTL Casings: Where indicated on the silencer schedule, silencers shall have high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer. If requested by the project engineer, relevant breakout noise calculations shall be provided to ensure compliance with the relevant room noise criteria that are based on the sound power levels of the specified equipment.

J. Special Construction:

1. Where noted on the silencer schedule, silencers shall HTL silencer casing.
2. Where indicated on the silencer schedule, provide security bars inside the silencer casing to prevent ingress through the silencer.

K. Accessories:

1. Shipping Protection: Silencers shall be shipped with factory-installed end caps.

L. Source Quality Control: Test according to ASTM E 477-13.

1. The manufacturer shall test silencer(s) as indicated in the silencer schedule if required and at owner's expense. Project engineer shall be notified of the test date in advance and tests shall comply with the project criteria.
2. Test facilities and reports shall be open to inspection from project engineer. Silencer performance must be substantiated by laboratory testing according to ASTM E-477-13. The laboratory must be NVLAP accredited for the ASTM E-477-13 test standard.

M. Capacities and Characteristics:

1. See duct silencer performance schedule on mechanical drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install silencer according to manufacturer's written installation instructions.

B. Support duct silencers independently from ductwork.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Ensure duct silencers are installed with airflow arrows in direction of airflow.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the Specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 20 05 11 Mechanical General Requirements.

1.2 REFERENCE STANDARDS

.1 Comply with requirements of:

1. ULC S110M - Fire Tests for Air Ducts
2. UL 181-2008 - Standards for Safety, Factory Made Air Ducts and Air Connectors
3. NFPA 90A-2009 - Standard for the Installation of Air Conditioning and Ventilating Systems
4. NFPA 90B-2009 - Standard for the Installation of Warm Air Heating and Air Conditioning Systems
5. SMACNA – 2005 - HVAC Duct Construction Standards - Second Edition

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 20 05 11 Mechanical General Requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by the manufacturer or Independent Testing Agency signifying adherence to Codes and Standards.

.2 Product Requirements.

PART 2 PRODUCTS

2.1 GENERAL

.1 Factory fabricated.

.2 Pressure drop coefficients listed below are based on sheet metal duct pressure drop coefficient of 1.00.

.3 Fire retardant type insulation materials, coverings and adhesives with maximum flame spread rating of 25 and maximum smoke developed rating of 50 when tested in accordance with CAN/ULC-S102 and NFPA 255-2006. Materials tested in accordance with ASTM C411-05 shall not flame, smoulder, glow or smoke at temperature to which exposed in

service. Flexible duct system shall meet OBC requirements for smoke and flame spread for return air plenums.

2.2 METALLIC-INSULATED

.1 Spiral wound flexible aluminum with 1" (25 mm) external insulation.

.2 Performance:

- Temperature range: -40°F to 250°F (-40°C to 120°C)
- Minimum bend radius: 1.5 x diameter
- Vinyl sleeve outer covering
- Maximum working pressure: 12" (3000 Pa)
- Class 1 duct material

PART 3 EXECUTION

3.1 DUCT INSTALLATION

.1 Install where indicated and in accordance with preferred method of SMACNA and the following:

1. Connections:

   a. Duct Sizes 300 mm (12") and Under:
      i. Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.

   b. Duct sizes above 300 mm (12"):
      i. Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.

   c. Screws shall be located at least 1/2" (12 mm) from the end of the duct.

   d. The collar to which the flexible duct is attached shall be a minimum 2" (50 mm) in length.

   e. Cover entire joint with tape and seal as specified in Section 15801.

2. Supports:

   a. Support shall be in accordance with SMACNA.

   b. The maximum amount of sag for flexible duct shall not exceed 1/2" (12 mm) per foot. Provide additional supports as required.

3. Length:

    a. Maximum length of flexible duct: 1500 mm (5 ft.).

    b. Minimum length of flexible duct connecting to light fixture troffers or ceiling diffusers shall be 72" (1800 mm).

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into maintenance manual specified in Section 20 05 11.

1.4 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 PRODUCTS

2.1 FANS GENERAL

.1 Capacity, static pressure, revolutions per minute, power, model, size and sound power levels: as indicated on the schedules.

.2 Sound ratings: comply with AMCA (Air Moving and Conditioning Association) 301-76 tested to AMCA 300-67. Sound power levels shall not exceed those of the fan selected on the Schedule.

.3 The fans shall bear the AMCA Certified Ratings Seal for air performance.

.4 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99-76.

.5 Ratings: based on tests performed in accordance with AMCA 210-74, and ASHRAE 51-75.

.6 Accessories and hardware: gravity back-draft dampers, wall sleeves and grilles (where applicable), insect screens.

.7 Factory primed before assembly in colour standard to manufacturer.

.8 Scroll drains: where indicated.

2.2 BELT DRUVE CENTRIFUGAL ROOF EXHAUST FANS

.1 Roof exhaust fans shall be centrifugal belt drive type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall consist of the motor cover, shroud, curb cap and lower windband, and shall be constructed of heavy-gauge aluminum. The housing shall have a rigid internal support structure and leakproof design. The fan shroud shall be one piece with a rolled bead for extra strength which directs exhaust air downward. The lower windband shall be one piece with formed edges for added strength and the curb cap shall include prepunched mounting holes to ensure correct attachment.

.2 The fan shall have sleeve bearing motors, carefully matched to the fan load, and furnished at specified voltage, phase and enclosure. Motors shall be mounted on true vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance. True vibration isolators shall be double-studded with no metal-to-metal contact. Each vibration isolator shall be sized to match the weight of each fan.

.3 A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

.4 A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.

.5 All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

.6 Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

.7 Standard of acceptance: Greenheck Model G, Penn, Carnes

2.3 CEILING MOUNTED WASHROOM/UTILITY EXHAUST FANS

.1 Ceiling mounted exhaust fans shall be of the centrifugal direct drive type. The fan housing shall be constructed of steel. The plastic duct collar shall be a tapered sleeve for ease of connection to 3 in. and 4 in. round ductwork and shall include a backdraft damper.

.2 The grille shall be constructed of non-yellowing high strength polymer and attached to the housing with torsion springs. The wheels shall be constructed of high strength polymer. The access for wiring shall be external. The motor disconnect shall be internal and of the plug in type.

.3 All fans shall bear the AMCA Certified Ratings Seals for sound and air performance and shall be U.L. Listed.

.4 Standard of Acceptance: Greenheck model SP, Penn, Jenn.

2.4 CEILING MOUNTED IN-LINE EXHAUST FANS

.1 Duct-mounted exhaust or return air fans shall be of the centrifugal direct drive type. The fan housing shall be constructed of heavy-gauge galvanized steel. The housing interior shall be lined with ½" (13mm) acoustical insulation. The outlet duct collar shall include an aluminum backdraft damper and shall be adaptable for horizontal or vertical discharge. The access for wiring shall be external. The motor disconnect shall be internal and of the plug-in type.

.2 The motor shall be mounted on vibration isolators. The fan wheel shall be of the forward-curved centrifugal type and dynamically balanced.

.3 All fans shall bear the AMCA Certified Ratings Seals for sound and air performance and shall be U.L. Listed.

.4 Standard of Acceptance: Greenheck model SQ, Carnes, Penn, Twin City, Loren Cook

2.5 DRYER BOOSTER FAN

.1 Dryer booster fan shall be capable of maintaining an air velocity of 6 meters per second (1200 fpm) with an equivalent duct length of 40 meters (130 feet) of 100mm (4 inch) rigid steel duct. The dryer booster fan shall be capable of exhausting air up to 75°C. Unit shall have a five year warranty. Motor shall be a permanently lubricated, enclosed, external rotor design. The blower wheel shall be a self cleaning backward curved impeller design. The dryer booster fan shall have a galvanized steel housing with powder coat finish. A 15 meter (50 foot) cable shall be provided to connect the remote mount indicator panel to the dryer booster fan. Unit shall be provided with a 1.7 meters (5-1/2 foot) long 120 Vac power cord. Dryer booster fan is to be provided with inlet and outlet flanges for connection to 100mm (4") duct. Quick disconnect duct clamp to be provided. Galvanized mounting bracket and hardware are to be provided. Unit shall be provided with 450mm (18") of pressure sensing tubing with mounting grommet.

.2 Standard of acceptance: Reversomatic, Fantech Model DBF4XLT, Greenheck, Carnes, Penn

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install fans as indicated, complete with resilient mountings. For all roof-mounted fans, manufacturer shall provide the matching curb.

.2 Provide a flexible connection on fans connections to ductwork. Each flexible connection shall be installed with at least 3" of slack across a clear metal to metal gap of 4" Each flexible connection shall consist of a minimum of 6" of fabric. Ensure metal bands of connectors are parallel with minimum 3" flex between ductwork and fan during running.

.3 Install fan restraining snubbers as indicated. Flexible connections shall not be in tension during running. Provide all sheaves and belts required for final air balance.

.4 The exact location of each fan is to be site approved by the Engineer prior to installation; seek the Consultant's approval and site review prior to commencing install. Any install completed without the Consultant's approval will require the Contractor to move the exhaust fan as directed at no extra cost to the Contract.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 11.

.2 Indicate the following: fan, fan curve, motor drive, filters c/w efficiency, mixing box, access doors, dampers and heating hot water coil, plus all performance data, to suit units, wiring diagrams, weight, sound power levels and bearings.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 11.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 20 05 11.

.2 Provide one spare set of filters for each Unit Ventilator.

1.5 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

1.6 ACOUSTICAL PERFORMANCE

.1 Acoustical performance shall be established by AMCA standard 330, ASHRAE Standard 68 or ARI 260P procedures. Sound data shall be supplied that meets or exceeds requirements indicated on schedules. (Data that is presented in sones or Bels is not acceptable.

.2 Deliver and install a complete unit ventilator certified for ventilation at ARI-840, or tested by an independent testing and balancing lab witnessed by owner's representative.

1.7 SPARE PARTS

.1 Provide one spare set of V belts for each fan provided.

PART 2 - PRODUCTS

1) UNIT VENTILATORS

a. Casings of all exposed units shall be constructed of 14 gauge (1.5mm) satin coat steel with an electrostatically applied textured powder coat finish. Color from Engineered Air's standard color selections to be chosen by architect.

b. Access panels shall have bottom alignment pins and allen key operated camlock fasteners. Separate access doors shall be provided for piping pockets, controls sections and fan sections

c. Units shall have sloped 18 gauge (1.2mm) stainless steel condensate drain pans with 5/8" (15.9mm) copper sweat connection. Drain pans shall have welded corners and be removable for cleaning.

d. Cabinets shall be lined with 1" (25mm) 3 lb. /ft^3 (48 kg/m^3) acoustic insulation. Condensate drain pans shall be externally insulated with closed cell foam for moisture proof operation and corrosion resistance.

e. Units shall include controls transformer. All units shall conform to UL Standard 1995 and CSA Standard C22.2 No. 236. Units shall be CSA approved and bear the $_{C}CSA_{US}$ label. Units shall include non-fused disconnect switch. Units shall include motor control relay.

f. Units shall have an integral mixing plenum with Engineered Air low leak dampers

g. Low leak damper assemblies shall be factory installed in the unit ventilator cabinet. Pivot rods of ½" (13mm) high grade carbon steel, cadmium plated, shall turn in brass bushings. Rods shall be secured to the blade by means of square hollow structured steel nested in damper blade brake. Damper brake ends shall be sealed with an adhesive backed polyurethane gasketing.

h. Hot water coils shall be constructed of 5/8"(16mm) heavy wall copper tubing for system pressure. Coils where subjected to freezing temperatures, shall be constructed of tube-in-tube design with 1"(25mm) outer tube and ½" (13mm) inner heavy wall steam distributing tube for steam pressures to 5 psi.

i. Fans shall be DIDW forward curved direct drive type constructed of galvanized steel in painted steel housings. Units shall have 14 gauge (1.9mm) fan board.

j. All motors shall be open type, resiliently mounted, incorporating sleeve bearings and automatic reset internal overloads. Motors shall be permanent split capacitor type, be capable of three speeds and shall have quick connect power coupling (coupling available on 120 volt models only).

k. Provide 1" (25mm) throw away filters.

l. Unit Ventilators shall be Trane, model numbers, sizes and capacities as indicated on drawings and/or schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install units in accordance with manufacturers' instructions and as indicated.

.2 Assemble and install all components furnished as per manufacturer's literature. Provide all wiring as per manufacturer wiring and control diagrams.

.3 Connect all heating hot water supply & return piping so equipment and circuits are serviceable without having to dismantle excessive lengths of pipe.

.4 Install the units on isolators in accordance with the vibration isolation schedule.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 11 Mechanical General Requirements.

1.3 SAMPLES

.1 Submit samples in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Submit samples for the following:
   a. None

1.4 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers shall be product of one manufacturer for generic type (i.e. grilles and registers by one, diffusers by one, or same).

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 GENERAL

.1 Provide standard product to meet capacity, throw, noise level, throat and outlet velocity.

.2 Where grilles, registers and diffusers penetrate fire walls and fire partitions, provide approved steel sleeve secured to structure in accordance with NFPA 90A-1993 and required fire damper.

.3 Frames:
   a. Steel: primed cold rolled steel with exposed welded joints and mitred corners.
   b. Aluminum: extruded satin finish with mechanical fasteners and mitred corners.
   c. Provide full perimeter gaskets.
   d. Provide plaster frames as plaster stops where set into plaster or gypsum board.
   e. Provide concealed fasteners and balancing operators in all finished areas.

f. Final finish to be selected by Architect from standard manufacturer finishes at shop drawing stage.
g. Style, frame, and installation details as indicated.

.4 Sizes and capacities: as indicated in the schedule.

.5 Standard of Acceptance: E.H. Price, Titus, Tittley Baily, Krugger

2.2 SQUARE PLAQUE DIFFUSERS

.1 Square type 600 x 600 (24" x 24"), having fixed pattern, plaque-type, and volume control dampers with flow straightening devices and blank-off quadrants. Diffuser to be finished in off-white baked enamel and to be suitable for the ceiling in which it is installed.

.2 Square type 300 x 300 (12" x 12"), having fixed pattern, and volume control dampers with flow straightening devices and blank-off quadrants. Diffuser to be finished in off-white baked enamel and to be suitable for the ceiling in which it is installed.

.3 Standard of Acceptance: E. H. Price Model SPD, Titus., Tittley Baily, Krugger

2.3 LOUVERED RETURN GRILLES

.1 Supply and install return grilles of the sizes and mounting types indicated on the plans and outlet schedule. Grilles shall be 0 degree deflection fixed louver type with blades spaced 1/2" (13) on center. The outlet shall have heavy extruded aluminum border and blades held in place with aluminum mandrel tubes not to exceed 12" (305) on center. Blades shall run parallel to the long dimension of the grille. The grille shall be finished as per the architectural requirements.

.2 Standard of Acceptance: E H price 635DAL series, Tittley Baily, Krugger.

2.4 EGG-GRATE EXHAUST GRILLES

.1 Furnish and install exhaust registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be of aluminum construction, consisting of aluminum 1/2" x 1/2" x 1/2" (13 x 13 x 13) grid (egg crate core) and an extruded aluminum border. The integral volume control damper (where required) shall be of the opposed blade type and shall be constructed of heavy gauge cold rolled steel. The damper shall be operable from the register face. The damper shall be coated steel. The grille shall be finished as per the architectural requirements.

.2 Standard of Acceptance: E H Price model 80, Titus, Tittley Baily, Krugger

2.5 DOUBLE DEFLECTION SUPPLY GRILLES - ADJUSTABLE BLADES

.1 Furnish and install aluminum supply registers of the sizes and mounting types indicated on the drawings. Registers shall be double deflection type with two sets of fully

adjustable deflection blades spaced 3/4" (19) on center. The front set of blades shall run parallel to the long dimension of the register. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The grille shall be finished in a color selected by the Architect at shop drawings stage.

.2 Standard of acceptance: E.H.Price model 610DAL, Titus, Tittley Baily, Krugger

2.6 TRANSFER GRILLE TYPES

.1 Aluminum construction, 32 mm flat border, sightproof appearance, off-white baked enamel finish.

.2 Standard of Acceptance: E.H.Price Model ATG1, Titus.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 All diffusers and grilles in finished areas to have concealed mounting. In unfinished areas and where grilles or diffusers are to be installed in ductwork, install with bulkheads tight to either side. Site measure for exact fit.

.3 Final locations of diffusers and grilles to be in accordance with details of Architect's reflected ceiling plan. Coordinate with lighting fixtures installation by Div. 16.

.4 Install and adjust air registers to provide noiseless and draftless distribution. Primary air balance to be done at duct dampers with final adjustment only at diffusers and grilles.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Indicate the following: Louvers, Style and Performance.

1.3 CERTIFICATE OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by the Manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 STATIONARY LOUVERS

.1 Louvers shall be by Mechanical Contractor.

.2 Frame: 102 mm deep, 6063T5 extruded aluminum. 3.2 mm nominal wall thickness. Downspouts and caulking surfaces included.

.3 Blades: 6063T5 extruded aluminum. 3.2 mm nominal wall thickness. Drainable blades are positioned at 45 degree angle and spaced approximately 102 mm center to center.

.4 Screen: 19 mm X 1.3 mm expanded, flattened aluminum bird screen in removable frame. Screen adds approximately 13 mm to louver depth. Also provide insect screen.

.5 Finish: Factory-applied Kynar 500 or equivalent, colour, selected at shop drawing stage.

.6 Features:

a. Published performance ratings based on testing in accordance with AMCA Publication 511.
b. High performance frame system with drainable head collects and removes water to provide excellent water penetration performance.
c. Drain gutter in each blade minimizes water cascade between blades.
d. All aluminum construction for low maintenance and high resistance to corrosion.
e. All welded construction.

.7 Performance:
   a. .1 52% minimum free area.
   b. .2 Beginning point of water penetration at 0.01 oz./sq. ft. is 1075 fpm
   c. .3 Pressure drop: 0.15" w.g. at 870 fpm (Intake) and 900 fpm (exhaust).

.8 Size of louvers shall be coordinated with the brickwork pattern. Minimum louver size shall be 305mm x 305 mm.

.9 Standard of Acceptance: E.H.Price, Ruskin.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers recommendations and in accordance with recommendations of SMACNA.

.2 Reinforce and brace air vents, intakes and gooseneck hoods for wind speed in accordance with NBC for location.

.3 Blank off and insulate with sheet metal, 2" of insulation and sheet metal, all unused portions of louvres.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION:

1.1.1. This section specifies flue gas exhaust system and all accessories from the boiler outlet to the stack outlet to the atmosphere.

1.2. RELATED WORK:

1.2.1. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
1.2.2. Section 23 52 25 HOT WATER HEATING BOILERS

1.3. QUALITY ASSURANCE:

1.3.1. Provide scale drawings showing nominal dimensions and weight of the systems.

1.3.2. Boiler and venting manufacturers shall review complete system from boiler flue gas outlet to stack outlet to atmosphere and advise the Consultant of any changes required to meet boiler and burner performance requirements. Note the altitude of plant site.

1.3.3. The manufacturer shall completely engineer the entire system and provide all components. Manufacturer's representative shall provide installation instructions prior to start of construction train the installers and certify in writing to the Consultant that the entire installation complies with the official standards of the manufacturer and with the project specifications.

1.3.4. Conform to NFPA 54 and NFPA 31 for installation of fuel burning equipment and appliances.

1.4. SUBMITTALS:

1.4.1. Prior to submission of the shop drawings, the boiler manufacturer shall review the contract documents, shall inspect the site, take measurements as required and coordinate with the mechanical contractor the final routing of the individual vents and common collector/vent, as applicable to the project.

1.4.2. Based on the information collected from the design documentation, from the site and from the mechanical contractor, the venting manufacturer shall submit a fully sized venting system including all required accessories such as barometric dampers, motorized dampers, pressure sensors, safeties and all other required devices to provide adequate draft at all firing modes. The entire venting system, including all draft control accessories shall be included in the contract price.

1.4.3. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION the following:

1.4.3.1. Design, materials, weights, construction, pressure and temperature limitations of breeching and stack systems.

1.4.3.2. Comprehensive draft calculations based on the ASHRAE methodology confirming the final chimney routing and diameter required to adequately vent the boiler under all anticipated outdoor weather conditions and temperatures. Incorporate flue gases data as provided by the burner/boiler manufacturer (flue gases temperature, CO_2 content, etc).

1.4.3.3. Drawings showing all components (including draft control devices), system arrangement, isometric diagram and dimensions.

1.4.3.4. Design, construction, allowable movements, movement forces, pressure and temperature limitations of expansion joints.

1.4.3.5. Damper design, construction, pressure and temperature limitations, pressure loss at design flow, and leakage of closed damper.

1.4.3.6. Support designs, locations and loads for entire assembly.

1.4.3.7. Written statement from boiler/venting manufacturers that the design of the system is satisfactory to achieve the required boiler/burner performance and the common venting system draft will be maintained within the range required by the boiler manufacturer.

1.4.3.8. All submitted information shall be included in the close-out documentation.

1.4.3.9. The Draft Calculations must be sealed (stamped) by a Professional Engineer licensed in the Province of Ontario to certify the calculations and validate the venting material and size is suitable for the proposed application and appliances.

1.5. **APPLICABLE PUBLICATIONS:**

1.5.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

1.5.1.1. CSA B-149.1 latest edition

1.5.2. National Fire Protection Association:

1.5.2.1. NFPA 54-2006 National Fuel Gas Code
1.5.2.2. NFPA 31-2006 Standard for the Installation of Oil-Burning Equipment

1.6. **WARRANTY**

1.6.1. Vent shall be warranted by the manufacturer against defects in material and workmanship for a period of (15) years from the date of manufacture.

1.7. **STANDARD OF ACCEPTANCE:**

1.7.1. Heat-Fab, Security Chimney, Cheminee Lining, Environ

PART 2 - PRODUCTS:

2.1. **DOUBLE WALL VENTING**

2.1.1. Provide and install a Pre-Engineered, Pre-Fabricated, Double-Wall System

2.1.2. Vent shall be factory-built special gas type, double wall, engineered and designed for use on Category I, II, III, and IV appliances.

2.1.3. System shall be completely factory-built, with all components and installation engineered and provided by manufacturer of system, including supports, thimbles, clean-outs, draft control devices, barometric dampers, heat shields and outdoor terminations. Drain taps shall be provided at low points.

2.1.4. Maximum continuous flue gas temperature not to exceed 550°F (288°C) for gas burning appliances.

2.1.5. Vent shall be constructed with an inner conduit constructed of AL29-4C® or 29-4 (S44735) superferritic stainless steel with a minimum thickness of .015" for diameters 3"-8", .020" for diameters 10"-16", .025" for diameters 18"-24", and .035" for 26" and greater.

2.1.6. Vent shall be listed for an internal static pressure of 15" w.g. and tested to 37" w.g.

2.1.7. All inner wall conduit components shall be manufactured from AL29-4C® or 29-4 (S44735). The joint closure system shall be an Inner Wall Mechanical Locking Strap design. Joints shall not use screws or fasteners that penetrate the inner conduit.

2.1.8. Vent shall be constructed with a factory installed gasket used to seal the joint for diameters 4"–16". Use of gasket lube, available from the factory, should be used for maximizing

gasket life and ease of installation. For diameters 18"- 32", joints shall be sealed with factory supplied RTV sealant.

2.1.9. Inner wall joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel. Proper ¼" per foot pitch must be maintained at all times and condensate should flow back toward the appliance to the required number of drains.

2.1.10. The outer wall casing shall be constructed of 430 stainless steel that shall not require additional surface preparation, such as painting, in order to withstand the outdoors or high humidity environments.

2.1.11. Inner conduit and outer wall casing shall be constructed with a one-inch air space between them and in such a fashion that prevents cross-alloy contamination. Optional 1" fiber insulation shall be provided where so specified, to maintain higher flue temperatures.

2.1.12. Tees and elbows shall provide a pressure drop less than 15 feet equivalent horizontal vent.

2.1.13. Fittings that increase or decrease vent diameter shall be asymmetric in construction with a flat wall that maintains a straight line with adjoining parts in order to facilitate the unobstructed flow of all condensate.

2.1.14. All parts shall be compatible with other single wall and double wall products of the same manufacturer.

2.1.15. System is to be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and other applicable codes.

2.1.16. System manufacturer's engineered support system, attached to structural members of the building, with expansion joints between rigid supports. Thermal expansion shall be handled by expansion joints and variable spring hangers. Thermal expansion and weight of system shall not impose loads in excess of that allowed by manufacturer of boiler, or any other equipment, or exceed capabilities of building structure. Spring hangers shall conform to MSS SP-58, Type 51, variable spring.

2.1.17. Guy wires: Provide stack guy wires above roof, with spring-loaded tensioners, in accordance with printed instructions of stack manufacturer.

2.2. **SEALANT – DOUBLE WALL VENTING**

2.2.1. General Electric RTV106 (aka Momentive) or Dow Corning 736 High Temperature Sealant shall be used to seal all joints on systems where the maximum flue gas temperature will not exceed 550°F.

2.2.2. Alternate: a factory installed 550°F compatible silicone rubber gasket shall be used to seal joints.

2.3. **ACCESSORIES - DOUBLE WALL VENTING**

2.3.1. Drains: Provide threaded pipe connection to allow drainage at all low points and drain connections in stack and breeching systems. Slope piping system to the drain. Pipe size shall be 25 mm (1 inch) minimum. Each drain shall include a min. 2" (50mm) deep trap.

2.3.2. All drainage from the stack shall pass through acid neutralizers supplied by the chimney manufacturer and installed by the mechanical contractor. All condensate drain upstream of the acid neutralizer shall be 316 SS and shall include a trap of a depth as specified by the manufacturer. All condensate drain downstream of the acid neutralizer can be schedule 80 PVC and shall be directed to the nearest funneled floor drain.

2.3.3. Where condensate piping runs at floor level and represents a tripping hazard, provide checkered aluminum protective ramp.

PART 3 - INSTALLATION

3.1. **PRE-ENGINEERED, PRE-FABRICATED DOUBLE WALL SYSTEM**

3.1.1. The entire chimney system shall be the product of a single manufacturer.

3.1.2. Refer to drawings for arrangement and dimensions, Connections to boilers must comply with the written recommendations of the boiler manufacturer. Ninety-degree tee sections are not permitted. Intersections must be made with lateral tees.

3.1.3. Install in accordance with NFPA 54 and NFPA 31 and manufacturer's instructions. Wherever possible, use 45 deg. elbows instead of 90 deg.

3.1.4. Drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The manufacturer's drawings may differ from the design documentation to allow for interference with other building services and required clearances from combustible materials; the manufacturer's drawings take precedence over the design documentation and the final layout shall be shown on the as-built drawings.

3.1.5. Slope horizontal sections to facilitate drainage of condensate.

3.1.6. Supports: Completely support all systems from the building structure without overloading the building structure or the connected equipment. Support system shall be engineered by the system manufacturer and shall accommodate thermal expansion.

3.1.7. When installed according to the manufacturer's installation instructions the stack and its supporting system shall resist side loads at least 1.5 times the weight per foot of piping.

3.1.8. Provide barometric dampers and/or motorized draft control dampers where necessary and adjust to optimize the operation of the boilers at no additional cost to the Board. Number and location of barometric dampers/motorized draft control dampers: to be established by the chimney manufacturer and included with the shop drawings submission.

3.1.9. Provide all power supply connections to the motorized darft control devices, including wiring, conduits and switches.

3.1.10. Seal and fire-stop all penetrations through building elements; use materials compatible with the temperature on the exterior wall of the assembly. For roof penetrations and flashing, refer to details on the drawings.

3.1.11. Deliver a copy of the instructions to the Contractor prior to commencing the installation.

3.1.12. Representative of manufacturer shall provide field training on all installation techniques to all installers.

3.1.13. Terminations

3.1.13.1. The vent system must terminate with manufacturer-approved caps, so that proper clearances are maintained as cited in local codes or the latest edition of the National Fuel Gas Code, ANSI Z223.1.73.4e and 7.8a, b as follows:

3.1.13.1.1. Do not terminate near soffit vents or crawl space or other area where condensate or vapor could create a nuisance or hazard or cause property damage.

3.1.13.1.2. Do not terminate the exhaust vent terminal where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

3.1.13.1.3. Do not terminate the exhaust vent terminal over public area or walkways where condensate or vapor can cause nuisance or hazard.

3.1.13.1.4. The vent shall terminate a minimum of 12" (25.4 cm) above expected snowfall level to prevent blockage of vent termination.

3.1.13.1.5. Vent terminations shall be supplied by the venting manufacturer. No other terminations are acceptable.

3.2. **ROOF OPENINGS**

3.2.1. Re-use existing vertical brick stack; extend 1,500mm above the stack termination end install a weather cap on top.

3.2.2. Seal around the termination of the existing brick with a stainless steel storm collar, to prevent rainwater ingress through the annular space between the new vent and the opening of the brick cap. Refer to detail on the drawings.

3.2.3. All hangers supporting the horizontal collector inside the boiler room shall be provided as per manufacturer's instruction.

3.2.4. All intermediate supports inside the brick stack shall be provided at spacing in accordance with the manufacturer's instructuons. Provide all cutting and patching through the brick stack walls inside the school as required to support the new vertical stack; if needed, install guy wires attached to the concrete stack top.

3.2.5. No part of the new venting shall be supported by the roof deck. Use existing steel construction or provide new independent support, using the floor and/or walls.

END OF SECTION

PART 1 - GENERAL

1.1. REFERENCE STANDARDS

1.1.1. Do installation of packaged boilers in accordance with Regulations of the Province of Ontario, CSA B51, ASME Section IV, ASME N626.3-1978, CSA B140.7.2, CGA CAN1-3.1, Canadian Electric Safety Code, CSA B139, CSA B139S1, CAN1-B149.1, ANSI B31.1, all publications of latest edition.

1.1.2. The boiler performance shall conform to the requirements outlined in ASHRAE 90.1 and the requirements outlined by the Ministry of the Environment.

1.1.3. The boiler and burner shall be certified together as one package; separate certifications for the boilers and burners are not acceptable.

1.2. SUBMITTALS

1.2.1. Before executing any work, submit in accordance with Section 01 33 23 the following:

1.2.1.1. Boiler:

1.2.1.1.1. Complete catalog information and outline drawings of boiler, burner, and accessories with dimensions including required service clearances and access space.
1.2.1.1.2. Catalog cuts showing arrangement and construction of pressure parts, casing, internals, and support frame.
1.2.1.1.3. Piping connection sizes, locations, types (threaded or flanged).
1.2.1.1.4. Technical data including temperature rating and arrangement of refractory and insulation.
1.2.1.1.5. Design pressures and temperatures

1.2.1.2. Boiler Trim: Includes water level alarm and cutoff devices, low water cutoffs, piping, all valves and fittings furnished by boiler manufacturer

1.2.1.2.1. Design, construction, arrangement on the boiler.
1.2.1.2.2. Pressure and temperature limitations.
1.2.1.2.3. ASTM numbers and schedule numbers of piping.
1.2.1.2.4. Type and pressure ratings of pipe fittings.
1.2.1.2.5. Scale ranges of gages, thermometers and pressure switches.
1.2.1.2.6. Set pressure and capacity of relief valves.

1.2.1.3. Burner and Fuel Valve and Piping Trains:

1.2.1.3.1. Catalog data and drawings showing burner assembly and fuel train arrangement.
1.2.1.3.2. Drawings and catalog data on all equipment in fuel trains.
1.2.1.3.3. ASTM numbers and schedule numbers on all piping.
1.2.1.3.4. Type and pressure ratings of pipe fittings.
1.2.1.3.5. Burner flow and pressure data

1.2.1.4. Burner Management (Flame Safeguard) System:

1.2.1.5. Catalog data and drawings showing burner management system assembly and arrangement. Full Function Factory Fire Test must be performed and documented on the boiler's fire test label. A Factory Authorized Start-up must be completed prior to final acceptance by the Consultant.

1.2.1.6. Submit water treatment test report to determine if selected boilers will be applicable to the facility.

1.2.1.7. Operation and Maintenance Manuals shall be submitted prior to final acceptance by the engineer and shall contain shop drawings, product data, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data, etc.

1.3. **CONTROLS**

1.3.1. All boilers shall be fully compatible with the building BAS

1.3.2. At the minimum, the building BAS shall be capable of:

1.3.2.1. enabling/disabling the boilers
1.3.2.2. sequencing multiple boilers
1.3.2.3. setting the supply or return water setpoint and have the boiler(s) modulate as required to maintain it
1.3.2.4. provide feedback to the BAS in regards to each boiler status, firing rate, hot water setpoint.
1.3.2.5. provide alarms in case of any boiler malfunction

PART 2 - EQUIPMENT

2.1. **QUALITY**

2.1.1. It is essential that the equipment complies with the requirements of this specification, performs as specified, and is the manufacturer's standard commercial product, unless otherwise specified.

2.1.2. Electrically operated components specified are to be "Listed" and/or "Labeled" as defined by NFPA 70, Article 100.

2.1.3. The boiler pressure vessel must be constructed in accordance with ASME Section IV Code and bear the "H" stamp and shall be manufactured within an ISO 9001 Certified facility to ensure high quality standards. Electrical connections, and vent connection, designed and constructed to Section IV, ASME Code and UL certification.

2.1.4. The boiler must be UL certified to the ANSI Z21.13 / CSA 4.9 standard for Gas Fired Low Pressure Steam and Hot Water Boilers and shall have the UL label affixed.

2.1.5. Boiler must be AHRI listed and certified in accordance with the Commercial Boiler program and the BTS-2000 testing standard and is required to undertake a Full Function Factory Fire Test before shipping out.

2.1.6. Boiler is required to be registered with the National Board directly from the manufacturing facility.

2.1.7. The manufacturer is required to provide, upon request, all quality assurance documentation and the results of the Full Function Factory Fire Test corresponding to the boiler's serial number.

2.1.8. Boiler(s) is to be test fired prior to shipping including all safety circuits tested. Combustion parameters and operating sequence to be factory tested requiring only site-specific adjustments and project specified set points.

2.2. **PERFORMANCE**

2.2.1. Boiler rated output in BTU indicated on the schedule and the boiler rating plate with efficiency confirmed by AHRI.

2.2.2. Achieving ultra-high efficiency shall be possible by optimizing all factors of the condensing process including lower return temperatures, lowering overall system temperature while reducing modulation rate.

2.2.3. The thermal efficiency of the boiler shall be no less than 98.4% for SP-1000 model. Combustion efficiency will not be is not accepted as "boiler efficiency"

2.2.4. Flue gas temperature leaving the boiler not to exceed 230 F.

2.3. **BOILER DESIGN**

2.3.1. Basis of Design is Absolute "SPIRE" high efficiency condensing boiler supplied by Applied Energy Systems Inc.

2.3.2. The boiler shall be an ultra-high efficiency condensing boiler, featuring a pressure vessel constructed from 316L stainless steel and designed with water tubes.

2.3.3. The boiler shall be designed for a maximum allowable working pressure of 160 PSIG and a maximum allowable temperature of 210 F.

2.3.4. Each space heating boiler shall be model Absolute Spire; fire tested, assembled and shipped as a factory "packaged" unit, complete with boiler jacket, burner and controls mounted & wired into the boiler, gas train manifold and all components and accessories including boiler trim required for an operable boiler.

2.3.5. The "packaged" boiler will be hydrostatically tested with headers attached, inspection of the pressure gauge and visually verified no leaks are found.

2.3.6. The heat exchanger construction must be of helical, multi-channel manifold tubes technology with large internal tube diameters to allow lowest water pressure drop facilitated by circulation of water.

2.3.7. The water connections will be positioned at the top of the boiler, while the flue gas exhaust will be located at the rear. The combustion air intake and incoming gas connection will be situated on the right side of the boiler

2.3.8. Additionally, the boiler(s) will be equipped with a factory-supplied, oversized ASME relief valve.

2.3.9. The heat exchanger must have no less than 75.4 sqf of Stainless Steel Heating Surface and shall have less than 8.1 sqf of total footprint.

2.3.10. The boiler must be of a horizontal design with a hinged front door to allow full access to the combustion chamber and the burner for inspection and cleaning. The boiler(s) will consist of one (1) horizontal stainless steel water tube heat exchanger, one (1) combustion blower, one (1) burner assembly and one (1) gas train manifold. No multiple heat exchangers, blowers, burners integral or otherwise are accepted.

2.3.11. Each boiler shall include an integral stainless-steel condensate pan/collector, condensate drain, removable burner assembly, and boiler trim mentioned in the boiler trim section.

2.3.12. Boiler supply/return headers shall be of groove lock style for left side or right-side attachment to system piping.

2.3.13. The boiler shall be capable of a 10:1 configuration. The standard 10:1 turndown ratio shall be achieved using the Honeywell Sola commercial boiler controller, EBM fan and Dungs "zero-governor" gas valve. Lower turndown ratios will not be accepted.

2.3.14. The boiler shall be using Natural Gas only as its approved fuel.

2.3.15. The electrical input to the boiler shall be 240V/1PH/60HZ

2.3.16. The boiler will have fork pockets and longitudinal rails underneath to allow rolling on a level surface, if necessary. Crane lifting lug locations will be affixed to the pressure vessel. Final leveling of the boiler will be achieved by adjusting the supplied leveling feet.

2.3.17. The boiler shall be capable of variable primary or primary/secondary piping arrangements.

2.3.18. The boiler shall be designed to operate in condensing mode at all firing rates in order to extract the latent heat from the combustion products of natural gas. A PVC condensate trap shall be supplied to allow for attachment to the field supplied condensate neutralization unit(s).

2.4. **BOILER TRIM**

2.4.1. The following ancillary components shall be installed and tested:

2.4.1.1. A probe type, low water cutoff control must include a manual test button, reset and fault indication.
2.4.1.2. High Limit Aquastat, non-recycling, preset at 210F, adjustable for lower temperature designs.
2.4.1.3. Two supply thermistors for control of modulation and maximum water temperature in one probe located inside a dry sensor well.
2.4.1.4. Return temperature thermistor for PID calculations and delta T limit located in a dry sensor well.
2.4.1.5. ASME Rated pressure relief valve (PRV). Relief valve pressure shall be specific psi rating for each system application.
2.4.1.6. Flow Switch on return header, preset, to lowest allowable flow rate
2.4.1.7. Automatic air vent shall be opened on the supply header during commissioning to assist air removal. This is not a system air vent and shall be closed at the end of commissioning.
2.4.1.8. Boiler pressure and temperature gauge (Tridicator) shall be minimum 3" diameter mounted on the supply header

2.5. **BURNER**

2.5.1. The boiler manufacturer must provide a complete fuel burner system with every boiler. This system includes an integral pre-mix style stainless steel mesh gas burner, a combustion blower for mixing air with fuel, main gas valve train, and an ignition system.

2.5.2. The burner manufacturer must ensure it works well with the boiler's heat exchanger and the control system to meet the needed power, efficiency, and performance standards. Boilers that do not include an integrated burner will not be accepted.

2.5.3. Combustion shall take place inside an enclosed heat exchanger under positive pressure. The air and fuel to be premixed in the EBM Papst fan with fuel metering adjusted by the Karl Dungs gas valve.

2.5.4. The 10:1 air fuel ratio system shall achieve combustion within +-1% oxygen through the firing range without the use of O2 trim, air or gas servos. The fan shall have RPM feedback as a safety measure to ensure fan performance is always within specified limits. VFD motor shall be inverter duty rated.

2.5.5. Burner tube shall be constructed of stainless-steel fiber mesh for solid body radiation of the burner flame installed horizontally inside the combustion chamber. Combustion shall take place on the surface of the burner mantle, which shall be constructed of a woven SS alloy material creating a 360-degree low temperature radiant flame. Reduction of NOx not exceeding 20 ppm to be achieved by only mesh burner design.

2.5.6. A permanent observation port shall be provided in the burner to allow observation of both spark ignition and the main flame. Flame detection for the 10:1 burner shall be an ionization rod.

2.5.7. As a minimum, the gas train shall meet the requirements of cULus and ASME CSD-1 and shall be installed and tested gas tight prior to shipping. Retesting required during commissioning.

2.5.7.1. Low Gas Pressure Interlock, manual reset.
2.5.7.2. High Gas Pressure Interlock, manual reset.
2.5.7.3. Upstream and downstream manual test ports
2.5.7.4. Appliance test firing valve and main shut off valve
2.5.7.5. Unibody, motorized double safety gas valve-regulator combination
2.5.7.6. Union connection to permit burner servicing.

2.6. CONTROLS

2.6.1. The Boiler shall include Honeywell Sola Commercial S7999 control including the 7" Honeywell HMI to display the supply temperature, return temperature, and set-point temperature at all times. Utilizing the stock Honeywell Commercial Sola, no added programming or extraneous device shall be required to operate the boiler. Honeywell factory programming shall allow full access to the Modbus registry for local and remote diagnostics.

2.6.2. The control shall allow for user input of either temperature or rate of modulation to optimize performance. Combustion fan reaction time shall allow adjustment to tune the boiler's performance to the system.

2.6.3. The "all in one" flame safeguard/boiler management control shall meet all UL/CSA and NFPA requirements for fully automatic boiler control with pre-ignition, ignition and running interlocks including self-checks. Boiler wiring to meet UL certification requirements as per ANSI Z21.13 and CSA 4.9

2.6.4. Diagnostics to include: Real time data logging of flame signal, boiler modulation and temperatures. The control shall be connected to a color touchscreen display interface that will retrieve lockout history information and allow user and service access to all diagnostic information.

2.6.5. The boiler control shall be fully accessible on a pull-out drawer slide from the front. Wiring to the panel must be completed as per Honeywell Sola Schematics without deviation. All wires terminated from external devices shall be wired directly to the pull-out electrical panel and any junctions clearly labeled.

2.6.6. Each boiler must have most common lock-out code chart & cause / check points adhered to the internal boiler casing for simplified serviceability

2.6.7. Commissioning setpoints is the responsibility of the installer. The display shall be highlighted in yellow when these settings need to be reconsidered. A yellow highlight will describe the parameter that is not achieved in the time allocated such as temperature, fan RPM or other load-based factors to allow for system tuning.

2.6.8. Accessory programming and terminals shall include space heating pump(s), isolation valve, start permissive interlock, boiler primary pump, DHW pump

2.6.9. Electrical power shall be provided by a single source to the boiler and disconnect switch. The boiler shall have an internal junction box containing the control transformer when

required to provide the 120 VAC for the control circuits and 24 vac for the low voltage devices.

2.7. **BUILDING AUTOMATION**

2.7.1. The boiler control must be able to communicate to a Modbus network cascading up to 8 boilers connected to one Master, seven Slaves, staged, rotated and modulated as a single boiler plant.

2.7.2. Boiler control(s) shall monitor outdoor temperature, supply water temperature, return water temperature, and shall communicate between boilers via RS-485 (serial) communication network.

2.7.3. The boilers shall be able to communicate to a building management system as either stand-alone boiler(s) or be programmed using a single master to communicate with the cascaded slaves. The boilers shall be able to run autonomously as stand-alone or cascaded to preset or outdoor reset temperature. A local remote switch shall be provided on boilers as an option at time of ordering

2.7.4. If BACnet is preferred a conversion module shall be made available from the boiler manufacturer as an option with a minimum preset nodes for either the master or the individual stand-alone boilers.

2.8. **DELIVERY, STORAGE, HANDLING AND INSTALLATION**

2.8.1. Installation of the boilers shall be by the Division 15 Contractor. Field electrical work shall be by Division 16. Control and automation work shall be coordinated by Division 25.

2.8.2. The manufacturer's field service representative shall approve installation and shall be present to supervise start up, commissioning and to instruct operators; all activities will be organized on different dates at owner's discretion.

2.8.3. The boiler pressure vessel shall be warranted against damage for a period of 5 years from the date of shipment, provided the boiler is operated and maintained in accordance with the conditions specified in the Owner's Operating and Maintenance Manual.

2.8.4. Receive equipment and add-ons in the packaging provided by the Factory. Check for any signs of damage. Ensure the boiler is kept in horizontal position from time of delivery to final installation.

2.8.5. During storage, all equipment should be shielded from outside factors such as wet or freezing weather conditions, construction work at the job site. Protect the equipment from harm by keeping the packaging intact until it's put into use.

2.8.6. Ensure the water meets the manufacturer's specified quality standards by providing the necessary water treatment.

2.9. **START UP**

2.9.1. Manufacturer's representative to provide maintenance and operating instructions to the installing contractor with a detailed start up procedure for review and approval two months prior to start-up.

2.10. **COMMISSIONING**

2.10.1. The commissioning agent will be provided with factory start-up reports and procedures to return to the factory for review. The manufacturer's representative will ensure the warranty is activated and communicate this to the owner with terms and conditions.

2.11. **TRAINING**

2.11.1. The Manufacturer's Representative shall be responsible for providing on-site training to the Owner's representatives for daily inspections, weekly inspections, monthly and annual service.

2.11.2. Training available to include full review of all components including but not limited to a full boiler internal inspection, construction details, burner operation, maintenance, flame characteristics, and adjustments, gas train maintenance, boiler normal operation, abnormal events, normal shut-down, emergency shut-down and setting up controls.

2.12. **WARRANTY**

2.12.1. The boiler manufacturer must warrant each boiler, including boiler, trim, boiler control system, and all related components, accessories, to be free of defects in material and workmanship for a period of twelve (12) months from date of shipping invoice date.

2.12.2. The boiler manufacturer must warrant the boiler's pre-mix burner head for a period of two (2) years from installation date, or two (2) years plus three (3) months from shipping invoice date.

2.12.3. The boiler manufacturer must warrant the boiler's stainless steel heat exchanger to be free of defects in material and workmanship and against failure due to thermal shock for a period of five (5) years from the installation date, or five (5) years plus three (3) months from shipping invoice date.

2.13. **ACCEPTANCE**

2.13.1. The Manufacturer shall demonstrate the full range of controls, operating functions and compliance with performance criteria.

2.13.2. The commissioning report shall be approved by the Owner or Owner's representative or Engineer of record prior to the turnover of the hot water boiler(s) to the Owner.

2.13.3. Following completion of the boiler(s) commissioning a copy of the documents must be supplied for the Owner's record files, installing contractor and Engineer of record to initiate warranty period.

2.13.4. The Owner/Consultant shall accept the requirement if the field and factory run performance test procedures and results are in conformance with ASME and local governing authority standards. If the equipment fails to perform within allowable tolerances, the manufacturer shall be responsible to make the necessary revisions to the equipment and retest as required until conformance is achieved.

PART 3 - EXECUTION

3.1. GENERAL

3.1.1. Installation shall be performed by the contractor in accordance with the requirements of the applicable codes. Contractor shall review the boiler and installation for compliance with requirements and/or issues that may affect boiler performance. Installation should not proceed until unsatisfactory conditions have been corrected.

3.1.2. Conform strictly with the manufacturer's recommended clearances and with the TSSA requirements for gas fired appliances.

3.1.3. Given the restricted access into the mechanical room, the contractor may chose to have the boilers delivered in separate sections, ready for site assembly. In such instance, all labor required for the site assembly of the boilers shall be included in the tender price, together with the cost of having the manufacturer's certified technicians inspect the site assembled boilers and certify that the work was done in accordance with the manufacturer's standards.

3.1.4. The contractor shall mount the equipment as described below:

3.1.4.1. Install boilers on cast-in-place concrete equipment base in compliance with the requirements for equipment bases in accordance with requirements of section 23 05 11

3.1.4.2. Install vibration isolation devices in compliance as specified in section Section 23 05 51

3.1.4.3. The contractor shall install gas-fired boilers in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada).

3.1.5. The contractor shall install gas-fired boilers in accordance with all requirements of local authorities having jurisdiction.

3.1.6. The contractor shall assemble and install any external boiler safety/trim devices.

3.1.7. The contractor shall install any electrical devices furnished with the boiler, but not specified to be factory-mounted and so required for the normal operation of the boiler.

3.1.8. Manufacturer's recommendations for clearances shall be strictly adhered to for boilers, gas trains and burners. Arrange piping as to provide adequate clearance for service and operation. In particular, ensure that the gas train assembly does not interfere with the clearances required for boiler and burner maintenance work. If such interference is substantiated by the Board Operations staff, modify the gas train configuration at no cost to the Board.

3.1.9. Vent all components of the gas trains to the atmosphere in accordance with the Gas Code and TSSA regulations; paint all gas vents yellow and terminate with insect screens as required by TSSA regulations; maintain clearances from intakes and building elements as per TSSA requirements.

3.1.10. Pipe safety relief valves and drain valves to floor drain (except where system contains glycol, in which case drain back to the glycol storage tank). Install thermometers and pressure gauges on supply and return piping no higher than 6 ft above floor. Install relief valve sized to suit boiler input and located upstream of any shut-off valve.

3.1.11. Install temperature and pressure sensors in accordance with the manufacturer's recommendations, to ensure correct readings. Coordinate with the Consultant exact location of sensors, prior to actual installation. No additional sums will be paid for failure to install the sensors where directed by the consultant.

3.1.12. Conform to manufacturer's installation instructions and piping schematic on drawings. Extend each gas pressure relief (full size) to the outside and terminate with gooseneck and screen.

3.1.13. Upon notification of completion of the installation, boiler manufacturer shall furnish the services of a field technician, to start up the boilers, adjust the burners, adjust the venting and provide combustion tests over the operating range and issue report to the Consultant indicating system acceptance as installed. The documentation shall be included in the Operations and Maintenance Manual. Also refer to section 23 51 00.

3.1.14. The manufacturer's start-up documentation shall include the confirmation that the installation and clearances are in accordance with the equipment instructions and installation manuals.

3.1.15. The manufacturer's qualified representatives shall inspect the venting system and shall supply/install draft control devices if so required by the local configuration of the building, and shall cooperate with draft inducer manufacturer in preparing the necessary documentation for the approval of the Authorities Having Jurisdiction, including TSSA,. There will be no additional charge to the Board for this operation

3.1.16. The contractor shall install all control wiring to field mounted electrical devices in accordance with NFPA 70 and all applicable codes. Connect boilers to BAS and provide sensors, relays and other devices as required to achieve the sequences indicated on the drawings.

3.1.17. The contractor shall install electrical (power) wiring to the boiler in accordance with the requirements of Canadian Electrical safety Code and NFPA 70. Supply and install all new wiring, disconnects, fuses, and emergency shut-off switches as required to make the burners fully operational and as indicated on the drawings. All new wiring to be in conduit except as described in Section 20 05 49.

3.1.18. Boilers:

3.1.18.1. Prior to ordering the boilers, the Mechanical Contractor shall examine the available clearances and access in the mechanical room. If necessary, the Mechanical Contractor shall order the boilers to be delivered in separate sections, suitable for site installation. If required, the burner shall be delivered separately, for installation on site.

3.1.18.2. Should the Mechanical Contractor choose the site assembly of the boilers/burners, the manufacturer's qualified representative shall certify the final assembly work.

3.1.19. Install boilers level and plumb on concrete pad. Arrange piping as to provide adequate clearance for service and operation. Pipe safety relief valves and drain valves to floor drain. Install thermometers and pressure gauges on supply and return piping no higher than 1800 mm above floor. Install relief valve sized to suit boiler input and located upstream of any shut-off valve. Conform to manufacturers installation instructions and piping schematic on drawings. Extend each gas pressure relief (full size) through roof and terminate with gooseneck and screen (where required).

3.1.20. Provide wiring between boiler controls mounted in piping, boiler control panel, and burner control panel.

3.1.21. Upon notification of completion of the installation, APPLIED ENERGY SYSTEMS shall furnish the services of a field technician, to start the boiler and provide combustion tests over the operating range and issue report to the Consultant indicating system acceptance as installed.

3.2. BOIL OUT OF NEW BOILERS

3.2.1. Provide softened water for boiling out new boilers.

3.2.2. Provide chemicals and labour for boiling out new boilers.

3.2.3. Boil out each new boiler with an alkaline boil out compound containing an embrittlement inhibitor.

3.2.4. Operate each boiler at sufficient pressure (30% - 50% of operating pressure) to ensure good temperature elevation and good circulation. Provide a temporary line to atmosphere to enable a "false load" to be imposed on the boiler.

3.2.5. The boil out period shall be of not less than 48 hours duration, or until all contaminants have been removed.

3.2.6. The method of boiling out shall not conflict with the boiler manufacturer's standard boil out instructions.

3.2.7. At the conclusion of the boil out, the boiler shall be cooled down and de-concentrated by alternately "blowing down" and "making up" with softened water.

3.2.8. When the boiler water alkalinity has been reduced to that of the makeup water, the boiler pressure shall be relieved, and the boiler drained and flushed immediately with treated water.

3.3. **TSSA INSPECTION OF THE COMPLETED HEATING PLANT**

3.3.1. Apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the work will take place, including TSSA and ESA. Have the work inspected and certified by PV [Boilers and Pressure Vessels Reg], OE [Operating Engineers Reg.] and FS [Fuel Safety Reg.] branches of TSSA. At the end of the work, the new plant shall be fully TSSA certified by all branches noted herein.

END OF SECTION

1. GENERAL

1.1. Air Handling Units shall be built to the level of quality as herein specified and to the description of the Air Handling Unit Schedule.

1.2. Substitution of any product other than that specified, must ensure no deviation below the stated capacities, air flow rate, heat transfer rate, filtration efficiency and air mixing quality. Power requirements must not be exceeded, and where specifically defined, sound power levels must not be exceeded. Applications for "equal" or "alternate" must address these factors.

1.3. Unless stated otherwise, air-handling units are to be shipped to the job in one piece, factory assembled. Modular units assembled to achieve a close proximation to the intent of this specification will not be considered equal. All equipment shall where specified and applicable, be pre-wired, and factory certified by an approved testing agency such as $_{C}$ETL, ETL$_{US}$, UL, CSA prior to shipment.

1.4. Pre-wired air handling units shall bear an approved label with all the necessary identification marks, electrical data.

1.4.1 Unit must conform to regulations set out in the Canadian Energy Efficiency Act for large air conditioners (condensing units). Packaged units shall be tested to CSA Standard C746-98 and must bear an EEV (energy efficiency verification) label provided by CSA.

"Where specified as factory packaged air conditioning unit, factory assembled split systems do not conform to the Canadian Energy Efficiency Act and will not be considered."

1.5. All electrical circuits shall undergo a dielectric strength test, and shall be factory tested and checked as to proper function.

1.6. The air handling units and major components shall be products of manufacturers regularly engaged in the production of such equipment and with a minimum of twenty continuous years of proven production experience.

1.7. Air Handling Units shall be as manufactured by Engineered Air and be base bid. Alternate products must show savings and clearly indicate all areas where they do not meet specified product. Alternate manufacturers shall submit full performance data and shop drawings eight days prior to tender for full review before they can bid on the project. No alternate manufacturer will be entertained after tender closing unless approved by the Owner.

2. UNIT CONSTRUCTION

.1 Unit casing shall be of minimum 18 gauge (1.3mm) satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two-part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.

.2 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and on all outdoor units roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.

.3 The following components shall be provided with a 22 gauge (.85mm) solid, or 24 gauge (.70mm) perforated (40% free area) galvanized metal liner over insulated areas:

	Solid Liner	Perf. Liner
- Fan Sections	___	_X__
- Coil Sections	_X__	___
- Filter Sections	_X__	___
- Access Sections	_X_	___
- Mixed Air Sections	_X_	___
- Underside of Unit(where visible)	_X__	___

.4 Units shall be provided with access doors to the following components: fans and motors, filters, dampers and operators, access plenums and humidifiers/wet cells, electrical control panels, burner compressor compartments. Access doors shall be large enough for easy access. Removal of screwed wall panels will not be acceptable.

.5 Units shall be provided with hinged access doors, with e-profile gasket, fully lined, and a minimum of two lever handles, operable from both sides for all units.

hinged access doors open outwards on all sections for outdoors units. Doors located on sections with positive pressure shall have a clear warning label and a safety device must be affixed.

whenever possible, hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. Where space constrictions require the use of outward opening doors to an area of positive pressure, a clear warning label and safety chain must be affixed.

hinged access doors shall be provided with tie back clips.

.6 All units shall be internally insulated with 2"(51mm) thick 1 1/2 lb./cu.ft. (24 kg./cu.m.) density insulation.

.7 1 1/2 lb./cu.ft. (24 kg/cu.m.)insulation shall be secured to metal panels with a fire retardant adhesive and welded steel pins at 16" (400mm) o/c.All longitudinal insulation

joints and butt ends shall be covered by a sheet metal break to prevent erosion of exposed edges. Drain pans and all floor areas shall be insulated on the underside.

.8 Unit casing floors shall be the same as unit walls and unit shall have reinforcing channels under floor to minimize deflection.

.9 Cooling coil drain pans shall be fabricated of stainless steel and are an integral part of the floor paneling, a minimum of 2" (51mm) deep, with welded corners. Drain pans shall extend a minimum of 6" (152mm) downstream of coil face and be provided with a 1 ½" (38mm) S.S. M.P.T. drain connection. Drain pans must have a fast pan and be sloped and pitched such that there is no standing water. Intermediate fast pans shall be provided between cooling coils where required for effective moisture removal.

.10 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include generally for the prevention of infiltration of rain and snow into the unit, louvers or hoods on air intakes and exhaust openings with 1"(25mm) galvanized inlet screens; rain gutters or diverters over all access doors; all joints caulked with a water resistant sealant; roof joints turned up 2" (51mm) with three break interlocking design; outer wall panels extend a minimum of ¼"(6mm) below the floor panel; drain trap(s) connections for field supply and installation of drain traps.

Units mounted on roof curbs incorporate welded floor to base construction. Floors are of three break upstanding design with welded corners and free of penetrations. Unit underside joints are caulked.

.11 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of 18" (457mm) high, and complete with wood nailer, neoprene sealing strip, and fully welded "Z" bar with 1" (25mm) upturn on inner perimeter, to provide a complete seal against the elements. External insulation and flashing of the roof-mounting curb shall be provided by the Roofing Subcontractor.

3. FANS

.1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20% below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.

.2 All fans assemblies shall be equipped with greaseable pillow block bearings, supported on a rigid structural steel frame.

.3 Drives shall be adjustable on fans with motors 7 1/2 HP (5.6 kW) or smaller. On fans with larger motors, fixed drives shall be provided. All drives shall be provided with a rust inhibiting coating. The air balancer shall provide for drive changes (if required) during the air balance procedure.

.4 Provide full section return air fan(s) as scheduled. The use of power exhaust propeller or centrifugal fan arrangements will not be acceptable.

.5 Provide variable air volume fan control for units via Adjustable frequency drive shall be mounted in a NEMA 1 enclosure and shall be labeled by an approved testing agency such as UL. VFD shall be housed in a factory installed large cabinet with venting to allow proper ventilation.

Sine wave carrier input, PWM output. IGBT transistors. Adjustable acceleration and deceleration timing.

Keypad to be removable, with alphanumeric display able to provide output status monitoring, output frequency, output voltage, output RPM, and output current. Include fault log display with capacity for the recent 30 faults with a time stamp. Diagnostic display menus to include reference speed command, heat sink temp, bus voltage, active I/O command status, time from power up, and current setting.

Unit mounted manual VFD bypass switch locks out VFD, fan runs on maximum set volume. Bypass switch and all interlock contacts are factory mounted and pre-wired.

Line and load reactors required for all 460 and 575 volt applications.

Drive shall be factory supplied and installed

Minimum CFM of 40% on DX, gas fired heat exchangers, and electric heat systems.

Provide standard OSHA compliant belt guards on all units with walk in sections over 60" (1524 mm) high.

.6 Fan-motor assemblies shall be provided with vibration isolators. Isolators shall be bolted to steel channel welded to unit floor, which is welded to the structural frame of the unit. All fans Motor assemblies shall incorporate vertical spring type isolators with leveling bolts, bridge bearing waffled pads with minimum 1" (25mm) static deflection designed to achieve high isolation efficiency. Use of separate bumper or snubber is not acceptable. Fans shall be attached to the discharge panel by a polyvinyl chloride coated polyester woven fabric, with a sealed double locking fabric to metal connection.

.7 Provide single extended grease line from far side to access side bearing.

.8 Fan motors shall be TEFC Super-E high efficiency type with minimum of three year warranty.

4. COILS

.1 Coils shall be 5/8" O.D. and/or 1/2" O.D. as manufactured by Engineered Air, constructed of Copper tube, aluminum fin, and copper headers with schedule 40 steel pipe connectors.

.2 Fins constructed of aluminum or copper shall be rippled for maximum heat transfer and shall be mechanically bonded to the tubes by mechanical expansion of the tubes. The coils shall have a galvanized steel casing. All coils shall be factory tested with air at 300 psig (2070 kPa) while immersed in an illuminated water tank.

.3 Headers shall be outside the air tunnel and inside of enclosed section for maximum serviceability and all piping shall be fully concealed Provide auxiliary drain pan complete with ½" (13mm) MPT drain connection at headered end of cooling coils.

.4 Coils shall be removable from the unit at the header end, unless shown otherwise on the drawings.

.5 Refrigerant evaporator type coils shall be equipped with distributors connected to the coil by copper tubes. Where a hot gas bypass is required, the inlet shall be at the refrigerant distributor. Solenoid valves, expansion valves, and related accessories are to be provided and installed by the refrigeration contractor.

.6 Refrigerant coils with multiple compressors shall be alternate tube circuited in order to distribute the cooling effect over the entire coil face at reduced load conditions. Provision for use of thermal expansion valves must be included for variable air volume and/or make-up air applications.

5. GAS HEAT SECTION (DJE , DJS, DJX) - Indirect Fired

General

.1 Heating units shall be indirect natural gas fired approved for both sea level and high altitude areas. The entire package, including damper controls, fan controls, and all other miscellaneous controls and accessories shall be approved by an independent testing authority and carry the approval label of that authority as a complete operating package.

All units must exceed the ASHRAE 90.1 requirement of steady state efficiency at low fire operation.

.1 Operating natural gas pressure at unit(s) manifold shall be 7"w.c.(1750 Pa)

.2 Gas fired units shall be approved for operation in -20°F. Packaged controls to allow operation below -20°Fthat shutdown at -20°F(-40°C) by control package is not acceptable.

.2 Heat Exchanger/Burner Assembly

.1 Heat exchanger shall be a primary drum and multi-tube secondary assembly constructed of titanium stainless steel with multi-plane metal turbulators and shall be of a floating stress relieved design. Heat exchanger shall be provided with condensate drain connection. The heat exchanger casing shall have 1"(25mm) of insulation between the outer cabinet and inner heat reflective galvanized steel liner. Blower location shall be engineered to improve the

required air flow pattern around the heat exchanger. Using duct type furnaces and closed coupled blowers are not acceptable.

.2 Units with optional high efficiency heat exchangers shall be tested and certified to ANSI/CSA standards to provide a minimum of 80%, efficiency throughout the entire operating range as required by ASHRAE 90.1. The manufacturer shall be routinely engaged in the manufacture of this type of high efficiency equipment.

.3 The heat exchanger/burner assembly shall be a blow through positive pressure type. Units incorporating the DJM module shall have an interrupted pilot ignition system to provide increased safety. Units using continuous or intermittent pilots are not acceptable.

.4 Flame surveillance shall be from the main flame after ignition not the pilot flame. The burner and gas train shall be in a cabinet enclosure. Atmospheric burners or burners requiring power assisted venting are not acceptable.

.5 The heat exchanger/burner assembly shall include 15:1 turndown for all input ranges. The high turn down heat exchanger/burner assembly minimum input shall be capable of controlling 6.7% of its rated input, excluding the pilot assembly, without on/off cycling and include built in electronic linearization of fuel and combustion air. Efficiency shall increase from high to low fire.

.3 Factory testing of indirect fired gas heating section.

.1 The minimum test requirements on all cabinet / fan size / fan type / fan orientation / heat exchanger / outlet configuration combinations previously built are listed below.

.1 Tests shall be performed after complete final unit assembly, just prior to shipping to job site. The tests shall be performed in accordance with the equipment standard that the gas heating section is certified.

.1 Heat exchanger shall be clocked with a dedicated calibrated gas meter to insure proper set up of the gas manifold.

.2 High and Low input flue gas combustion analysis using a calibrated combustion analyzer including O_2 and CO to provide proper air fuel ratio throughout the entire operating range.

.3 A copy of the combustion test report shall be provided.

.2 Any previously untested combination of cabinet / fan size / fan type / fan orientation / heat exchanger / outlet orientation and all duct furnaces shall have the following additional tests performed.

.1 Any single component or size or type or orientation change requires these tests. The tests shall be performed with standard factory temperature air, not design temperature air, through the unit as an additional heat exchanger safety factor.

.1 Heat Exchanger airflow pattern shall be tested to ensure uniform airflow across all parts of the heat exchanger.

.2 Once the equilibrium operating temperatures have been reached, the heat exchanger temperatures shall be checked to insure that all surfaces are below 1075°F (579.4°C). Temperatures above this can lead to premature heat exchanger failure.

.3 Flue gas temperature and combustion analysis shall be performed. The heat exchanger efficiency shall be analyzed and must meet current requirements.

.4 High limit operational check shall be performed to ensure proper function at all normal airflows including loaded filters.

.5 If the unit is capable of or intended to operate at varying air flows, all of the above tests must be performed at high flow and low flow.

.6 A copy of the test report shall be provided.

.3 Venting

.1 DJE and DJS venting is to be provided by the installing contractor using materials approved for outdoors. Installation and venting provisions must be in accordance with CAN/CSA Standard B149.1, ANSI Z223.1-NFPA54 and local authorities having jurisdiction. Where flue requirements exceed 6" (150 mm) above the unit casing height, it is the installing contractor's responsibility to provide and install venting including all structural-supporting requirements. Support is to be independent of the unit.

.2 Standard outdoor shall be provided with stainless steel flue extension.

.4 Controls

.1 Electronic DJM module (Modulating Fuel w/ Modulating Combustion Air) complete with proportional and integral control with discharge air sensor to maintain set point temperature and provide rapid response to incremental changes in discharge air temperature. Combustion air motor speed varies proportionally in response to the modulation of gas flow to provide optimum fuel/air mixture and efficiency at all conditions. Combustion blower RPM shall be proved using a hall effect speed sensor. Two speed or step speed combustion blowers are not acceptable.

.2 Combustion efficiency of high efficiency heat exchangers shall increase by up to 1-3% from high fire to low fire while turning down on units incorporating 15:1 turndown (HT Burner). Heat exchangers shall provide a minimum of 80% efficiency throughout the entire operating range.

.3 Alternate manufacturers units that do not incorporate a variable speed combustion air blower shall have a modulating gas valve and a combustion air damper with a linear linkage connected to an actuator which has a minimum of 100 steps of control.

.4 Controllers for heating only units incorporating the DJM3 module shall include the following standard features:

.1 Service analyzer with diagnostic lights for ease of set-up and service linear gas and combustion air flow obtained via a built in solid-state linear algorithm
.2 -40°F(-40°C) minimum operating ambient temperature
.3 four air change pre-purge on units with over 400MBH(117kW) input
.4 maintained purge to decrease temperature cycles
.5 post purge
.6 interrupted pilot
.7 self check on start-up to make sure air proving and discharge air sensors are operating within design tolerances
.8 low fire start
.9 controlled burner start-up and shut down
.10 blower contactor that starts fan after burner prepurge
.11 economizer enable control
.12 damper contact that allows fan to start after damper opens, damper to close after fan stops, and damper to close on flame failure
.13 non-recycling auto by-pass low limit with alarm contacts and built-in sensor checking
.14 built-in alternate blower and damper functions and set back temperatures for unoccupied mode operation using a single room thermostat
.15 separate gas and air actuators independently controlled to give the correct air to fuel ratio though out the entire firing range.

.5 Heating control function shall be modulating discharge air complete with sensor and integral selector.

.6 Controllers for heating only units to incorporate low limit feature.

.7 Discharge air sensor shall be field mounted in supply ductwork by installing contractor.

.8 The Manufacturer shall provide all controls and modules and provide all points as required to connect to TDSB's BAS System

6. FILTERS

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side as noted on the drawings.

.2 For units with filter banks up to 72" (1825mm) high, the filter modules shall be designed to slide out of the unit. Side removal filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.

.3 2"(50mm) Pleated Panel Disposable Filters: An optimum blend of natural and synthetic fiber media with a rust resistant support grid and high-wet strength beverage board enclosing frame with diagonal support members bonded to the air entering and air exiting

side of each pleat. Provide permanent re-usable metal enclosing frame. The filter media shall have a minimum efficiency of 30-35% on ASHRAE Standard 52.1-92, and a minimum of MERV 13 per ASHRAE 52.2. Rated U.L. Class 2.

.4 Provide filter bank with "Dwyer 2000 magnehelic" air filter gauge complete with static pressure tips and aluminum tubing all factory installed. Filter gauge to have a range of 0 to 1" (0-250 Pa).

.5 Where the filter gauges are provided on outdoor units they shall be mounted inside of a weatherproof enclosure with viewing window.

7. DAMPERS

.1 Damper frames shall be made Extruded aluminum airfoil type low leak airfoil Tamco Series 1000.

.2 Mixing dampers shall be parallel blade type.

.3 Gravity relief dampers shall be single blade gasketted design.

.4 Mixing Box Controls shall provide a modulating normally closed damper operator controlled from an adjustable modulating mixed air temperature controller integral to CTRAC controller with an adjustable minimum outside air positioning potentiometer. Provide an adjustable high ambient set back thermostat, temperature controller, and relay to return the outside air damper to the minimum setting when the outdoor ambient temperature rises above 59°F(15°C).

8. MECHANICAL COOLING

.1 Compressors shall be hermetic type, 3600 RPM, set on resilient neoprene mounts and complete with live voltage break internal overload protection and internal pressure relief valve. External crankcase heaters locked out during compressor operation.

.2 Air Cooled Condenser

.1 Condenser coils shall be copper tube type, mechanically expanded into aluminum fins. Coils shall be factory tested with air at 300 psig (2070 kPa) while immersed in an illuminated water tank.

.2 Condenser fans shall be direct driven propeller type arranged for vertical draw through airflow. Motors shall be weather resistant type, with integral overload protection and designed for vertical shaft condenser fan applications. Fan and motor assemblies shall be mounted on a formed orifice plate for optimum efficiency with minimum noise level.

.3 Condenser fan shall be fully housed fan with protective screen and fluted blades for optimum efficiency with minimum noise level.

.4 Condenser to form an integral part of the unit.

.3 Packaged Air Conditioning Units

.1 Packaged units shall be CETL, ETLUS approved and operate down to 50°F(10°C) as standard. Where applicable, multiple refrigeration circuits shall be separate from each other. Refrigeration circuits shall be complete with liquid line filter-driers, and service ports fitted with Schraeder fittings. Units with over 6 Ton hermetic compressors and all units with semi-hermetic compressors shall also incorporate load compensated thermal expansion valves with external equalizers and combination sight glass moisture indicators. units shall have condensers designed for 15°F (8°C) liquid sub-cooling and be equipped with suction line filters and liquid line manual shutoff valves. The complete piping system shall be purged and pressure tested with dry nitrogen, then tested again under vacuum. Each system shall be factory run and adjusted prior to shipment.

.2 Packaged units shall be supplied with R-410 refrigerant.

.3 Controls for hermetic compressor units shall include compressor and condenser fan motor contactors, supply fan contactors and overload protection, control circuit transformer, cooling relays, ambient compressor lockout, automatic reset low pressure controls, and manual reset high pressure controls on compressors over 6 tons. Head pressure actuated fan cycling control shall be provided on all multiple condenser fan units.

.4 Provide five minute anti-cycle timers.

.5 Provide inter-stage time delay timers.

.6 Provide hot gas bypass on the lead compressor to maintain adequate suction pressure in the event of low loads. This feature shall be provided on all VAV applications with less than four stages of cooling control.

.7 Compressors shall be located on the side of the unit in a service enclosure complete with hinged access doors c/w leverlok handles for ease of service and non-interrupting unit operation

.8 Units to have a minimum of 3 compressors.

.9 Provide low ambient controls for 59 °F (14 °C) operation.

.10 Provide optional compressor service valves for packaged units incorporating hermetic compressors.

.4 Cooling Control

.1 C-TRAC3 Controller

.1 The controller shall automatically start in heating, economizer, or cooling mode based on continuously monitored ambient temperature and load requirements.

.2 The controller shall include an adjustable low limit set point for freeze protection to cease equipment operation in the event of low discharge temperature. If the discharge air temperature falls below the adjusted set point, the blowers will shut down and the outside air dampers shall close. The low limit bypass timer shall vary automatically depending on the thermal coefficient of the style of heat exchanger.

.3 If the discharge air temperature approaches the low limit set point, the controller shall automatically reduce the economizer minimum fresh air down to half of its original setting to compensate.

.4 As the ambient temperature falls, the C-TRAC3 controller shall automatically compensate for outside air thermal expansion by proportionally reducing the amount of outside air.

.5 Mechanical cooling shall be disabled below an adjustable low ambient temperature set point.

.6 The cooling function shall be disabled by a remote binary input contact.

.7 The controller may initiate the economizer mode on an initial call for cooling with an adjustable minimum fresh air setting.

.5 (Heating Controls)

Heating shall be disabled above an adjustable ambient temperature set point.

The minimum heater protection when using the DJM module as a secondary controller shall be a high temperature limit switch, an induced draft motor speed sensor, flame proving controls.

The C-TRAC3 shall continuously monitor the pilot valve and flame relay operation.

.1 The controller shall attempt up to 3 ignition attempts in the event of loss of flame signal before disabling equipment operation.

.2 Volume compensation (VAV)
The controller shall automatically increase the minimum position of the outside air dampers to compensate for the required minimum volume of fresh air as the VAV (Variable Air Volume) system reduces the total volume of air. The economizer function shall be disabled to minimum position if the ambient temperature rises above a predetermined set point.

.3 Variable air volume (load shedding)
the C-TRAC3 shall automatically compensate the internal control algorithms when a change in air volume from the supply blower variable frequency drive occurs for improved temperature control.

9. FACTORY SUPPLIED CONTROLS/WIRING

.1 Provide a system of motor control, including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, control transformers, auxiliary contactors and terminals for the connection of external control devices or relays.

.2 Gas fired units shall also include high limit and combustion airflow switch.

.3 Fire alarm circuits (where required) shall be powered from a relay in unit circuitry.

.4 Factory installed and wired non-fused disconnect switch in CEMA/NEMA 3 weatherproof configuration.

.5 Rooftop unit shall come with a service receptacle mounted on the Unit. Wiring by Electrical.

.6 Automatic controls shall be housed in a control panel mounted in or on the air handling unit, which will meet that standard of the specific installation.

.7 The unit is intended to be controlled by the School's existing Building Automation System. The unit shall come complete with all hardware, software and components necessary to interface with the School's BAS System and in full compliance with the Toronto District School Board's Controls Standards and Sequences. Consultant with TDSB's Controls Group and Controls Contractor at the time of Shop Drawing preparation and prior to manufacturing to ensure that the unit is properly manufactured to work with the School's BAS System. BACNet control points or functionality will not be permitted whatsoever. Refer to Controls Sequences for the full extent of control and sequences for the units. The unit shall come shipped with ready-to-go controls points to meet the desired control points and sequences. Any site modifications to the existing unit to bring it to compliance with TDSB's Standards and requirements will be responsibility of the Unit Manufacturer in the event of miscoordination or inadequate coordination.

10. QDT HEAT PIPE WITH INTEGRATED TILT PACKAGE (ITP):

.1 Provide an air-to-air heat pipe exchanger with performance as shown in the schedule, to be QDT as manufactured and supplied by Engineered Air. Alternative heat pipe manufacturers shall provide at the Engineer's request, samples of tubes with the internal wick before and after expansion of the tubes.

.2 Heat exchanger core shall be of 5/8" (16 mm) or 1" (25 mm) as required, seamless aluminum tubing permanently expanded into fins. Each tube shall be an individually sealed heat pipe filled with a working fluid conforming to Group 1 in the American National Standard Safety Code for Mechanical Refrigeration. Tubes shall include flow separators

whenever vapour and condensate streams interact limiting the heat transfer capacity of the pipe.

.3 The secondary surface shall be continuous plate aluminum fins of corrugated design to produce maximum heat transfer efficiency. Spiral fins are not acceptable.

.4 The capillary wick of each heat pipe shall be an integral part of the inner wall of the tube to provide a completely wetted surface for maximum heat pipe capacity, with minimum heat transfer resistance. Heat pipes manufactured without capillary wick or where the wick is not acceptable to the Engineer shall have a minimum of 20% additional rows than that shown in the schedule. Where additional rows are provided, the heat pipe shall be increased in face area to provide a pressure drop equal or less than that shown in the schedule.

.5 Optional double (hospital) partition with one inch (25 mm) dead air space shall be provided to isolate the exhaust and supply air streams and prevent cross contamination. Tubes shall be mechanically expanded into the tube sheet for a tight seal. Heat pipes manufactured without single piece tube sheets or with tubes that are not mechanically expanded into the tube sheet, shall have the one inch space completely filled with sealant approved by the Engineer.

.6 The TRU shall be mounted on a cradle with accompanying linkage, fulcrum, control actuator and Q-TRAC solid state dedicated operating controller. These will effectively tilt the unit to achieve the following:

- Accurate supply air temperature control
- Summer/Winter operation changeover
- Frost prevention on the exhaust leaving side of the TRU

In conditions when the exhaust air could provide more heat than is required, the tilt angle of the heat pipe is varied by the Q-TRAC to limit heat transfer and maintain supply air set point.

When the exhaust temperature is below the supply air setpoint, the tilt angle is reversed in order to cause heat transfer from supply air to exhaust air and pre-cool the supply air.

When outside air is cold enough to extract heat from the exhaust air to the point where frost will form on the exhaust side of the heat pipe, the Q-TRAC will reduce the tilt angle to limit heat transfer and keep the exhaust air above the frost threshold.
Enhanced Recovery (recommended option): Maximum heat recovery is obtained by first allowing frost to form on the exhaust side of the coil and using a pressure differential switch to sense when the frost forms. Just prior to frost forming maximum heat recovery occurs. When frost is detected the frost control setpoint is reset upwards, and the heat pipe is sent to defrost mode. Recovery is still achieved but at a lower level until the heat pipe is clear of frost.

.7 Vinyl coated flexible connectors shall be installed to permit the necessary tilting movement of the reclaim coil. Provide three (3) flex connectors, one for each face of the heat pipe exchanger except the exhaust leaving face. Provide four (4) flex connectors, one for each face of the heat pipe exchanger on applications where the exhaust is blow through.

The flex material to weigh a minimum of ± 13 ½ ounces per square yard with a flexible operating range of -65°F to 150°F. The fabric to be polyester (BHT) with polyvinyl chloride coating that contains an anti-fungal, anti-bacterial treatment. Flex material to be resistant to abrasion, weathering, oil and other hydrocarbons.

Tilt mechanism to incorporate a low friction pivoting base with self aligning ball or roller bearings.

.8 Face and Bypass Damper for heating only recovery without tilting package IS NOT ACCEPTABLE.

END OF SECTION

1. GENERAL

1. QUALITY ASSURANCE
    1. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with current AHRI Standard 410.
    2. Air Handling Units shall be rated in accordance with AHRI Standard 430 for airflow, static pressure, and fan speed performance.

2. SUBMITTALS
    1. No equipment shall be fabricated or delivered until the receipt of approved shop drawings from the Owner or Owner's approved representative.
    2. The AHU manufacturer shall provide appropriate sets of submittals as referenced in the General Conditions and shall submit to the Owner electronic copies of the IOM.
    3. The AHU manufacturer shall list any exceptions to the specification.

3. REGULATORY REQUIREMENTS
    1. Agency Listings/Certifications
        1. 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. In the event the unit is not UL/CUL or ETL approved, the contractor shall, at his/her expense, provide for a field inspection by a UL/CUL or ETL representative to verify conformance. If necessary, contractor shall perform modifications to the unit to comply with UL/CUL or ETL as directed by the representative, at no additional expense to the owner.
        2. Certify air handling units in accordance with AHRI Standard 430. Units shall be provided with certification label affixed to the unit. If air handling units are not certified or fans are not rated in accordance with AHRI Standard 430 contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
        3. Certify air handling coils in accordance with AHRI Standard 410. Units shall be provided with certification label affixed to the unit. If air handling coils are not certified in accordance with AHRI Standard 410, contractor shall be responsible for expenses associated with testing of coils after installation to verify performance of coil(s). Any costs incurred to adjust coils to meet scheduled capacities shall be the sole responsibility of the contractor.

4. DELIVERY, STORAGE, AND HANDLING
    1. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
    2. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Shipping splits shall be clearly defined on submittal drawings. Cost associated with non-

conformance to shop drawings shall be the responsibility of the manufacturer. Each section shall have lifting lugs for field rigging, lifting and final placement of AHU section(s). AHU's less than 100-inches wide shall allow for forklift transport and maneuverability on the jobsite.

3. Unit shall be stretch or shrink wrapped to protect unit from in-transit rain and debris per ASHRAE 62.1 recommendations.
4. Installing contractor shall be responsible for storing AHU in a clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

5. START-UP AND OPERATING REQUIREMENTS
    1. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated (if applicable), condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test run under observation.

6. WARRANTY
    1. AHU manufacturer shall provide, at no additional cost, a standard parts and labour warranty that covers a period of one year from the 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.

2. PRODUCTS

1. ACCEPTABLE MANUFACTURERS
    1. Approved manufacturer shall be Trane as the Basis of Design and Tender. Alternates may be entertained after Tender Close in consultation with the Owner and Contractor. No other Manufacturers will be entertained prior to Tender Closing.
    2. Manufacturer must clearly define any exceptions made to Plans and Specifications. Any deviations in layout or arrangement shall be submitted to consulting engineer prior to bid date. Acceptance of deviation(s) from specifications shall be in the form of written approval from the consulting engineer. Mechanical Contractor is responsible for expenses that occur due to exceptions made.

2. GENERAL
    1. Unit layout and configuration shall be as defined in project plans and schedule.

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 125-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All 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 performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft2 of casing surface area) = CL X P0.65.
3. Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. 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.
4. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.
5. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, 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 13 Hr*Ft2*ºF/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. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

4. ACCESS DOORS
   1. 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.
   2. All doors shall be provided with a thermal break construction of door panel and door frame.

3. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
4. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
5. Handle hardware shall be designed to prevent unintended closure.
6. Access doors shall be hinged and removable without the use of specialized tools.
7. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
8. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
9. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.
10. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

5. 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 type and class as specified on the schedule. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. 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 grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground.
   3. Direct drive plenum fans with integral frame motors, shall be mounted on isolation bases. Fan shall be dynamically balanced throughout the operating range to a BV-3 (0.20 in/s) per AMCA 204 test standard. Fan and motor shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

6. MOTORS AND DRIVES
   1. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when

applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.

2. Fan Motors shall be heavy duty, open drip-proof operable at scheduled voltage. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.
3. Direct driven fans utilizing integral frame motors shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
4. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

7. 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 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. 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.
   4. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

8. FILTERS
   1. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule.

9. ACCESS SECTIONS
   1. Access sections shall be provided where indicated in the schedule and plans 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.

10. Factory Wiring of Lights, VFDs, Motorized Impeller Control Panels, and Combination Starters/Disconnects
    1. All power wiring for voltages greater than 24V and traveling through multiple unit sections shall be contained in an enclosed, metal, power-wiring raceway or EMT. Sections less than 6-inch in length may be contained in FMC.
    2. For fan motors not supplied with a factory mounted and wired starter, MICP or VFD, the unit manufacturer shall supply a 4 X 4 NEMA 4 junction box on the

exterior of the fan section(s) with wiring, prewired to the fan motor, to allow for ease of field installation of a starter or VFD.

11. BUILDING AUTOMATION SYSTEM / CONTROLS
    1. The unit is intended to be controlled by the School's existing Building Automation System. The unit shall come complete with all hardware, software and components necessary to interface with the School's BAS System and in full compliance with the Toronto District School Board's Controls Standards and Sequences. Consultant with TDSB's Controls Group and Controls Contractor at the time of Shop Drawing preparation and prior to manufacturing to ensure that the unit is properly manufactured to work with the School's BAS System. BACNet control points or functionality will not be permitted whatsoever. Refer to Controls Sequences for the full extent of control and sequences for the units. The unit shall come shipped with ready-to-go controls points to meet the desired control points and sequences. Any site modifications to the existing unit to bring it to compliance with TDSB's Standards and requirements will be responsibility of the Unit Manufacturer in the event of miscoordination or inadequate coordination.

12. DAMPERS
    1. The Air Handling Unit shall come with the following dampers built-into the unit and ready to interface with the BAS:

3. EXECUTION

1. SHIPPING
    1. Paper copies of the IOM shall also be shipped with each AHU.
    2. The AHU manufacturer shall identify all shipments with the order number. Enough information shall be provided with each shipment to enable the Mechanical Contractor to confirm the receipt of units when they are received. For parts too small to mark individually, the AHU manufacturer shall place them in containers.
    3. To protect equipment during shipment and delivery, all indoor units shall be completely stretch or shrink wrapped. Wrap shall be a minimum of 7 mil plastic. Pipe ends and pipe connection holes in the casing shall be capped or plugged prior to shipment
    4. After loading the equipment for shipment, the AHU manufacturer shall contact the shipping contact on the order and provide the name of the carrier, description of equipment, order number, shipping point, and date of shipment.

2. ON-SITE STORAGE
    1. If equipment is to be stored for a period of time prior to installation, the Mechanical Contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in a well-drained area. Covering units with plastic tarps shall not be acceptable.

3. FIELD EXAMINATION
    1. The Mechanical Contractor shall verify that the mechanical room and/or roof are ready to receive work and the opening dimensions are as indicated on the shop drawings and contract documents.
    2. The Mechanical Contractor shall verify that the proper power supply is available prior to starting of the fans.

4. INSTALLATION
    1. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner's selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.
    2. The AHU manufacturer shall provide all screws and gaskets for joining of sections in the field.
    3. The Mechanical Contractor shall verify that the following items have been completed prior to scheduling the AHU manufacturer's final inspection and start up:
        1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
        2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
        3. All water and steam piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
        4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
        5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
        6. All automatic temperature and safety controls have been completed.
        7. All dampers are fully operational.
        8. All shipping materials have been removed.
        9. All (clean) filter media has been installed in the units.
    4. All units shall be installed on rubberized isolation pads located at all pressure points around the Unit's base frame.

5. LEVELING
    1. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

6. FINAL CONNECTIONS TO AIR HANDLING UNITS
    1. All duct connections to air handling units shall be utilizing flexible connections.

7. FINAL INSPECTION AND START UP SERVICE
    1. After the Mechanical Contractor has provided all water and steam piping connections, ductwork connections, and field control wiring, and Electrical Contractor has provided all the field power wiring, the Mechanical Contractor shall inspect the installation. The Mechanical Contractor shall then perform startup of the equipment.
    2. The Automatic Temperature Control (Building Direct Digital Control) Contractor shall be scheduled to be at the job site at the time of the equipment start up.
    3. The Mechanical Contractor, shall 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, steam pressures and flow, and outside air temperature.
        16. Check all control sequences.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11.

.2 Submit shop drawings of the pumps, complete with pump curves, for review.

.3 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 11.

PART 2 PRODUCTS

2.1 VERTICAL IN-LINE CENTRIFUGAL PUMPS

.1 Furnish and install, as indicated on the plans and specifications, Optional Integrated Technologic design split coupled vertical in line pumps. Capacity and power supply: as indicated on the equipment schedule.

.2 Supply and install as shown on plans and specifications, The pumps shall be single stage, single suction type, and vertical inline design suitable for future variable speed drive controls. The seal shall be serviceable without disturbing the motor or the piping connections. The capacities and characteristics shall be as outlined in the plans and specifications. The complete pump unit shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108.

.3 Pump casing shall be constructed of ASTM A48 class 30 cast iron with ANSI 125 / PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (66°C) and ASTM A536 ductile iron with ANSI 250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (66°C). The casing shall be hydrostatically tested to 150% maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line.

.4 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.

.5 The impeller shall be bronze, fully enclosed type. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.

.6 The pump shaft shall be stainless steel.

.7 The coupling is to be rigid spacer type constructed of high tensile aluminum alloy. The coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.

.8 The pump shall be fitted with an outside balanced type mechanical seal, with Viton elastomers and antimony carbon (or resin-bonded carbon for potable water applications) vs. silicon carbide faces rated up to 250°F (121°C). A 316 stainless steel gland plate shall be provided with a factory installed flush line with manual vent.

.9 All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.

.10 If required to improve seal chamber cleanliness, supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered. Filters shall be changed, by the installing contractor, after system is flushed and on a regular basis until turned over to the Board.

.11 Alternately, supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator for pump differential pressures exceeding 30 psig (or 200 kPa).

.12 The motor frame shall be NEMA TC type. Motor enclosure is to be TEFC with NEMA Premium Efficiency 12.12 rating. Motor shall be inverter duty type, so it can be operated by variable frequency drive in future.

.13 Standard of Acceptance: Taco, Bell & Gossett.

2.2 SUCTION GUIDES

.1 Furnish and install on the suction of each pump a suction guide, with outlet flow stabilizing guide vanes, removable stainless steel strainer and fine mesh start-up strainer.

.2 For 150 psig flanged pipe: Supply valve with Cast Iron body with 125 psig flanged ports.

.3 For 300 psig flanged pipe: Supply valves with Ductile Iron body and 250 psig flanged ports.

.4 Standard of Acceptance: Taco, Bell & Gossett.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install with bearing lubrication points accessible. Check rotation.

.2 Supply and install a strainer and isolation valve upstream of each pump.

.3 Supply and install an isolation valve, check valve and balancing valve downstream of each pump.

.4 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to drawings and manufacturer's installation instructions for details.

.5 Provide vibration isolation between the pumps and pipes, and between the pumps and the concrete housekeeping pads. Refer to section 20 05 49.

.6 Pipe drain tapping to floor drain.

.7 Install volute venting pet cock in accessible location.

.8 Change cartridge filter on regular basis prior to, and at turn over to owner.

.9 Contractor to provide and install one pressure gauge, piped to pump suction, pump discharge and strainer inlet. Pressure gauge tappings with necessary isolating valves to enable differential pressure reading across pump and strainer to be taken.

.10 Contractor shall cover motor during construction and have area clean of construction debris before starting the motor.

.11 Contractor to follow the manufacturer's instructions for start-up and venting of mechanical seal.

.12 If pump is used during temporary heating or flushing of system, contractor shall be responsible for changing mechanical seal or replacing motor bearings if so instructed by the board representative.

.13 The pump manufacturer shall coordinate with the hydronic balancer to balance the system to the required flows.

.14 Provide drip pan and piped to nearest drain for each pump. Drip pan shall be sized to suit pump dimensions.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements outlined in Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS

1.2.1 Submit shop drawings in accordance with Section 20 05 11 Mechanical General Requirements.

1.2.2 Indicate:

.1 Equipment, capacity, piping, and connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

.3 Shop drawings shall indicate location of supply and return hook-ups in addition to interconnection details for each zone.

.4 Total pressure drop through each cabinet heater and convector systems.

1.3 MAINTENANCE DATA

1.3.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 11 Mechanical General Requirements.

1.4 SAMPLES

1.4.1 A mockup of each of the convector shall be provided at the Shop Drawing stage. Mockup to be approved prior to the order for the convectors being placed.

1.5 CAPACITY AND PERFORMANCE

1.5.1 Capacity, performance, sizes and specifications shall be as indicated on the Drawings and Equipment Schedule.

PART 2 - PRODUCTS

2.1 GENERAL

2.1.1 All convector covers, force flow heaters and radiant panels shall be factory painted with factory baked enamel finish. Colour to be chosen at shop drawings stage. A physical paint chip of all options shall be provided to the Architect.

2.1.2 Provide for noiseless expansion of all components.

2.1.3 Radiation to give output indicated on the schedule.

2.2 WALL FIN CONVECTOR

2.2.1 Enclosure lengths are assembled together using concealed joiner strips to give a single unit look in every room. Enclosures shall come with all brackets, element hangers, joggle strips, end caps, inside and outside corners, laps, access doors, pilaster kits and manual dampers as required for a full install.

2.2.2 Enclosures are made of quality cold rolled steel, 16 gauge, formed and reinforced with top supports, degreased, phosphatized and coated inside and out with a corrosion resistant tan primer. Factory paint with enamel finish; colour to be coordinated with the architect.

2.2.3 Panels are manufactured in lengths of 2'0" to 8'0" by 6" increments. Enclosure complete with components for wall to wall installation, following the contour of the wall, complete with end caps, wall trim, concealed joiners, inside corners, outside corners, access doors and pipe covers as required. Joints and filler pieces to be recessed. Support rigidly top and bottom, on wall mounted brackets. Joints and filler pieces to be clear of cover grilles.

2.2.4 Elements:

.1 Elements are seamless copper tube with aluminum fins. The tubes are expanded within the fins to obtain a permanent thermal bond between the two. These are manufactured in lengths of 1'0" to 10'0" by 6" increments. Both elements can be used on either steam or hot water systems.

.2 The aluminum fins are square 4" x 4", min. 52 fins/linear foot of heating element.

.3 All tubes are manufactured to receive standard sweat fittings. The elements designed for use at 300 degree F entry water temperature maximum working conditions.

2.2.5 Enclosure Accessories:

.1 End Piece: End pieces are used to close off enclosure ends when cabinets do not terminate on an adjacent wall. The end piece is manufactured with rounded corners and protrudes 1" beyond enclosure to give a neat finished appearance.

.2 Wall Trim: Joiners are manufactured to overlap enclosures and cover the gap between cabinet end and adjacent wall or columns. These are usually supplied in 4", 5", 6" or 8" lengths.

.3 Concealed Joiner (Butt Joint): This piece fits between two enclosure lengths to give a clean hairline joint appearance to the installation.

.4 Inside Corner: Inside corners are manufactured to overlap enclosures and are used when piping runs on two or more inside walls to meet heating requirements. These are usually supplied at 90 deg. angles, however may be modified to meet project conditions.

.1 Outside Corner: Outside corners are manufactured to overlap enclosures and are used when piping runs on two or more outside walls to meet heating requirements. These are usually supplied at 90 deg. angles, however may be modified to meet project conditions.

.2 Access Doors: Access doors are manufactured to permit access to valves or other controls located inside enclosure. Two types are available, factory installed 5" x 7" or field mounted 5" x 7" with frame. They are supplied as standard with a screw lock, however a camlock type is also available. For field mounted access doors, the contractor is required to perforate the enclosure.

.3 Pipe Covers: Pipe covers are used to hide pipes that run around a column. These are supplied in 5", 11" or 17" heights and are 3 3/4" deep.

.4 The Contractor is responsible for supply and installing ¾" thick mineral wool insulation on the inside surface of the convector enclosure over the full length and height of all convector enclosure. Adequately adhere (with adhesive) the insulation to the enclosure. The intent of this is to minimize the surface temperature of the convector enclosure for staff and students.

2.2.6 Controls – Refer to the Controls Specifications.

2.2.7 Standard of Acceptance: Rosemex models IRVS (where noted on drawings), Engineered Air (1-B), Rittling

2.1 FORCE FLOW UNIT HEATERS

2.1.1 Cabinet:

.1 The cabinets are constructed of heavy 16 gauge furniture steel with removable fronts to provide easy access to motor, blower and heating element. The cabinets are rust proofed and then finished with a prime coat. Units furnished with a factory enamel finish; colour to be coordinated with the architect.

.2 ½" flexible fiber glass duct liner on back and sides off external box, for recess arrangement only. Allows easy access to the piping, valve, filter and full access to fan deck.

2.1.2 Coils

.1 The heating coils are of 5/8" O.D. seamless copper tubes expanded into aluminum fins to form a permanent mechanical bond. Two rows for hot water or steam. Female pipe coil connections. Steam distributing coils have cast iron headers. Supply and return connections on left side of units on all models and sizes.

2.1.3 Blowers

.1 The blowers consist of two double inlet type centrifugal aluminum fans mounted directly on a double ended motor shaft.

2.1.4 Access Door

.1 Provides easier access to controls on left side with camlock fastener.

2.1.5 Hinged Panel

.1 Supplied on ceiling arrangements to remove fan deck & filter.

2.1.6 Motors

.1 Permanent split capacitor type. Steel shell, die cast aluminium shields, galvanized steel cradle. Resilient mount. Self aligning sleeve bearings, horizontal mount, class "B" insulation, thermally protected.

2.1.7 Speed Switch

.1 Solid state three speed control with off position.

2.1.8 Controls

.1 Fan operation controlled by the self contained thermostat. No water flow control required. On a call for heat, the fan shall be energized, until setpoint is achieved; at that time, the fan will stop.

2.1.9 Filters

.1 Filters in these cabinet heaters are removable in seconds, without tools. After simply opening the unit's front panel, the filter easily slides out. Filters are provided as standard. Filters clean air entering the cabinet heater before it is discharged into conditioned space.

2.1.10 Piping

.1 Space is provided to allow all piping connections to be made inside the cabinet. Manual reset toggle switch starter with overload protection.

2.1.11 Standard of Acceptance: Engineered Air.

2.2 RADIANT PANEL

2.2.1 Panels shall be provided as shown on the drawings and details. Radiant panel shall be constructed and installed strictly as shown on details, deviation from this details and Specifications shall not be accepted. Fabrication of non-custom and modular units shall be same as custom made units. Radiant ceiling manufacturer shall prove that they have similar installation in Ontario, utilizing custom made panels.

2.2.2 Connections between lengths of panel to be as detailed.

2.2.3 The panels shall be extruded aluminum with copper tubing of 12.8 mm I.D. mechanically attached to the aluminum face plate. The copper tube shall be held in place by an aluminum saddle which extends more than half way around the diameter of the tube. A non hardening heat conductive paste shall be placed between the copper tubing and the aluminum face plate. Panels shall weigh no more than 10.5 kg/m2 (2.15 lb/ft2) when operating. The use of adhesive and/or clips to attach the copper tube to the extrusion will not be acceptable.

2.2.4 Panel colour shall be selected by the Architect at the shop drawing stage.

2.2.5 Panel capacities shall be based on an entering and leaving water temperatures as per the Drawings.

2.2.6 The supplier shall provide a sample section of the proposed radiant panel on site prior to the order for the balance of the radiant panel. A 3 metre section of the radiator shall be provided for review by the Consultant after the shop drawings have been approved and prior to the order for the balance of the radiant panels.

2.2.7 Radiant panels shall be fully assembled at the manufacturer factory, with all integral bends so as to leave each panel with one supply and one return connection. Panel widths as shown on the drawings are minimum widths and shall not exceed the dimensions as noted. Field assembled and field cut panels will not be accepted. Length of all panels shall be site measured prior to fabrication. Unit manufacturer to coordinate with Division 15.

2.2.8 Panels shall be complete with removable flush mounted access panels. For sizes and locations of access panels refer to drawings.

2.2.9 Radiant panels shall be complete with factory installed integral mounted border frame suitable for drywall installation.

2.2.10 Radiant ceiling manufacturer shall supply the panels with insulation connected to the panels. Insulation shall be foil faced back, minimum 50 mm (2") thick.

2.2.11 Standard of Acceptance: Rosemex, Engineered Air, Sigma/HTS.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

3.1.1 Install in strict accordance with the manufacturer's instruction and with all fittings indicated on the drawings and schematics. Support finned elements using the manufacturer's supplied brackets; space wall-fin supports in accordance with the manufacturer's instructions.

3.1.2 Install according to the piping layout. Provide for pipe movement during normal operation.

3.1.3 Ensure that adequate space is provided within the equipment enclosures for the isolation valves, control valves and strainers. Ensure that access doors are provided to all control elements. Panels shall be constructed in a manner to allow for disassembly and access to hot water piping connections without damaging the radiator panel.

3.1.4 Manufacturer to visit the site prior to submission of shop drawings and perform accurate measurements, to ensure that the wall-fin covers match the exact room sizes.

3.1.5 Where redundant openings are left above, below or around the new heating equipment, make good wall to match existing. Where necessary, enlarge the existing wall openings as required to fit the new equipment. Make good all surfaces affected by the work and paint to match existing wall finishes.

3.1.6 Provide power and wiring to all new forced flow heaters; provide all new thermostats, sensors, control valves and control wiring.

3.1.7 Automatic control valves shall be supplied, installed and wired by the Mechanical Contractor and Controls Contractor.

3.1.8 Mechanical contractor shall supply the step-down transformers required to power the control valves. Line voltage to the step-down transformers shall be provided by Division 16. Coordinate the location of junction boxes that will provide the power to the step-down controls transformers.

3.1.9 Coordinate with Division 26 the location of junction boxes required.

3.1.10 Should deviations beyond allowable clearances arise, request and follow Consultant's directive.

3.1.11 Refer to manufacturer's installation drawings. Verify electrical service work with characteristics stamped on unit.

3.1.12 Check that all openings for appurtenances and operating weight conform to shop drawings.

3.1.13 Valves
- .1 Install valves with stems upright or horizontal unless approved otherwise.
- .2 Install isolating ball valves and circuit balancing valves on each unit.

3.1.14 Provide screwdriver vent on convectors and radiators. Clean all finned tubes and comb straight.

3.1.15 Provide clear caulking at all corners of the forced flow heaters and convectors interfacing with a block wall. Verify extent of caulking with the Architect prior to starting caulking work.

END OF SECTION

INDEX

PART 1 GENERAL

1.1 General Requirements
1.2 Approved Control System Manufacturers
1.3 Shop Drawing Submittals
1.4 As-Built Documentation
1.5 Warranty
1.6 Ownership of Proprietary Material
1.7 Facilities with Existing BAS
1.8 As Found Conditions Report for Existing BAS
1.9 Interoperability with Third Party Devices
1.10 Testing, Adjusting and Balancing (TAB)

PART 2 PRODUCTS

2.0 System Hardware
2.1 General Requirements
2.1.1 Primary Control Units
2.1.2 Programmable Application Controllers
2.1.3 Application Specific Controllers
2.1.4 Temporary Site Workstation PC
2.1.5 Connection to the TDSB WAN
2.1.6 TDSB Central Server
2.1.7 Local Service Ports (Ethernet)
2.1.8 Fail State Position of Outputs

2.2 System Software
2.2.1 BAS Workstation Software
2.2.2 Trend Logs and Totalizers
2.2.3 User Access
2.2.4 Alarms and Totalizers
2.2.5 BAS Alarm Output / Surveillance System Armed Status
2.2.6 Space Temperature Setpoints

2.3 BAS Workstation Dynamic Graphics

2.4 Field Devices
2.4.1 Automatic Control Valves
2.4.2 Automatic Control Valve Actuators
2.4.3 Butterfly Valves – Motorized and Supervised Manual Actuators
2.4.4 Automatic Control Dampers
2.4.5 Automatic Control Damper Actuators
2.4.6 Space Temperature Sensors
2.4.7 Heating/Cooling Thermostats
2.4.8 Electric to Pressure Transducers (EPT)

2.4.9 Current Sensors (Analogue)
2.4.10 Status Relays (Solid State)
2.4.11 Duct Humidity Sensors
2.4.12 Space Humidity Sensors
2.4.13 Liquid and Steam Pressure Transmitters
2.4.14 Air Static Pressure Transmitter
2.4.15 Water Flow Sensors
2.4.16 Duct Temperature Sensors
2.4.17 Duct Averaging Temperature Sensors
2.4.18 Outdoor Air Temperature Sensors
2.4.19 Immersion Temperature Sensors
2.4.20 Strap-on Temperature Sensor
2.4.21 Pushbuttons
2.4.21 Spring-Wound Timers
2.4.23 Current Switches
2.4.24 Occupancy Sensors
2.4.25 Firestopping and Smoke Seal Materials
2.4.26 Wall Opening Cover Plates
2.4.27 Access Doors
2.4.28 Motor Starters and Accessories
2.4.29 Variable Frequency Drives
2.4.30 LAN Cabling
2.4.31 Lighting Relays
2.4.32 CO2 Sensors
2.4.33 Thermostat Guards
2.4.34 Thermostats for Force Flow Heaters (Fan Cut-Out)
2.4.35 Cold Alarm Aquastat Wired to Building Surveillance System

PART 3 EXECUTION

3.1 Coordination with New Mechanical Work
3.2 General - Installation of Controls
3.3 Power Sources and Wiring Methods
3.4 Installation of Temperature Sensors in Piping
3.5 Installation of Standard Control Dampers and Actuators.
3.6 Installation of Automatic Control Valves and Actuators.
3.7 Installation of Outdoor Air Temperature Sensors
3.8 Installation of Water Flow Meters
3.9 Installation of Water Differential Pressure Sensors
3.10 Cold Alarm Aquastats in Existing Buildings
3.11 Pneumatic Fail Safe Interlocks
3.12 Boiler Selector Switches
3.13 Installation of Firestopping and Smoke Seal Materials
3.14 Installation of Wall Opening Cover Plates

3.15 Cutting and Patching
3.16 Packing and Sealing Core Drilled Conduit Openings
3.17 Access Doors Installation
3.18 Electrical Wiring and Accessories
3.19 Installation of Motor Starters and Accessories
3.20 Installation of Variable Frequency Drives
3.21 Equipment Enclosures and Location
3.22 Identification and Labelling of Control Equipment
3.23 Systems Hardware Commissioning
3.24 TDSB Review and Site Report
3.25 Training

APPENDIX 1 – VFD Requirements

PART 1 GENERAL

1.1 General Requirements

1.1.a The controls contractor shall provide the necessary design, installation, power wiring, equipment, programming, supervision, commissioning and operator training to ensure for a complete and fully operational system.

1.1.b The controls contractor shall perform a review of all existing control components (e.g. control valves, control dampers, linkages, actuators, etc.) to be re-used by the newly installed BAS. Immediately report any defective or inoperative components to the caretaker.

1.1.c The controls contractor shall coordinate the work of the Mechanical Contractor (see Section 3.1) and all sub-contractors required to complete the scope of work as specified in the contract documents.

1.1.d The controls contractor and all sub-contractors shall employ only certified tradespersons to carry out all applicable work.

1.1.e Urinal tank solenoids are to be supplied and installed by TDSB. The controls contractor shall provide wiring and termination to the specified urinal tank locations.

1.1.f Where not already existing, the controls contractor shall provide hand-off-auto (H-O-A) switches for existing equipment starters connected to the BAS.

1.1.g Provide all necessary power wiring and hardware to complete the entire project, including but not limited to, wiring, fittings, connectors, conduits, hangers/supports, box covers and all other accessories required to ensure complete, safe and fully operational systems. This shall include the power wiring for all the equipment installed by the Mechanical Contractor.

1.1.h The controls contractor shall arrange for Electrical Authority inspection of all electrical work. Arrange for a separate inspection of any field assembled electrical panels or systems that have not been pre-approved by CSA/ULC. Submit the Certificate of Inspection and Product Approval Certificate with the as-built documentation.

1.1.i The controls contractor shall provide written notification to TDSB, prior to tender closing, of any errors, omissions, discrepancies or ambiguities contained in the tender documents. Following the award of the contract, TDSB reserves the right to act as the sole arbiter of any disputes arising from the interpretation of the tender documents**.**

1.2 Approved Control System Manufacturers

1.2.a Only approved building automation systems will be accepted. No substitutes or alternates are allowed. The accepted system manufacture and vendor is:

1. **ESC Automation Toronto**
   5525 Eglinton Ave. West, Suite 100
   Toronto, Ontario, M9C 5K5

647-789-2600

2. **Automated Logic Corporation**
   5201 Explorer Dr.
   Mississauga, ON, L4W 4X3
   905-660-0878

1.2.a The Controls Contractor shall be a Sub-Contractor of the Mechanical Contractor. The costs of the Controls Contractor shall be included in the Base Tender Price of the Mechanical Contractor.

1.3 Shop Drawing Submittals

1.3.a The controls contractor shall prepare and submit shop drawings for the review and approval of TDSB and the mechanical consultant. Under no circumstances shall the controls contractor commence site work prior to the acceptance of shop drawings by TDSB and the mechanical consultant.

1.3.b The shop drawing submittal shall include the following:

1. Control schematics for each system
2. Detailed sequence of operation for each controlled system.
3. System Architecture indicating the type and model number for all BAS components, the proposed interconnection and location of all panels, network connection and key peripheral devices.
4. BAS points list indicating the panel ID, panel location, hardware address, point acronym, point description, field device type, point type (i.e. AO/DO/AI/DI), end device fail position, end device manufacture and model number and wire tag ID.
5. Wiring diagrams including complete power system, interlocks, control and data communications.
6. Manufacturers' data/specification sheets and catalogue cuts for all material and equipment supplied.
7. Automatic control valve and damper, VAV box, terminal unit and control module schedules where required.
8. Bill of materials included as part of the project.
9. An As-Found Conditions report where existing controls are being replaced or upgraded and mechanical equipment or controls sensors are being reused. See section 1.8.
10. Commissioning (prefunctional) test sheets for each controller (new or existing) to be commissioned.

1.4 As-Built Documentation

1.4.a Prepare one (1) preliminary copy of BAS As Built and Operating/Maintenance manuals and submit directly to TDSB and the mechanical consultant for review and acceptance.

1.4.b Upon acceptance, include a link to the As-Built Documents on the main BAS graphics page for the site.

1.4.c The As-built documentation shall include the following:

1. An Title sheet that contains:
    - School Name and address
    - Project name
    - A brief description of the control details: total number of inputs and outputs in the scope of the project and total number of controllers existing on site.
    - Software version.
    - BAS/TDSB WAN IP address.
    - BAS contractor Name, address, and Phone number.
2. Detailed sequence of operation for each controlled system.
3. Control schematics for each system.
4. A System Architecture indicating the type and model number for all BAS components, the proposed interconnection and location of all panels, network connection and key peripheral devices.
5. BAS Points List indicating the panel ID, panel location, hardware address, point acronym, point description, field device type, point type (i.e. AO/DO/AI/DI), end device fail position, end device manufacture and model number and wire tag ID.
6. Floor plan with the location of all field mounted control devices.
7. Programming code for all DDC controllers.
8. List of alarms and equipment schedules.
9. Wiring diagrams including power supply system, interlocks, control and data communications.
10. Manufacturers' Operation and Maintenance Manuals and catalogue cuts for all material and equipment supplied (e.g. valves, starters, VFDs, etc.), including material supplied under a separate mechanical scope of work. This section shall include a summary sheet that indicates all BAS Device, Manufacturers', model number, and quantity of each used on this job.
11. Equipment calibration certificates (e.g. water flow sensors).
12. Air and water balancing reports.
13. Automatic control valve and damper, VAV box and terminal unit schedules where required.
14. Electrical Authority Inspection Certificates – General Inspection and Product Approval Inspection.
15. Completed commissioning reports signed and dated by the BAS contractor's field technician.
16. As found condition report.
17. Signed warranty letter

18. Certificate of completion

1.4.d Consult with the head caretaker at the conclusion of the project to determine the specific equipment operating schedules required for the facility. Ensure that BAS weekly and holiday schedules for all controlled equipment are customized to match the actual occupancy requirements of the facility. See training requirements for schedule setup.

1.4.e Provide information required for the future replacement and activation of the panel by TDSB staff. This information should include a listing of all network addresses and configuration settings for each DDC panel (new and existing) within the facility.

1.5 Warranty

1.5.a All labour and material (hardware and software) supplied under this contract shall be warranted free from defects for a period of **three (3) years** after final completion and acceptance. Final completion and acceptance is defined as the date of the project turnover meeting or the date of the certificate of completion (C of C) issued by the TDSB BAS Coordinator, whichever occurs first. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost to TDSB. The contractor shall respond to TDSB's request for warranty service within one (1) business day.

1.5.b All work shall have a single warranty date, even when TDSB has received beneficial use of part of the system in advance of the final completion date.

1.5.c The contractor shall be responsible for correcting any deficiencies, errors or omissions in operating strategies, programming code, system functionality or parameters and operator workstation graphics during the warranty period.

1.6 Ownership of Proprietary Material

1.6.a All project-developed software and documentation shall become the property of TDSB. These include, but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project application programming code
5. All documentation

1.7 Facilities with Existing BAS

1.7.a Where a facility has an existing BAS that is to be replaced, modified or upgraded, the controls contractor shall be responsible for ensuring that the entire system (hardware, programming and system graphics) and all integral parts (new and re-used) function as an integrated and seamless system. Specifically, the interactive workstation graphics shall be created for both the new and re-used parts of the BAS using the latest and most up-to-date version of the manufacturer's graphics software (see also 1.7.d, 1.7.e, 1.7j).

1.7.b Provide current generation products only. The supply of out-of-date or obsolete products shall not be accepted. The supply of discontinued products or products no longer supported by the manufacturer shall not be accepted.

1.7.c Ensure complete interoperability and compatibility between new and existing DDC systems and components. Provide system firmware and/or hardware upgrades to existing DDC panels/modules where required to ensure a complete working system to the satisfaction of TDSB and the mechanical consultant. Ensure that firmware revision level of all controllers is the most up to date as recommended by the manufacturer and is consistent throughout the facility.

1.7.d For existing Automated Logic installations, provide only native ALC WebCtrl controllers and devices compatible with Exec 6 or Exec B firmware or later. For all controllers (new or existing), provide WebCtrl graphics throughout.

1.7.e For existing Delta Controls installations, provide only Delta Version 3 series controllers and devices. For all controllers, provide programming and graphics for specific use with the Delta Version 3 series system.

1.7.f Where an existing DDC panel is re-used, ensure that sufficient controller memory is present to provide for all specified control functions. Provide memory and/or panel upgrades where required to meet system memory requirements.

1.7.g Ensure that all re-used DDC panels/modules are upgraded to be compatible with the latest version of system firmware and system operating software.

1.7.h Provide new labelling for wiring, devices and equipment where existing labelling does not meet the requirements of these specifications or where panel hardware addressing is modified as a result of the new project work.

1.7.i Provide only new, customized WebCtrl or Delta v3 graphics for any existing automation panels that are re-used and remain part of the BAS network within the facility. Programming and graphics must be fully compatible with the BAS manufacturer's latest software and firmware revision level.

1.7.j Where approved in writing by the TDSB, native-BACnet controllers from Automated Logic or Delta Controls may co-exist within the same facility *where there will not be any legacy controllers from either vendor remaining in the facility at the conclusion of the project*. The successful bidder is responsible for providing new graphics for the *entire facility* and shall be responsible for interfacing all required BACnet objects from the other vendor's controllers to the new BAS. The BACnet router and TDSB data drop serving the previous vendor's BAS shall remain in service to allow for remote access to these modules as before.

1.8 As Found Conditions Report for Existing BAS

1.8.a Where modifications, upgrades or additions are made to an existing BAS, facility, the BAS contractor shall carry out an operational review of all existing BAS devices prior to the start of any project work related to this contract. The purpose of the review is to provide a "snap shot"

of found conditions prior to the start of work and to identify any operational deficiencies or abnormalities related to the existing BAS equipment.

1.8.b The report shall include the following:
- A report or screen shot of all inputs to the system to verify correct readings (i.e. no open circuits or failed devices)
- A report to indicate whether any hardware I/O's or software objects are found in manual mode or overridden
- A screen shot showing whether all DDC panels are on-line and communicating normally
- Copies of existing panel databases and graphics files
- Copies of existing logic
- Copies of existing points list

1.8.c The report shall be included in the shop drawing submittal and submitted to the TDSB BAS Coordinator prior to the start of any site work. If this report is not provided, or is provided after site work has commenced, then it will be assumed that the existing BAS at the facility is operating without problems or defects.

1.8 d This report shall be included in the As-Built Documents.

1.9 Interoperability with Third Party Devices

1.9.a Where the BAS is interfaced to third party devices (i.e. VFDs, chiller panels, equipment controllers, etc.), use only hard-wired, physical I/O's to achieve desired interoperability.

1.9.b The use of industry standard communication protocols (i.e. BACnet, LONWorks MODBUS) shall not be used to control third party devices, unless specifically approved by the TDSB.

1.9.c Acceptable use of standard communication protocols to third party devices shall be for monitoring purposes only.

1.10 Testing, Adjusting and Balancing (TAB)

1.10.a Where specified, provide the services of an approved TAB company. Ensure that all applicable site personnel employed by the TAB company meet TDSB trades certification and registration requirements.

1.10.b The controls contractor shall assist the TAB contractor where necessary to carry out their duties.

1.10.c TAB work shall be performed to ANSI/ASHRAE-III-1988 and 62-1989. Other standards are as listed in the NBCTA 1995 Directory, AABC and NEBB publications.

1.10.d The TAB report shall be based on true tests which are properly documented. The report shall have all elements of description, design, equipment supplier and testing data. The testing method (set up), applied testing instruments, achieved accuracy and comfort level need to be described and commented.

1.10.e Where applicable, the TAB report shall have the following structure:

- Front Title Sheet
- Table of Content
- Systems Description, Testing Method and Comments
- Performance Table, which includes all systems
- Equipment Test Sheet c/w S.P. profile
- Autocad Schematics
- Report Certification
- Performance Curves
- Building Pressurization Diagnosis
- Deficiencies
- Any system setpoints required by the BAS

1.10.f The BAS contractor shall program and document all VFD modulations and differential pressure setpoints based on measurements provided by the TAB contractor.

PART 2 PRODUCTS

2.0 SYSTEM HARDWARE

2.1 General Requirements

2.1.a The system architecture will be comprised of PCUs (Primary Control Units), PACs (Programmable Application Controllers), ASCs (Application Specific Controllers) and any required communications or interface components networked together to provide a system of connected controllers that operate as a single BAS for the entire project.

2.1.b The building operator shall be able to access the local BAS by logging onto an existing TDSB network PC. All required site database and graphics files shall reside on the TDSB central BAS server.

2.1.c Supply PCU's and PAC's as required to interface to all specified equipment.

2.1.d Allow for a minimum of 25% spare program and trend memory capacity in each PCU and PAC.

2.1.e For each specified BAS control point, the contractor shall supply the hardware point type (e.g. AI, AO, DI, DO) as indicated on the controls points list. The use of alternate hardware point types or the use of external interface cards or devices to simulate the function of a specified hardware point type is not acceptable. For example, the use of a DO point and an external PWM card to simulate the function of a physical AO point shall not be accepted.

2.1.1 Primary Control Units (PCU)

2.1.1.a Use only Primary Control Units to directly control any major mechanical equipment. Major mechanical equipment includes air handling units, boiler plants, chiller plants, cooling towers, roof-top units and other critical equipment.

2.1.1.b For Delta Controls, examples of controllers that shall be accepted as a PCU:
- DSC 1616
- DSC 1212
- DSC 1280

2.1.1.c For Automated Logic, examples of controllers that shall be accepted as a PCU:
- ME-Line modules
- SE-Line modules

2.1.1.d Each PCU shall contain a real time clock and sufficient memory to store the its own application database, operating parameters, user programs and trend data storage.

2.1.1.e Battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours to eliminate operating data reload in case of power failure.

2.1.1.f Each PCU output shall include a Hand/Off/Auto (HOA) selector switch for each analogue and digital output.

2.1.1.g Each PCU shall have a minimum of 10% spare capacity for each type of input and output channels.

2.1.2 Programmable Application Controllers (PAC)

2.1.2.a Programmable Application Controllers (PAC) are fully programmable controllers used for controlling distributed equipment including, but not limited to, VAV boxes, heat pumps, force flow units and unit ventilators. The TDSB considers examples of PAC's to include the ALC ZN series controllers and the Delta DVC, DFC and DAC series controllers.

2.1.2.b PACs shall not be used for controlling major mechanical equipment as described above in 2.1.1.a.

2.1.2.c Each PAC shall contain a real time clock and sufficient RAM to store its own application database, operating parameters, user programs and trend data storage.

2.1.2.d Battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours to eliminate operating data reload in case of power failure.

2.1.3 Application Specific Controllers (ASC)

2.1.3.a Application Specific Controllers (ASC) are pre-programmed controllers used to control large quantities of distributed equipment such as heat pumps or VAV boxes.

2.1.3.b The use of ASCs shall not be permitted unless written approval is obtained from TDSB.

2.1.4 Temporary Site Workstation PC

2.1.4.a The server-based BAS shall not require dedicated BAS site workstation PC, unless specifically noted in the drawings.

2.1.4.b Provide a temporary workstation PC for use during the commissioning and verification of the BAS. Install the PC in the head caretaker's office or other location designated by TDSB.

2.1.4.c The temporary workstation PC shall remain the property of the BAS contractor and may be removed from site once the project is certified to be substantially completed.

2.1.5 Connection to the TDSB WAN

2.1.5.a Advise the TDSB Project Supervisor of the proposed location of the system router/gateway panel within the facility. The TDSB shall provide a network jack (RJ45) in the specified location. The controls vendor shall connect the BAS to the TDSB WAN and confirm that network access to the BAS has been established.

2.1.5.b Submit the proposed site-specific BAS network wiring diagram to TDSB for approval. The use of field installed hubs/switches is not allowed under any circumstances.

2.1.6 TDSB Central Server

2.1.6.a Site databases and graphics files shall be installed on the designated central TDSB central server located at 140 Borough Drive.

2.1.6.b Submit a change request form to the TDSB Energy Project Engineer prior to installing new site databases on the TDSB server. Do not install software or make any changes to the server without the written consent of the TDSB.

2.1.6.c Set up and configure the server software and area routers (Delta) to allow for seamless access to the site BAS via the TDSB WAN.

2.1.7.d Include the cost of providing additional Delta router(s) to 140 Borough Drive if the existing area routers (Delta) have reached maximum capacity.

2.1.6.e Coordinate all activities related to the central server with the TDSB Project Engineer and the TDSB ITS group. Provide the TDSB with detailed documentation related to any changes made to the server software, settings or protocols.

2.1.6.f Provide designated TDSB Operations staff with at least 24 hours notice of any planned BAS server shutdowns or disruptions.

2.1.7 Local Service Ports (Ethernet)

2.1.7.a Where specified, provide dedicated network of CAT6 cabling and RJ45 jacks in each mechanical room. The service connections shall provide access to the TDSB WAN. Ensure compliance with section 2.4.29 of these specifications.

2.1.8 Fail State Position of Outputs

2.1.8.a Unless specified otherwise, configure BAS output points for the following fail state (e.g. device position upon panel failure):

All Fans	OFF
Heating Valves	Full heat to terminal device
Mixing Dampers	Full recirculation air
Face/Bypass Dampers	Full to face
Zone Dampers	Full heat
Heating Pumps	ON (except boiler belly pumps)
Boiler Belly Pumps	OFF
Variable Frequency Drives	ON, minimum programmed speed
Lighting Relays	Last State
Boilers (1 stage)	ON
Boilers (Multi-stage)	LOW ON, HIGH OFF

Cooling Equipment	OFF
Electric Heating	OFF
Domestic Hot Water Pumps	OFF
Roof-top Gas Burners	OFF

2.2 SYSTEM SOFTWARE

2.2.1 BAS Workstation Software

2.2.1.a Site licenses are not required.

2.2.2 Trend Logs

2.2.2.a Provide trend logs for all hardware inputs, outputs and control setpoints.

2.2.2.b All relevant trends should be accessible via the graphical interface.

2.2.2.c Multi-trends shall contain all related variables of a control loop (i.e. setpoint, measured variable and control output) and have the ability to be plotted simultaneously on the same graph.

2.2.2.d Trends shall be configured as follows:

Variable Type	Sample Rate	Trend History	Samples
Slow Acting (e.g. Space Temp)	30 minutes	5 days	240
Fast Acting (e.g. SAT)	5 minutes	2 days	576
Binary (On/Off)	COV	-	100

2.2.2.e The primary input sensor (measured variable) for all control loops must physically be wired to the same panel containing the control loop output (e.g. boiler water temperature and burner control output).

2.2.2.f Trend data storage must be in the same panel as the hardware or logical points being trended.

2.2.3 User Access

2.2.3.a Provide TDSB-standard user IDs and passwords for operations, maintenance and engineering staff.

2.2.4 Alarms and Totalizers

2.2.4.a Alarms shall be assigned the following categories:

Maintenance Alarms

a. Mismatch of equipment control and status.
b. Any other miscellaneous alarm not specifically noted herein

Energy

a. Run time of major equipment exceeds a weekly limit (72 hours nominal)
b. Any space temperature exceeds 24°C and the outdoor air temperature is below 5°C.
c. Any space temperature in an air conditioned area is below 22.5°C and the outdoor air temperature is above 21°C.
d. Any air handling unit mixed air temperature is less than 7°C and the supply fan has been running for at least 30 minutes.
e. Any classroom space temperature drops below 10°C.
f. The BAS Alarm is active.

2.2.4.b Alarms shall not require any acknowledgment before automatic reset by the system.

2.2.4.c An alarm notification shall not be issued when an alarm condition returns to normal.

2.2.4.d The controls contractor shall provide additional alarms as directed by the mechanical consultant.

2.2.4.e Provide totalizers to record the operating hours for all air handling units and chillers. Separate totalizers shall be provided to record daily, weekly and yearly run times. Provide a corresponding trend log to record the run time total for each day. This trend shall sample the run time total once per day at 11:59pm and shall contain a total of 365 samples. The daily totalizer shall be reset immediately after the daily trend sample is taken.

2.2.5 BAS Alarm Output / Surveillance System Armed Status

2.2.5.a If not already existing, provide a binary output point and normally-open relay for the BAS Alarm. The BAS Alarm output shall be activated when any space temperature is less than 10°C and the outdoor air temperature is less than 5°C. Space temperatures to be monitored include classrooms, offices, gyms, auditoriums, cafeterias and libraries.

2.2.5.b When installing a new BAS Alarm, provide a binary input and 10vdc relay to monitor the building surveillance panel armed status. The relay shall be energized when the building surveillance system is armed.

2.2.5.c Provide wiring from the BAS panel to the designated building surveillance panel. Termination to the surveillance panel shall be performed by TDSB. Ensure sufficient spare cabling is provided to allow for termination by others.

2.2.6 Space Temperature Setpoints

2.2.6.a Standard Zones include Classrooms, Offices, Library, Washrooms, Auditorium, Cafeteria and Change Rooms. Space temperature setpoints shall be configured as follows:

Space Type	Occ Htg	Unocc Htg	Occ Clg
Standard Zone	21 °C	14 °C	24 °C
Pool	29 °C	29 °C	N/A
Gym	19 °C	14 °C	24 °C
Corridor	20 °C	14 °C	24 °C

Entrance	18 °C	14 °C	24 °C
Indoor Storage	18 °C	14 °C	N/A
Mech Room	18 °C	14 °C	24 °C
Outdoor Storage	14 °C	14 °C	N/A

2.3 BAS DYNAMIC GRAPIHCS

2.3.a Provide customized, site specific dynamic graphics to meet the requirements of the mechanical consultant and TDSB.

2.3.b Contact TDSB for specific requirements regarding BAS graphics content, layout and functionality.

2.4 FIELD DEVICES

2.4.1 Automatic Control Valves

2.4.1.a Automatic control valves shall be supplied by the controls contractor and installed by the mechanical contractor.

2.4.1.b Automatic control valves 2" (50mm) and smaller shall be threaded Characterized Ball Valves. Modulating valves between 2.5" (65 mm) to 6" (150 mm) shall be flanged globe valves. Valves and actuators shall be ordered as one factory-assembled and tested unit.

2.4.1.c Submit for review, a valve schedule containing the following information for each valve:

a. Valve type and size
b. Connection type
c. Line size
d. Valve manufacturer and model number
e. Valve flow coefficient
f. Design flow
g. Pressure drop across valve
h. Maximum close-off pressure
i. Actuator manufacturer and model number
j. Actuator maximum torque

2.4.1.d Valves 2" (50mm) and smaller shall be constructed of bronze. Valves 2 1/2" (65mm) and larger shall have iron bodies and bronze mountings.

2.4.1.e All control valves shall have stainless steel stems. Ball valves shall be equipped with stainless steel balls and stems.

2.4.1.f The bronze in bodies and bonnets of all bronze valves shall conform to ASTM B62 for valves rated up to 150psig (1035 Kpa) working pressure and to ASTM B61 for valves rated at 200 psig (1380 Kpa) working pressure.

2.4.1.g The bodies and bonnets of iron body valves shall conform to ASTM A126, Class B.

2.4.1.h Control valve discs and seats shall be of bronze for 100 °C or less fluid temperature and of stainless steel for fluid temperatures above 100 °C.

2.4.1.i Control valves 2" (50mm) and smaller shall be complete with screwed ends type, except for bronze valves installed in soldered copper piping which shall be complete with soldering ends. Control valves larger than 2" (50mm) shall be complete with flanged end type and proper flanged adapters to copper shall be provided where flanged valves are installed in copper piping.

2.4.1.j The water control valves shall be sized for a pressure drop of 6 ft. water column (2.6 psi) or as indicated on mechanical drawings.

2.4.1.k Steam control valves shall be sized for the respective steam flows and a pressure drop of 25% of the inlet absolute maximum operating pressure.

2.4.1.l Each automatic control valve must provide the design output and flow rates at pressure drops compatible with equipment selected.

2.4.1.m Each automatic control valve must be suitable for the particular system working pressure.

2.4.1.n Each automatic control valve shall be fitted with a position indicator.

2.4.1.o Each automatic control valve must have the manufacturer's name, pressure rating and size clearly marked on the outside of the body.

2.4.1.p Heating valves shall be normally open and cooling valves are to be normally closed, unless otherwise specified.

2.4.1.q Standard of Acceptance

a. Siemens Flowrite Globe Valve with SKB/SKC/SKD actuators.
b. Belimo G-Series Globe Valves
c. Belimo B2/B3 Series CCV Ball Valve, stainless steel, (sizes 2" (50 mm) and smaller)
d. Belimo B2-HT (high temperature) Ball Valve, stainless steel, for low pressure steam applications (sizes 1" (25 mm) and smaller)

2.4.2 Automatic Control Valve Actuators

2.4.2.a Each automatic control valve shall be fitted with a "fail-safe" operator capable of tight shut-off against the differential imposed by the system.

2.4.2.b Operators for valves in electric-electronic control systems shall be single phase AC, 24V electric motor operators.

2.4.2.c Valve actuators shall accept a 0-10VDC control signal for all proportional applications

2.4.2.d The use of floating point control valve actuators is not acceptable under any circumstances.

2.4.3 Butterfly Valves - Motorized and Supervised Manual Actuators

2.4.3.a This contractor shall provide motorized butterfly valves and/or supervised manual butterfly valves where specified.

2.4.3.b The standard of acceptance for motorized butterfly valves shall be either of the following:

Bray Series 30, cast iron body, ASTM A126 Class B, aluminium bronze disk ASTM B148-954, stainless steel stem ASTM 416 and EPDM seat. Bray R4 Series 70 proportional (4 to 20mA) electric actuator, manual override hand wheel, position display visible from any angle at a distance, end switches for both open and closed positions

Challenger Butterfly Valve with cast iron body, ductile iron/brite nickel full rated disk, stainless steel stem and EPDM seat. OM electric actuator, proportional (4 to 20mA), manual override handwheel, position display visible from any angle at a distance, end switches for both open and closed positions and local/remote switch.

2.4.3.c The standard of acceptance for supervised manual butterfly valves shall be:

Challenger Butterfly Valve with cast iron body, ductile iron/brite nickel full rated disk, stainless steel stem and EPDM seat and equipped with a manual, handwheel and worm gear actuator. Complete with valve position transmitter and position display visible from any angle at a distance. Provide chain and padlock to lock the valve in place, complete with minimum of 3 keys with lamicoid labels on key rings to identify the keys or combination lock and show combination on the summary page of the site as-built documentation.

2.4.4 Automatic Control Dampers

2.4.4.a The automatic control dampers not provided as part of the packaged equipment shall be supplied by the Control Subcontractor and installed by the Mechanical Contractor.

2.4.4.b The automatic control dampers shall be opposed blade type for modulating applications and parallel blade type for 2-position applications.

2.4.4.c Maximum damper blade length shall be 4'-0"(1.2m). Maximum permissible leakage shall not exceed 1% of the total flow based on an approach velocity of 1,500fpm(7.5m/s) over a temperature range of –30 °F (–34.4 °C) to 100 °F (37.7°C) and a pressure of 3 in H_20 (0.75 kpa). Unless otherwise noted, blades are to be constructed of formed galvanized steel with neoprene seal edges, continuous stops and seals on all sides, oil impregnated bronze bearings and galvanized steel channel frames.

2.4.4.d Centre bar linkage connectors shall be used wherever possible but where centre bar linkage cannot be used due to space limitations, external linkage connectors may be used.

2.4.5 Automatic Control Damper Actuators

2.4.5.a All new actuators for control dampers shall be electric type and be powered by a single phase AC 24V overload-proof synchronous motor.

2.4.5.b All newly provided actuators shall be direct-coupled type for both modulating or two position control dampers.

2.4.5.c Damper actuators shall accept a 0-10VDC control voltage signal for all proportional applications

2.4.5.d All damper actuators shall be selected to operate maximum damper loads of 28 sq.ft. (2.6 sq.m.)

2.4.5.e Each actuator shall be "fail safe", complete with external adjustable stops to limit the length of stroke in either direction and mounted on an adjustable bracket. Operating arms shall have double yoke linkages and double set of screws for fastening to the damper shaft.

2.4.5.f 2-position damper actuators shall be provided with an end-switch to indicate the open position.

2.4.5.g The standard of acceptance shall be Belimo.

2.4.6 Space Temperature Sensors

2.4.6.a Sensors shall utilize a 10Kohm thermistor to sense temperature.

2.4.6.b Provide stainless steel, ventilated plate-type temperature sensors.

2.4.6.c Mount sensors at a height of 60" above the finished floor. Unless indicated otherwise, mount new sensors adjacent to the existing thermostat in the space.

2.4.6.d End-to-end accuracy +/- 0.3 °C over the entire operating range.

2.4.6.e Provide a heavy-duty metal guard for existing zone thermostats that remain in service. In a typically classroom, this would be a pneumatic thermostat controlling a perimeter heating valve. In this situation, the space sensor is monitoring temperature only and not directly controlling an end device.

2.4.6.f Do not mount sensors on outside walls or other locations influenced by external thermal sources (e.g. computers, boiler rooms, printers).

2.4.6.g Standard of acceptance:

Greystone, BAPI

2.4.7 Heating/Cooling Thermostats (Low Voltage)

2.4.7.a Provide new thermostats to replace existing where specified.

2.4.7.b Unless indicated otherwise, thermostats shall be equipped with coiled bimetal sensing elements and mercury switches, individual heating and cooling setpoint levers, multiple stages of heating and cooling as required, adjustable heating anticipator and fixed cooling anticipator, system and fan switching subbase (off-heat-cool-auto) and key lock cover with internal thermometer.

2.4.7.c Mount new thermostats in the same location as existing.

2.4.7.d The standard of acceptance shall be Honeywell T874 with Q674E subbase and TG504A1025 key lock cover with internal thermometer.

2.4.7.e The use of a fully programmable, Native BACnet, digital room controller shall be accepted as an alternate to the thermostat in 2.4.7.d. The controller shall be equipped with a stylized housing suitable for wall mounting in finished areas, an LCD display and keypad. The standard of acceptance shall be Delta DNT-T305.

2.4.7.f Where replaced, return existing thermostats to TDSB.

2.4.8 Electric to Pressure Transducers (EPT)

2.4.8.a Provide electric to pneumatic transducers with the following minimum characteristics:

a. Input range of 2 - 10 vdc or 4 - 20 mA.
b. Directly proportioned output range of 3 to 15 psi.
c. Dust-proof housing unless panel mounted.
d. Combined non-linearity, repeatability and hysteresis effects not to exceed +/-2% of full scale over entire range of operation
e. Integral zero and span adjustment
f. Temperature effect of +/-2% full scale at 50 °C or less

2.4.8.b Provide a 1-1/2" diameter pressure gauge (0-30psi) on the input and output air lines for each transducer.

2.4.8.c For <u>each</u> transducer, provide a separate, dedicated supply air line filter rated at 0.2 microns that changes colour when contaminated by oil.

2.4.8.d Standard of acceptance:

Greystone

2.4.9 Current Sensors (Analogue)

2.4.9.a Current sensors (CT) shall be used for status monitoring of all motor-driven equipment, where specified.

2.4.9.b Technical Performance – Output should be only 4-20mA only. Voltage output will not be accepted. End-to-end accuracy +/- 1% of full scale at each range.

2.4.9.c The current sensors shall be mounted inside the starter cabinets whenever possible. If this is not possible due to space limitation, provide an enclosure to house the sensor.

2.4.9.d Standard of Acceptance:

Greystone

2.4.10 Status Relays (Solid State)

2.4.10.a The status relays shall be mounted inside newly provided enclosures mounted near the respective equipment starter cabinets.

2.4.10.b Standard of Acceptance:

Omron G7L-1A, LY2N

2.4.11 Duct Humidity Sensors

2.4.11.a Provide humidity sensors with the following minimum characteristics:

a. Operating range from 10% - 90%RH over 0-60 °C temperature range.
b. End-to-end accuracy of +/- 2% of operating range, with maximum temperature dependence of 0.2% per °C change.
c. 200mm long probe, with enclosure for mounting in duct.
d. 4-20mA output only. Voltage output is not acceptable

2.4.11.b Standard of Acceptance:

Greystone

2.4.12 Space Humidity Sensors

2.4.12.a Provide space RH sensors with the following minimum characteristics:

a. Minimum operating range from 10% - 90%RH over 0-60 degrees C temperature range.
b. End-to-end accuracy of +/- 2% of operating range, with maximum temperature dependence of 0.2%per °C change.
c. Assembly shall be complete with a base plate for wall mounting, and a rigid circuit board for all circuitry and sensing element.
d. Assembly shall be complete with a ventilated enclosure.

e. 4-20mA output only. Voltage output is not acceptable.

2.4.12.b Humidity sensors installed in swimming pool areas shall be supplied with a conformal coating to protect electronic components from corrosion.

2.4.12.c Standard of Acceptance:

Greystone

2.4.13 Liquid and Steam Pressure Transmitters

2.4.13.a Provide liquid and steam pressure transmitters with the following minimum characteristics:

a. Minimum pressure operating range from 0 – 60 psi over 0-85 degrees C ambient/medium temperature range, for the liquid type.
b. Minimum pressure operating range from 0 – 30 psi over 0-85 degrees C ambient/medium temperature range, for the steam type.
c. End-to-end accuracy of +/- 1% of operating pressure range over 0-85 degrees C ambient/medium temperature range.
d. Wetted parts shall be stainless steel 316L complete with SS304 for the case.
e. 4-20mA output

2.4.13.b Provide a 3-valve manifold assembly (optional kit to be ordered with sensor) to facilitate sensor servicing and maintenance.

2.4.13.c Provide a pressure gauge (Winters P1S 100 series, 3-1/2" dia.) to measure the pressure of the high and low side piping connected to the transducer. Consult with the mechanical consultant for suitable gauge pressure range. The tap point(s) for the gauge shall be the same as those used by the pressure transducer and the gauge shall be installed adjacent to the transducer. For single pressure applications, provide a manual shut-off valve. For differential pressure applications, provide a t-connection and manual shut-off valves for the high and low side lines so that the gauge can display either pressure.

2.4.13.d Coordinate with the mechanical contractor to provide a pressure tap complete with shut-off valve and "pig tail" tubing (primed with water) for each sensor used to monitor steam pressure.

2.4.13.e Standard of Acceptance:

Greystone PGS100A (for low pressure steam monitoring)
Greystone WP-D-103-LCD-VB

2.4.14 Air Static Pressure Transmitter

2.4.14.a Provide air pressure transmitters with the following minimum characteristics:

a. Solid State design.
b. Operating on capacitance principle.

c. With non-interactive fine resolution zero and span adjustments.
d. End-to-end accuracy +/- 1% of full scale pressure range, including temperature compensation.
e. 4-20mA output only. Voltage output is not acceptable.

2.4.14.b Provide a pitot-tube style static or velocity pressure probe (8" nominal) and fitting for insertion into ductwork. Follow manufacturer's instructions for correct installation method.

2.4.14.c Standard of Acceptance:

Setra model 264

2.4.15 Water Flow Sensors

2.4.14.a Flow sensors must be insertion, electromagnetic technology.

2.4.14.b Calibration certificate must be included in as-built documents.

2.4.14.c Output shall be 4-20 mA.

2.4.14.d Standard of Acceptance:

Onicon F-3500 Series

2.4.16 Duct Temperature Sensors

2.4.16.a Provide duct mounted temperature sensors (DTS) with the following minimum characteristics:

a. Sensor encapsulated in a 200mm long, 6mm OD copper or stainless steel probe.
b. Operating range 0-60 degrees C.
c. End-to-end accuracy +/- 0.3 °C.
d. Assembly complete with wiring housing and mounting flange.

2.4.16.b Standard of Acceptance:

Greystone

2.4.17 Duct Averaging Temperature Sensors

2.4.17.a Provide plenum mounted mixed air temperature averaging type sensors with the following minimum characteristics:

a. Constructed of FT6 plenum rated cable incorporating a minimum of 9 temperature sensors encapsulated at equal distances along the 24 foot length of the element. The

assembly acts as a single sensor reporting the average temperature from all individual sensors.

b. End-to-end accuracy +/- 0.3 °C.
c. Mount in a zigzag manner to provide continuous coverage of the entire duct cross-sectional area.
d. The use of thermistor type sensors is required.

2.4.17.b Standard of Acceptance:

Greystone

2.4.18 Outdoor Air Temperature Sensors

2.4.18.a Provide outdoor air temperature sensors with the following minimum characteristics:

a. Each sensor shall be 10Kohm thermistor probe
b. Provide two sensors for each site.
c. Both sensors shall be mounted inside a heavy-duty (blow-proof) solar shield.
d. Provide a heavy-duty, metal, wire guard.

2.4.18.b Standard of Acceptance:

Greystone

2.4.19 Immersion Temperature Sensors

2.4.19.a Use immersion temperature sensors with thermwells for all applications where a temperature of a fluid in a pipe is being sensed.

2.4.19.b Provide well-mounted water temperature sensors with the following minimum characteristics:

a. The sensors shall be 10k ohm thermistor encapsulated in a 6mm OD, 50m long probe, with screw fitting for insertion into a standard thermowell.
b. Operating range -10 to +100 degrees C.
c. End-to-end accuracy +/- 0.3 °C over the entire operating range.
d. The sensors shall be complete with brass thermowell. Provide a stainless steel thermowell where exposed to corrosive liquids.
e. Use thermal conductive gel when mounting the sensor in the thermowell. Sensors mounted on insulated piping shall be installed clear of the insulation.

2.4.19.c Standard of Acceptance:

Greystone

2.4.20 Strap-on Temperature Sensors

2.4.20.a Obtain written approval from the mechanical consultant and TDSB before using any strap-on type sensor.

2.4.20.b Where approved, provide strap-on type water temperature sensors with the following minimum characteristics:

a. The sensors shall be 10k ohm thermistor encapsulated in a 6mm OD, 50mm long probe to be strapped-on the pipe.
b. Operating range -10 - +100 degrees C.
c. End-to-end accuracy +/- 0.3 °C over the entire operating range.

2.4.20.c Standard of Acceptance:

Greystone

2.4.21 Pushbuttons

2.4.21.a Where specified, provide a push button with the following minimum characteristics:

a. The pushbutton shall be surface mounted.
b. The unit shall have a button that is flush with casing.
c. The casing shall be heavy-duty and abrasion-proof.

2.4.21.b Standard of Acceptance:

Danfoss RB2-BA2/RB2-BZ101
BACO LBX10110

2.4.22 Spring-Wound Timers

2.4.22.a Where specified, provide a spring-wound timer without a hold feature for the time interval indicated.

2.4.22.b Where the timer is used to directly switch the power supply to an air conditioning unit, provide a time delay relay (set to 3 minutes delay on make) and horsepower rated relay. Wire the devices such that the air conditioning compressor will have a minimum off time of 3 minutes between any timer activation. Mount all devices within an electrical enclosure complete with hinged door and key lock. Provide a lamicoid label to describe the timer operation. Consult with the TDSB for exact wording to be used in the label.

2.4.22.c Standard of Acceptance:

a. Intermatic FF series

2.4.23 Current Switches

2.4.23.a The current switch shall induce power from the monitored load

2.4.23.b The current sensor shall provide on/off status indication of electrical loads from 0.15 to 60A (minimum).

2.4.23.c The current sensors shall be mounted inside the starter cabinets whenever possible. If this is not possible due to space limitation, provide an enclosure to house the sensor.

2.4.23.d The current sensor shall be isolated to 600VAC RMS (UL ratings), 300VAC RMS (CE ratings)

2.4.23.e The current sensor output shall be N.O., Solid State, 1A @30VAC/DC

2.4.23.f Standard of Acceptance:

Greystone

2.4.24 Occupancy Sensors

2.4.24.a The Occupancy Sensor system shall detect the presence of human activity within the desired space and activate automatically.

Sensors shall be installed to activate when detecting motion within 2 feet of entrance and shall not initiate based on motion outside of entrance.

Sensing technologies shall be completely passive in nature, in that the occupancy sensor system shall not emit or interfere with any other electronic device, or human characteristic. Acceptable known technologies are Passive Infrared (PIR), or Microphonic.

All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed.

All sensors, power packs, and relays shall be UL Listed under either Industrial Control Equipment, or Energy Management Equipment. Appliance Control listing shall not be accepted.

2.4.24.b Low Voltage Ceiling and Wall Sensors

Sensors must be designed to work in conjunction with remote power packs, relays, or other control systems. Sensors must operate with a Class 2, low voltage wiring strategy. Sensors must be capable of being parallel wired for multi-sensor applications.
Sensors must accept 12 to 24 volts AC or DC. Sensor must provide a transistor output, returning the voltage input rectified to DC, to control remote power packs, relays, or other control systems.

Sensor must have optional single pole, double throw signal relay capable of being wired open on occupancy, or closed on occupancy.

Sensor must also provide optional photocell output for daylight override. Sensor shall not consume more than 14 milliamps of current.

Sensor Time Delay shall be factory set for typical applications, and field adjustable from 30 seconds to 20 minutes.

Photocell override shall be factory set in the off mode, but be field adjustable. All adjustments shall be concealed once installed.

Sensor shall provide a green LED motion indicator. Red LED denoting life safety shall not be permitted.

2.4.24.c Standard of Acceptance:

Sensor Switch
WattStopper

2.4.25 Firestopping and Smoke Seal Materials

2.4.25.a Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115-M85, for installation in U.L.C. designated firestopping and smoke seal Systems. These Systems shall provide a positive fire, water and smoke seal and a fire- resistance rating (flame, smoke hose stream and temperature) not less than the fire resistance rating of surrounding construction.

2.4.25.b Materials shall form ULC listed or UL classified assemblies and be compatible with abutting dissimilar materials and finishes.

2.4.25.c Standard of Acceptance:

a. 3M Canada Limited
b. A/D Fire Protection System Ltd.
c. Fire Stop System

2.4.26 Wall Opening Covering Plates

2.4.26.a All hole covering plates used on this project shall be stainless steel 18-8 chrome metal alloy, type 302, non-magnetic type for finished areas and pressed steel for unfinished areas. Finish brush marks shall be run in a vertical direction.

2.4.27 Access Doors

2.4.27.a Access doors installed in unfinished areas shall be constructed of 12 ga prime coated steel and of stainless steel for all areas finished with tile or marble surfaces.

2.4.27.b Access doors shall be complete with 180° opening door, round safety corners, concealed hinges, screwdriver latches, plaster lock and anchor straps.

2.4.27.c Access doors shall be 24'x 24' or 12'x 18' as per site condition.

2.4.27.d Access doors in fire rated construction shall be ULC listed and labeled and of a rating to maintain the fire separation integrity.

2.4.27.e Standard of Acceptance:

a. Zurn Industries Canada Limited
b. LeHage Industries Limited
c. Acudor Acorn Limited.

2.4.28 Motor Starters and Accessories

2.4.28.a Starters shall be CSA and ULC approved.

2.4.28.b Starters shall be full voltage, non-reversing magnetic starters. Full protection is to be provided in the starters by means of one thermal overload relay per phase per starter with manual reset button to suit the service factor and acceleration time of the motor served.

2.4.28.c Starters shall be equipped with auxiliary contacts to satisfy interlocking and automatic control requirements, "Hand-Off-Automatic" switches, pilot lights (green-On; red-Off), thermal overloads, necessary fuses and control transformer (if required) for operation of all controls on 120V single phase.

2.4.28.d Where required by applicable codes, starters shall be equipped with "quick-make" and "quick-break" fused disconnects.

2.4.28.e Standard of Acceptance:

a. Eaton/Cutler-Hammer
b. Schneider

2.4.28.f Fuses in starters to be CSA certified Form 1, current and energy limiting type 200,000 ampere interrupting capacity with NEMA Class "J" rejection type mountings.

2.4.28.g Size fuses installed in starters or in disconnect switches used in conjunction with magnetic starters, for motor and branch circuit protection in accordance with fuse manufacturer's recommendations. Provide one spare set of three fuses for each rating and type of fuse used.

2.4.28.h Enclosures for loose starters are to be EEMAC 1A, unless otherwise specified.

2.4.29 Variable Frequency Drives

2.4.29.a See Appendix 1.

2.4.29.b Standard of Acceptance:

a. ABB
b. Danfoss

2.4.30 LAN Cabling

2.4.30.a All LAN cabling shall be Category V as defined by EIA/TIA 568A. The contractor shall test all cabling to verify that 100Mb bandwidth is supported. See commissioning requirements.

2.4.30.b Cabling shall be 4 pair, 100 ohm UTP, #24 AWG solid copper conductor PVC insulated, with blue or grey colour coded jacket. FT6 rated cable shall be used unless otherwise required to meet building codes or by-laws.

2.4.30.c Data outlets shall be RJ45, 8 pin connectors, with 50 microns of hard gold over nickel, minimum durability of 750 mating cycles and contact pressure of 100 grams per contact. Transmission characteristics shall meet TSB-40 Category V.

2.4.30.d Provide one RJ45 data outlet adjacent to each device to be terminated (e.g. workstation PC, DDC panel, hub, etc.) Use a flexible patch cable to connect from the data outlet to the end device. For Delta Controls installations, provide a duplex data outlet at the workstation PC to accommodate the remote security key wiring. LAN cabling shall not be directly terminated to any device.

2.4.30.e Provide protection from EMI sources in accordance with CSA-T530 article 4

2.4.30.f The contractor shall test all cabling to verify conformance with TIA /EIA TSB-67 - Basic Link Test using a Level 2, bi-directional tester. See commissioning requirements.

2.4.30.g Where there are more than 2-90 degree in a conduit run, provide a pull box between sections so that there are two bends or less in any one section.

2.4.30.h Where a conduit run requires a reverse bend, between 100 degrees and 180 degrees, insert a pull box at each bend having an angle from 100 degrees to 180 degrees.

2.4.30.i Ream all conduit ends and install insulated bushings on each end.

2.4.30.j Terminate all conduits that protrude through the structural floor 2" above the concrete base.

2.4.30.k Do not use a pull box in lieu of a conduit bend. Align conduits that enter a pull box from opposite ends with each other.

2.4.31 Lighting Relays

2.4.31.a All relays used for switching lighting loads shall be the latching type. Maintained relays or contactors shall not be accepted.

2.4.31.b Provide custom lighting enclosures to house all lighting relays. The enclosures shall be equipped with barriers to separate the control and load wiring.

2.4.31.c Provide local ON pushbuttons at each lighting relay enclosure to allow for manual operation of all lighting relays in the case of BAS panel failure. Pressing the pushbutton shall turn on all lighting relays by applying voltage directly to the relay (i.e. bypass the BAS). If a lighting panel is located in an area accessible by students or teaching staff, provide momentary key switches in lieu of pushbuttons. The key type shall be designated by TDSB. Deliver all keys to TDSB at the completion of the project.

2.4.31.d The standard of acceptance shall be G.E. RR-7 and RR-8 relays.

2.4.32 CO2 Sensors

2.4.32.a Provide CO2 sensors for either wall or duct mounting applications as specified. Provide a heavy duty metal guard to protect the sensor when mounted on walls. Provide the factory-supplied duct mounting kit for all duct mount applications.

2.4.32.b The sensor shall be microprocessor controlled, fully digital, non-dispersive dual wavelength infrared technology with temperature compensation. The device output shall be 4 to 20mA.

2.4.32.c The sensor shall have a measurement range of 0 to 2000ppm with an accuracy of +/-30ppm..

2.4.32.d Install the sensor in accordance with all manufacturer's instructions. Wall mounted sensors shall be installed at a minimum height of 60" above the finished floor. Sensors shall not be mounted on an outside wall, close to a window, door or in draft areas with direct airflow.

2.4.32.e The sensor shall be auto calibrating for a guaranteed interval of 5 years.

2.4.32.f Standard of acceptance:

Greystone CCD4A.

2.4.33 Thermostat Guards

2.4.33.a Provide a heavy duty, metal thermostat guard for specified existing, stand-alone thermostats.

2.4.33.b The guard shall be have a minimum 18 guage metal cover and 22 guage ring base. The unit shall be tamper-resistant and equipped with a lock and key. The colour of the unit shall be beige.

2.4.33.c The standard of acceptance shall be White Rodgers Model #F29-0222.

2.4.34 Thermostats for Force Flow Heaters (Fan Cut-Out)

2.4.34.a Where indicated, provide thermostats to disable fan operation of force flow heaters when the unit supply water temperature is less than 35C. This will prevent the fan from operating when the building heating system is off or operating in setback mode. The thermostat shall be

equipped with a remote capillary which shall be attached to the heating supply water piping serving the heating coil.

2.4.34.b Ensure that the bulb of the thermostat is rated for a minimum temperature of 93C (200F).

2.4.34.c Install the thermostat within the force flow enclosure in a manner that facilitates servicing. Adhere to manufacturer's installation instructions.

2.4.34.d Standard of acceptance:
Honeywell T675A1540
Johnson A19AAF-12C.

2.4.35 Cold Alarm Aquastat Wired to Building Surveillance System

2.4.35.a Provide a low temperature aquastat (strap-on type) and affix to the boiler primary loop piping at a location where the boiler supply water temperature from all boilers in the plant can be measured. The aquastat shall be set to trip at temperatures below 40C to indicate that the boilers have failed.

2.4.35.b Provide an additional thermostat with remote bulb and capillary to measure the outdoor air temperature. Wire the outdoor air thermostat in parallel with the low temperature aquastat so that the aquastat contact is bypassed when the outdoor air temperature is above 5 C.

2.4.35.c Provide wiring from the cold alarm aquastat to the designated building surveillance panel. Termination to the surveillance panel shall be performed by TDSB. Ensure sufficient spare cabling is provided to allow for termination by others.

2.4.35.d Test trip the aquastat and verify that a correct alarm signal is received by the building surveillance system.

2.4.35.e Refer to section 3.8 for work in existing boiler plants.

PART 3 EXECUTION

3.1 Coordination with New Mechanical Work

3.1.a In a facility where mechanical retrofits are planned, obtain and review the mechanical drawings and mechanical specifications for each site. Coordinate all site work with the mechanical contractor.

3.1.b Provide all specified labour and material as indicated in the Mechanical Drawings and/or Specifications. Provide written installation instructions for all supplied equipment and devices to be installed by the Mechanical Contractor.

3.1.c The Controls contractor shall supply all required controls equipment (e.g. valves, dampers, thermowells, pressure sensors etc.) to the Mechanical Contractor for installation, where specified. If a separate Mechanical Contractor has not been hired by TDSB to work on the project, the Controls Contractor shall be responsible for the installation of these devices.

3.1.d The controls contractor shall be responsible for identifying and marking the location of all controls equipment to be installed by the mechanical contractor.

3.2 General - Installation of Controls

3.2.a Remove all existing field and panel mounted control devices (e.g. transducers, controllers, thermostats, etc.) that have been made redundant or inoperative by the new BAS control strategies. Remove any other controls as specified or directed by TDSB or the mechanical consultant.

3.2.b Ensure that all systems remain operative at all times, whether under the existing controls or under the new controls. Do not leave any system without some form of automatic control.

3.2.c Properly cut and cap all remaining active control air lines.

3.2.d Provide properly sized cover plates for all openings resulting from the removal of redundant control devices. This shall be applicable to walls, ductwork and control panels. In occupied areas, cover plates shall be stainless steel.

3.2.e Provide new cabling, conduits, control cabinets, power supplies and other auxiliary equipment, as required for a complete operational system.

3.3 Power Sources and Wiring Methods

3.3.a All wiring shall be installed in EMT conduit unless specified otherwise. Exposed wiring in finished areas (e.g. corridors, classrooms, gymnasiums, etc.) shall be installed in wiremold (colour to match surrounding area).

3.3.b Wiring from DDC controllers to sensors and actuators and control system network and low voltage wiring running in accessible ceilings may be installed using LVT cable. Where the ceiling is used as a return air plenum, plenum rated cable shall be used in lieu of LVT cable.

3.3.c Install EMT and cable at right angles to building lines, securely fastened, and in accordance with current electrical codes and standards.

3.3.d Power and control wiring shall be copper conductor (RW90). For power wiring, provide #12 AWG (minimum) with a 3% maximum voltage drop in accordance with CEC requirements. Control wiring shall be a minimum of #14 AWG, unless otherwise specified.

3.3.e **Wiring smaller than 18 gauge shall not be accepted on the project.** Exceptions are made for wiring between terminal computer devices, wire in standard communication cables, such as printers and short haul modems, wire used in communication networks, i.e. any cable transferring digital data, using twisted shielded pairs.

3.3.f The wiring from panels to devices shall be installed without splices. The use of crimp connectors is not allowed when connecting field wiring to sensor or device leads. The use of wire nuts is acceptable in this application.

3.3.g Power for control system shall <u>not</u> be obtained by tapping into miscellaneous circuits that could be inadvertently switched off. Only dedicated circuit(s) shall power the control system. Provide additional breakers or electrical panels as required.

3.3.h Mount transformers and other peripheral equipment in panels located in serviceable areas. Provide line-side breakers/fuses for each transformer.

3.3.i All 120 VAC power for any controls equipment shall be from dedicated circuits. Provide a breaker lock for each breaker used to supply the control system. Update the panel circuit directory.

3.3.j A dedicated power circuit may be used to power DDC panels and equipment within the same or adjoining mechanical rooms. The use of one power circuit to power DDC panels distributed throughout the building is not acceptable.

3.3.k The controller may be powered from the equipment that it is directly controlling (i.e. heat pump, rooftop unit) only if the controller controls no other equipment and the power supply to the controller remains energized independently of unit operation or status.

3.3.l Provide all required code gauge boxes, connectors and other wiring accessories.

3.3.m For all DC wiring, positive conductors shall be WHITE or RED in colour while negative conductors shall be BLACK in colour.

3.3.n On exterior building surfaces, wiring shall be rated for 90C and wet environments. Conduit shall be rigid metal or rigid PVC with waterproof joints and connectors used throughout.

3.4 Installation of Temperature Sensors in Piping

3.4.a The controls contractor shall supervise and direct the Mechanical Contractor to ensure that thermowells are installed as described herein.

3.4.b For each immersion sensor, provide a compatible thermowell to the Mechanical Contractor for installation. Provide stainless steel thermowells where installed in piping carrying corrosive or chemically reactive fluids.

3.4.c Install thermowells in piping such that the bottom of the well does not make contact with the pipe. Install the well at a 90 degree elbow or tee where the pipe diameter is less than the well length.

3.4.d If the use of strap-on sensors has been approved by TDSB or the mechanical consultant, use metal clamps to securely fasten the sensor to the piping. Apply heat transfer compound to the contact area between the sensor and piping. Re-insulate all piping.

3.5 Installation of Standard Control Dampers and Actuators.

3.5.a Supply new automatic control dampers where specified.

3.5.b The new ducts and/or plenums-mounted dampers shall be installed as part of the air distribution Work specified in a different section of the Specification.

3.5.c The dampers shall be made available at the site at the location where they are required.

3.5.d Ensure that each damper assembly is properly mounted.

3.5.e The linkage and motors shall be provided and completely connected for all control dampers, including for dampers factory supplied with equipment.

3.5.f Where newly installed damper sizes exceed 28 sq. ft. (2.6 sq. m) multiple operators shall be provided.

3.5.g Wherever possible, the new damper actuators shall be installed so they are accessible from outside ducts, plenums and equipment casings.

3.6 Installation of Automatic Control Valves and Actuators.

3.6.a All control valves shall be supplied by the Controls Contractor and installed by the Mechanical Contractor, unless specified otherwise.

3.6.b Each control valve shall be equipped with its own actuator.

3.6.c The controls contractor shall ensure that each control valve assembly is properly connected and installed.

3.6.d The controls contractor shall test, adjust and verify the operation of each control valve to ensure that it is properly functioning, as required and left in safe working order.

3.6.e Motorized butterfly valves (usually installed for boiler isolation) shall be supplied and installed by the Mechanical Contractor but shall be wired up by the controls contractor. The valve details are in the Mechanical specifications.

3.7 Installation of Outdoor Air Temperature Sensors

3.7.a The outdoor air sensors shall be mounted so that the ventilation slots on the solar shields are facing downward (when mounted horizontally) or towards the wall (when mounted vertically).

3.7.b Mount the sensors on the north-facing side of the building away from direct sunlight.

3.7.c Mount the sensors in an easily serviceable location.

3.7.d Ensure that the sensors are located away from building exhaust air or equipment air flows.

3.8 Installation of Water Flow Meters

3.7.a The controls contractor shall identify the location and advise the mechanical contractor where the flow meters shall be installed.

3.7.b Flow meters shall be installed in the mechanical room or the closest possible location.

3.8.c Water flow meters shall be installed with a minimum of 5 pipe diameters upstream and 10 pipe diameters downstream of straight piping.

3.9 Installation of Water Differential Pressure Sensors

3.9.a The controls contractor shall identify the location and advise the mechanical contractor where the differential pressure sensor shall be installed.

3.9.b Differential pressure sensors shall be installed across the main supply and return lines in the mechanical room as far away from the pumps as possible.

3.9.c Where possible, differential pressure sensors should be mounted on a wall at a serviceable height.

3.10 Cold Alarm Aquastats in Existing Buildings

3.10.a Identify the location of all existing cold alarm aquastats installed on the heating water piping. These aquastats (usually strap-on type) are normally located in the boiler room but may also be found in other fan rooms throughout the building.

3.10.b For information purposes only, the location of known cold alarm aquastats may be indicated in the site specific information for each site (see Appendix A). Regardless of the information provided, if any, the controls contractor shall be solely responsible for locating all existing cold alarm aquastats in each facility and carrying out the work described herein.

3.10.c Once all existing cold alarm aquastats in the facility have been located, relocate one functional aquastat (or provide one new aquastat) to the boiler primary supply water header. Provide new wiring to connect to the existing alarm circuit. The relocated boiler room aquastat shall be the only device in the alarm circuit.

3.10.d Remove all additional cold alarm aquastats and wiring in the facility.

3.10.e Test trip the relocated or new boiler room aquastat and verify that a correct alarm signal has been received by the building surveillance system.

3.11 Pneumatic Fail Safe Interlocks

3.11.a Existing pneumatic damper actuators under BAS control shall be physically interlocked (e.g. solenoid air valve exhausts control air when fan is off) to return to their fail safe positions when their respective fan is off, regardless of BAS command.

3.11.b The controls contractor shall immediately report to TDSB and the mechanical consultant any situation in which an existing pneumatic damper actuator to be placed under BAS control is not pneumatically interlocked to the fan starter or where an existing pneumatic interlock is inoperative or defective.

3.11.c If the controls contractor fails to report to TDSB and the mechanical consultant any abnormalities as described in 3.9.b, it shall be assumed that all pneumatic interlocks were present and functioning at the time of the Controls installation. Any subsequent deficiencies related to missing or defective pneumatic interlocks shall be corrected by the controls contractor at no additional cost to TDSB.

3.11.d Unless specified otherwise, pneumatic heating valves under BAS control in air handlers shall not be physically interlocked (e.g. solenoid air valve exhausts control air when fan is off) to the respective fan starter.

3.11.e Provide labour and material, as required, to ensure that all new and existing electric-to-pressure transducers (EPT) controlling heating valves are supplied with non-switched main control air.

3.12 Boiler Selector Switches

3.12.a Provide a two-position selector switch (toggle or rotary) for each boiler under BAS control. Provide lamicoid labels to indicate "Local" and "BAS" positions.

3.12.b Where modulating burner controls are present, provide an additional two-position selector switch (toggle or rotary) to switch between the local potentiometer and the BAS modulation signal. Provide lamicoid labels to indicate "Local" and "BAS" positions.

3.12.c Mount the override switch on the boiler panel adjacent to the existing on-off switch.

3.12.d Wire the override switch such that in the "BAS" position, the boilers operate under normal BAS control. Wire the "Local" position such that the boilers are forced to the ON position regardless of the signal from the BAS. For multi-stage boilers, the "Local" position shall be wired to force low fire ON and high fire OFF.

3.13 Installation of Firestopping and Smoke Seal Materials

3.13.a Where conduits penetrate the fire rated construction, ULC listed and labelled firestopping and smoke seal materials shall be supplied and installed in accordance with ULC Firestop System requirements to seal holes and voids in the walls or slabs and as follows:

1. Conduit through a floor with a sleeved or core drilled circular opening – ULC System SP115.
2. Conduit through a floor with a cast or cut rectangular opening – ULC System SP116.
3. Conduit through a wall with a sleeved or core drilled circular opening – ULC System SP114.
4. Conduit through a wall with a rectangular cast or cut opening – ULC System SP107.

3.13.b Select thickness and arrangement of back-up materials to suit size of service, length of sleeve and anticipated movement.

3.13.c At time of application all surfaces shall be properly cleaned, dried and free from dust, oil, grease, loose or flaking paint and foreign materials.

3.14 Installation of Wall Opening Cover Plates

3.14.a All existing wall openings of the removed electrical and control devices shall be covered with properly sized plates in an approved manner so that the finished Work presents a neat and clean appearance.

3.15 Cutting and Patching

3.15.a All cutting, patching, painting and making good for the installation of the BAS work shall be done by the BAS Contractor. All cutting shall be performed in a neat and true fashion, with proper tools and equipment to the mechanical consultant and/or TDSB Project Representative approval. The surfaces shall be made good to reasonably match existing finishes to the mechanical consultant and/or TDSB Project Representative approval.

3.15.b Location of the existing services concealed in the construction, if any, shall be determined prior to drilling or cutting an opening. If required, the Contractor is to x-ray the walls or slabs and

in any case he shall not drill or cut any surface without the TDSB project representatives approval.

3.15.c The Contractor shall be responsible for the repair of any damage to existing services, exposed or concealed, caused as a result of this Work.

3.16 Packing and Sealing Core Drilled Conduit Openings

3.16.a The void between the conduit opening and the conduit shall be packed and sealed for the length of the opening as follows:

1. Pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a watertight seal.

2. Pack and seal openings in fire rated walls and slabs as specified in this Section and as per article entitled "Installation of Firestopping and Smoke Seal Materials"

3.17 Access Doors Installation

3.17.a All access doors shall be flush mounted.

3.17.b Access doors shall be installed such as to give proper access to all newly installed electrical and control equipment and other similar electrical Work which may need maintenance or repair but which are concealed in inaccessible construction.

3.17.c All access doors shall be installed by the professional trades specialized in working on the particular type of construction in which the doors are required.

3.18 Electrical Wiring and Accessories

3.18.a Install all electrical materials and equipment conform to Canadian Electrical Code as amended to date and as specified below.

3.18.b Provide conduit, electrical wiring and fittings from load side of starters and/or disconnects to motor or electrical connected item, including the connections to all mechanical equipment.

3.18.c Provide control wiring, conduit and relays to interlock starters and connect safety and operating controls as required.

3.18.d Wire final 12 in to 18 in of motor connections with flexible liquid tight conduit, with insulated throat connectors.

3.18.e Use thin wall conduit up to and including 1 ¼ in size for wiring in ceiling, furred spaces and where not exposed to mechanical injury. Use rigid galvanized steel conduit for exposed wiring and for conduit 1 ½ in size and larger.

3.18.f Provide branch circuit wiring and an outlet for each motorized damper control.

3.18.g Conduit shall be in accordance with the following CSA standards:

1. C22.2 No.813 - 1976 - Electric Metallic Tubing
2. C22.2 No.56 - 1977 - Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit
3. C22.2 No.136 - 1966 - Rigid PVC Conduit

3.18.h Install all wiring in conduit, unless otherwise specified.

3.18.i Conduit accessories, conduits and fittings shall conform to C.S.A. Standard C22.2 No.18 - M1987.

3.18.j Use thin wall conduit for branch circuit and signal wiring in ceiling, furred spaces and where not exposed to mechanical injury.

3.18.k Conduit shall be of sufficient size to permit easy removal of conductors at any time. Do not bend conduit over sharp objects. Do not use bends and fittings together.

3.18.l All conduit connections made to enclosures housing electrical devices (e.g. DDC panels, transformers, etc.) shall be made on the sides or bottom end of the enclosure. No openings of any kind shall be made to the top side of such enclosures.

3.19 Installation of Motor Starters and Accessories

3.19.a Provide magnetic starters for new motorized equipment.

3.19.b Provide an identification nameplate for each motor starter.

3.20 Installation of Variable Frequency Drives

3.20.a Install each VFD in accordance with manufacturer's recommendations and local, provincial and national safety codes.

3.20.b Use motors with a minimum of CLASS F insulation. Motor shall be rated for inverter duty.

3.20.c Provide verification and start-up certificate from the VFD supplier for each unit supplied. Incorporate these certificates in the Documentation Manuals.

3.20.d Install floor mounted units on 100mm (4") thick concrete pad extending a minimum of 100mm (4") beyond the foot print of the unit. Chamfer all pad edges to avoid spalling.

3.21 Equipment Enclosures and Locations

3.21.a Provide new enclosures for all field equipment (e.g. DDC panels, transducers, relays, etc.). Enclosures shall be equipped with a hinged door and latch. Provide a TDSB-standard key/lock set for each enclosure.

3.21.b Existing enclosures can be reused if they are in good condition and meet the requirements of 3.21.a

3.21.c Mount all enclosures in serviceable areas of mechanical rooms, storage rooms or janitor closets. Obtain written approval of the mechanical consultant prior to mounting any enclosure in ceiling spaces or more than 5'-6" above the finished floor.

3.21.d All transformers and power supplies for control equipment shall be installed in new dedicated metal cabinets with hinged, lockable covers located in the proximity of their dedicated controller cabinets.

3.21.e Include within a DDC panel enclosure one 120 VAC duplex receptacle for portable PC power, if the controller cabinet is located further than 5'-0" from the nearest wall receptacle.

3.21.f Ensure that enclosures are sized to allow for ease of servicing of all equipment contained within. Enclosures containing DDC panels shall be sized to allow for the installation of the maximum allowable number of expansion panels/boards. Do not mount other equipment in a manner that may interfere with the future installation of expansion panels/boards.

3.21.g For enclosures containing pneumatic transducers or devices, provide one pressure gauge (1-1/2" dial, 0-30psi) for the main air line supply.

3.22 Identification and Labelling of Control Equipment

3.22.a All lamacoids must be minimum 3"x1".

3.22.b All installed field sensors and control devices must have lamacoids on or adjacent to them and visible from the ground.

Lamacoids are required to indicate point name, controller address and point address.

Lamcoids must be secured by adhesive or tie-wrap for indoor applications and by screws where mounted outside of the building, in un-heated spaces, in high humidity areas or where subject to vibration.

3.22.c All controllers and panels require a lamacoid indicating designation and function (i.e. "BAS Panel 1" or "Relay Panel 3"). Controller lamacoids require indication of equipment controlled and address (i.e. Heating Plant Add 4)

3.22.d All devices within a field enclosure shall be identified via a label or tag.

3.22.e All transformer panels supplied by the BAS contractor must be labelled with a Lamacoid indicating the panel and circuit number that it is fed from (e.g. "120vac fed from LP-2A cct #1).

3.22.f All field control equipment (e.g. relay panels) panels fed from more than one power source must have a warning label on the front cover.

3.22.g All wires shall be identified with the hardware address with a band-type self-adhesive strips or clip-on plastic wire markers at both ends.

3.22.j All BAS panels will be supplied with a point's list sheet (within a plastic sleeve) attached to the inside door.

3.22.k The points list shall identify the following for each point:

a. Panel number.
b. Panel location.
c. Hardware address.
d. Software name.
e. Point description.
f. Field device type.
g. Point type (i.e. AI or DO).
h. Device fail position.
i. Device manufacturer.
j. Model number or reference.
k. Wire tag reference.

3.22.l Where requested by TDSB or the mechanical consultant, provide a wiring diagram affixed to the inside of any relay panel or similar enclosure.

3.22.m Provide laminated wiring diagrams or modify existing equipment wiring diagrams wherever the BAS interfaces to other equipment. (e.g. boilers, chillers, etc.). Securely attach to the inside of the respective control cabinet.

3.22.o Provide lamicoid or machine labels (as outlined above) for all interposing relays or contactors used in control circuits. The labels shall include the related point software name and hardware address

3.22.p Provide a lamicoid label to identify the location of concealed devices above the ceiling space. Mount the label on the ceiling grid t-bar or a permanent surface adjacent to the devices. The label shall contain the wording "BAS Devices Above".

3.22.q Provide lamicoid labels for all auxiliary HVAC equipment (e.g. force flow cabinets, unit ventilators, unit heater, window AC units, etc.) controlled by the BAS. Mount the labels in the vicinity of the existing thermostat or power switch for the unit. The label shall contain the wording "Under BAS Control".

3.22.r Where directed by TDSB or the mechanical consultant, provide any and all additional labelling, diagrams. schematics or instructions as may be required to facilitate the correct operation and maintenance of controlled building systems.

3.23 Systems Hardware Commissioning

3.23.a This contractor shall be responsible for the "end to end" commissioning, testing, verification and start-up of the complete control system hardware including panels, sensors, transducers, end devices, relays and wiring. Where applicable, this shall include any points from an existing and/or re-used automation system in the building.

3.23.b The contractor shall conduct the hardware commissioning at each facility in conjunction with a team of Skilled Trades staff (normally 2 tradespersons) designated by TDSB. The contractor shall supervise the hardware commissioning process and ensure that the Skilled Trades staff are actively participating in all facets this work.

3.23.c When the site hardware installation is 100% completed (including all labelling and documentation), the contractor shall provide written notification to the TDSB Project Supervisor to schedule the hardware commissioning dates for each facility.

3.23.d TDSB reserves the right, at it's sole discretion, to discontinue site commissioning at any time if any part of the site hardware installation is found to be incomplete on the date of commissioning. If this occurs, the Contractor shall assume responsibility for any additional costs related to rescheduling of the site commissioning.

3.23.e The Contractor shall prepare a hardware commissioning report containing the following information and test results:

a. Analogue inputs (i.e. temperatures, pressure, etc.) shall be verified with an approved calibration device. All actual temperature readings should be with +/- 1C of the readings observed at the workstation. Record calibration adjustments and settings.
b. Analogue outputs shall be verified by manually commanding the output channel from the operator workstation to two or more positions within the 0-100% range and verifying the actual position of the actuator or device. All devices shall operate over their entire 0-100% range from a minimum control range of 10-90%. Record the actual output scale range (channel output voltage versus controller command) for each analogue end device
c. Digital outputs shall be verified by witnessing the actual start/stop operation of the equipment under control.
d. Digital inputs shall be verified by witnessing the status of the input point as the equipment is manually cycled on and off.
e. Record all out-of-season or unverified points in the commissioning report as "non-commissioned".
f. Identify any existing equipment (valves, dampers, fan starters, etc..) that are inoperative or require maintenance or repair.

g. The BAS field panel power source shall be toggled on and off to ensure reboot functionality and power down memory retention of all parameters. During the power down test, all controlled system outputs shall go to their fail-safe position.

h. Verify PID loop tuning parameters by applying a step change to the current setpoint and observing the response of the controlled device. Setpoint should be reached in an acceptable period of time without excessive cycling or hunting of the controlled device. Provide a graph of the trend response to setpoint change for important controlled devices (e.g. valves 1-inch or larger, dampers on major air handlers, etc.)

i. Provide confirmation that a series of test alarms has been successfully received at a designated remote monitoring workstations.

3.23.f Include with the hardware commissioning report a site floor plan indicating the location of all equipment installed in concealed or recessed locations (e.g. interposing relays in ceiling spaces).

3.23.g Provide testing of all LAN cabling to ensure that 100Mb bandwidth is supported.
Verify conformance with TIA /EIA TSB-67 - Basic Link Test using a Level 2, bi-directional tester. Provide all equipment necessary to carry out the required tests.

3.23.h The hardware commissioning report must be signed and dated by the Contractor's technician performing the tests and participating TDSB trades staff.

3.23.i At the completion of site commissioning, submit four (4) copies of hardware commissioning report to the TDSB Project Supervisor.

3.24 TDSB Review and Site Report

3.24.a At the completion of the site hardware inspection, TDSB shall issue a site report within ten (10) business days detailing the deficiencies in the as-built documentation, labelling, hardware, programming and graphics.

3.24.b The contractor shall respond to the site reports detailing when all the items have been completed or addressed.

3.24.c Upon completion of all the site report items being addressed, TDSB will issue a certificate of completion.

3.24.d Any deficiency item missed in an previous site report revision can be added to a later site report revision.

3.24.e Any items missed during the site report do not relieve the contractor of their responsibility to comply with all standards during the warranty period.

3.25 Training

3.25.a Provide four (4) hours of operator training per facility. The allocation of training hours and the number of participants shall be determined by TDSB. The training hours may be divided over several training sessions. The number of trainees to be determined by TDSB but shall not exceed 8 for any one session. Training may take place on site, at another TDSB location, at the Contractor's office or any combination thereof.

3.25.b During training, the contractor shall work with the caretaker to setup occupancy schedules for all equipment (ie. new and existing) at the facility. Equipment schedules for individual zones must reflect zone occupancy. For example, classroom schedules should only be occupied during normal school hours (i.e. M-F 7:00 AM to 5:00 PM).

3.25.d Provide a record of training indicating:
a. Date of training
b. School name and project
c. Names and signatures of participants and trainers
d. Training topics covered
e. Completed check-in protocol

APPENDIX 1 Variable Frequency Drives

A.1 Products

1. Environmental operating conditions: 0 to 40°C continuous. VFD's that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
2. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable.
3. For 600V networks, the input voltage of the VFD shall be rated 500V -10% to 600V + 10% minimum. VFD rated for 575V +/- 10% or less are not acceptable.
4. All VFDs shall have the following standard features:
   a. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
   b. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
   c. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital

input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

d. The VFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
e. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
f. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
g. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
h. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
i. The VFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add AC line reactors.
j. The input current rating of the VFD shall be no more than 3% greater than the output current rating.
k. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
l. The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signalling a false under-load condition.
m. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
n. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

5. All VFDs to have the following adjustments:

a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
b. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the VFD keypad, analogue inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analogue input and modulate one of the analogue outputs to maintain setpoint of an independent process (e.g. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input.
c. Two (2) programmable analogue inputs shall accept current or voltage signals.
d. Two (2) programmable analogue outputs (0-20ma or 4-20 ma). The outputs 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.
e. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows:
f. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate).
g. When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to an VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided.
h. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.
i. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be 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. Outputs shall be true form C type contacts; open collector outputs are not acceptable.
j. Seven (7) programmable preset speeds.
k. Two independently adjustable acceleration and deceleration ramps with 1 – 1800 seconds adjustable time ramps.
l. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

m. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without de-rating the VFD or operating at high carrier frequency only at low speeds.
n. The VFD shall include password protection against parameter changes.

6. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall utilize the following assistants:

   a. Start-up assistants
   b. Parameter assistants
   c. Maintenance assistant
   d. Troubleshooting assistant

7. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

   a. Output Frequency
   b. Motor Speed (RPM, %, or Engineering units)
   c. Motor Current
   d. Calculated Motor Torque
   e. Calculated Motor Power (kW)
   f. DC Bus Voltage
   g. Output Voltage

8. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analogue/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

9. Serial Communications

   a. The VFD shall have an RS-485 port as standard. The protocols shall be **BACnet**. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.

   b. The BACnet connection shall be an RS485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

a. Data Sharing – Read Property – B.
b. Data Sharing – Write Property – B.
c. Device Management – Dynamic Device Binding (Who-Is; I-AM).
d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
e. Device Management – Communication Control – B.

If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.

c. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, acceleration/deceleration time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (re-settable), operating hours (re-settable), and drive temperature.

d. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analogue input and analogue output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.

e. The VFD shall allow the DDC to control the drive's digital and analogue outputs via the serial interface. This control shall be independent of any VFD function. For example, the analogue outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analogue inputs shall be capable of being monitored by the DDC system.

f. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value control, etc. Both the VFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The VFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.

10. All VFD's through 60HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad.

11. OPTIONAL FEATURES to be provided are:

2. Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed and CSA Approved by the drive manufacturer as a complete assembly and carry a UL508 and CSA label.
3. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection and shall be provided in both drive and bypass modes.
4. Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
5. Fused VFD only disconnect (service switch). Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable.
6. The drive / bypass shall provide single-phase motor protection in both the VFD and bypass modes.
   The following operators shall be provided:

   a. Bypass Hand-Off-Auto
   b. Drive mode selector
   c. Bypass mode selector
   d. Bypass fault reset

7. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.

   a. Power-on (Ready)
   b. Run enable (safeties) open
   c. Drive mode select damper opening
   d. Bypass mode selected
   e. Drive running
   f. Bypass running
   g. Drive fault
   h. Bypass fault
   i. Bypass H-O-A mode
   j. Automatic transfer to bypass selected
   k. Safety open
   l. Damper opening
   m. Damper end-switch made

8. The following relay (form C) outputs from the bypass shall be provided:

   a. System started
   b. System running
   c. Bypass override enabled
   d. Drive fault
   e. Bypass fault (motor overload or under-load (broken belt))
   f. Bypass H-O-A position

9. The digital inputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.
10. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes (not functional in Fireman's Override 2). The remote start/stop contact shall operate in VFD and bypass modes.
11. Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman's override. Two modes of operation are required.

    a. One mode forces the motor to bypass operation and overrides both the VFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.
    b. The second fireman's override mode remains as above, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs to the system (run until destruction).

12. The VFD shall include a "run permissive circuit" that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.
13. Class 20 or 30 (selectable) electronic motor overload protection shall be included.
14. There shall be an internal switch to select manual or automatic bypass.
15. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.
16. Startup:

Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner.

Provide an allowance for the factory-authorized technician of one site visit of one day to train operating staff in the operating and maintenance of the drive.

For the duration of the warranty period, provide a call back within 30 minutes of receiving an emergency call for service and provide on-site service within two (2) hours.

CONTENTS

SECTION	TITLE
26 05 00	Common Work Results for Electrical
26 05 01	Basic Materials & Methods
26 05 20	Electrical Panelboards
26 05 73	Short Circuit, Coordination & Arc Flash Study
26 50 00	Lighting Systems
26 52 13	Emergency Lighting Systems
26 52 15	Lighting Controls
27 51 16	Integrated Public Address & In-House Phone System

END OF SECTION

1.1 REFERENCES

.1 Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

1.2 APPLICATION

.1 This Section applies to and is a part of all Sections of the Electrical Contractor.

1.3 WORK INCLUDED

.1 Sections of these Electrical Specifications are not intended to delegate functions nor to delegate work and supply to any specific trade and the work shall include all labour, materials, equipment and tools required for a complete and working installation as described.

1.4 INTENT

.1 Mention herein or indication on drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated and; performance of each operation prescribed with furnishing of necessary labour, equipment and incidentals for Electrical Trade, The Electrical Contractor.

.2 Supplementary to definitions established are:

1. "Concealed" means hidden from normal sign in furred spaces, shafts, ceiling spaces, walls, or partitions. Wiring, raceways, and electrical boxes for all new or relocated devices shall be concealed.

2. "Exposed" means work normally visible, including work in equipment rooms, tunnels, and similar spaces.

3. "Provide" (and all tenses) means supply and install for a complete, operational, and code-compliant system, including all devices/equipment as specified complete with wiring, raceways, electrical boxes, and all other accessories or components required for a complete, operational, and code-compliant installation.

4. "Install" (and all tenses) means secure in position, connect as specified, test, and verify.

5. "Supply" means to supply all devices/equipment to the responsible trade.

6. "Remove" means to isolate, disconnect, disassemble, remove, and dispose of all devices, equipment, wiring, raceways, and connections to other equipment. Patch and make good all surfaces affected by the removal. Remove and dispose of all redundant material off site

.3 Where used, wordings such as "approved, to approval, as directed, permitted, permission, accepted, acceptance", shall mean: approved, directed, permitted, accepted, by authorized representative of the Owner.

.4 Equipment and installation provided under this Division shall conform to applicable standards and regulations of the following organizations:

Canadian Standards Association (CSA)
Underwriter's Laboratories of Canada (ULC)
Ontario Electrical Safety Code (OESC)
Electrical Safety Authority (ESA)
Ontario Building Code (OBC)

1.5 WORKMANSHIP

.1 Workmanship and method of installation shall conform to best standards and practice. Where required by local or other By-Laws and Regulations, tradesmen shall be licensed in their trade.

1.6 TEMPORARY & TRIAL USAGE

.1 Temporary or trial usage of any equipment or materials shall not be construed as evidence of acceptance of same and no claim for damage shall be made for injury to or breaking of any part of such work which may be so used..

1.7 BY-LAWS & REGULATIONS

.1 Work shall conform with latest rules, regulations and definitions of Canadian Electrical Code and applicable Municipal and Provincial Codes and Regulations, and with requirements of other authorities having jurisdiction in the area where work is to be performed. Minor changes required by an authority having jurisdiction shall be carried out without change to the Contract amount. Standards established by drawings and specifications shall not be reduced by applicable codes or regulations.

1.8 PERMITS & FEES

.1 File Contract Drawings with proper authorities and obtain their approval of installation and permits for same before proceeding with work. Prepare and submit necessary detailed shop drawings as required by Authorities.

.2 Pay all fees in connection with examination of drawings, permits, inspections and final certificate of approval.

.3 All ESA Costs shall be included in the Electrical Contractor's Base Tender Price.

1.9 CERTIFICATES

.1 Furnish necessary certificates as evidence that work installed conforms with laws and

regulations of authorities having jurisdiction.

1.10 GUARANTEE - WARRANTY

.1 All material and labour provided as a part of the project shall be warrantied for a period of twelve (12) months starting from the Date of Substantial Completion for the Project.

1.11 SPECIFICATIONS, DRAWINGS & JOB CONDITIONS

.1 Electrical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to electrical work or equipment locations to accommodate structural conditions. Equipment locations may be altered by Engineer without extra charge provided change is made before installation and does not necessitate major additional material.

.2 Examine site and local conditions. Examine carefully all drawings and complete specifications to ensure that work can be satisfactorily carried out as shown. Before commencing work, examine the work of other Sections and report at once any defect or interference affecting the work, its completion or warranty. No allowance will be make later for any expense incurred through failure to make these examinations or to report any such discrepancies in writing.

.3 Relocate equipment and/or material installed but not coordinated with work of other Sections as directed, without extra charge.

.4 Furnish "built-in" items in ample time and give necessary information and assistance in connection with building-in of same. Notify Section concerned in writing of size and location of recesses, openings and chases at least 48 hours before walls are erected, floors poured and similar work.

1.12 TENDER & SUBSTITUTIONS

.1 The Base Tender Price shall be submitted based on the Base Specified Manufacturer as listed on the Drawings and/or Specifications. Any manufacturers listed as "equal" or "equivalent" may be proposed as an alternate to the Base Specified Manufacturer prior to Contract Execution with written approval only by the Consultant and Owner. Any changes to the Manufacturer of any materials/labour after execution of the Project Contract is not permitted.

.2 Substitutions for materials may be proposed by submitting details with Supplementary Tender Form together with price difference to Stipulated Sum Tender amount under the following conditions:

1. Product name shall be stated together with price difference, if any, to stipulated sum for each substitution proposed.

1.13 INTERFERENCE DRAWINGS

.1 Prepare and submit complete interference drawings (in PDF format) to avoid and/or resolve conflict of trades and to coordinate the work of the Electrical Division with that of all other Trades. Submission of interference drawings shall be done no later than 20 business days after the Project has officially begun. The cost of producing the interference drawings shall be included for in the Base Tender Price.

.2 Interference drawings shall indicate exact arrangements, of all areas and equipment to scale with dimensions.

.3 Cooperate with work of the Mechanical Contractor and provide data requested and as required in the preparation of interference drawings for the work of The Mechanical Contractor.

.4 Make interference drawings in conjunction with all parties and trades concerned showing sleeves and openings and passage of electrical work through building structure. Drawings shall also show inserts, special hangers and other features to indicate routing through confined spaces, installation of equipment in such areas.

.5 Provide detail drawings, fully dimensioned, of equipment in Boiler and Mechanical Equipment Rooms, Electrical Rooms, Fan Rooms, etc. Base equipment drawings on approved Shop Drawings and include, but do not necessarily limit to, details pertaining to access, clearances, sleeves, connections, etc.

.6 Provide detail drawings of pulling pits, equipment bases, anchors, floor and roof curbs, etc., pertaining to Electrical work.

1.14 SHOP DRAWING MATERIAL & LISTS

.1 Prepare and submit shop drawings and lists of materials for review in accordance with Architectural Sections. Make submittals of more than two pages in booklet form. Individual and loose drawings will not be accepted for review.

.2 Prior to equipment fabrication, delivery or installation, submit complete lists of materials proposed, indicating manufacturer, catalogue numbers and complete performance data.

.3 Review of Shop Drawings by Consultant is for sole purpose of ascertaining conformance with general design concept. This review shall not mean that Architect and/or Engineer approves detail design inherent in Shop Drawings, responsibility for which shall remain with Contractor and such review shall not relieve Contractor of his responsibility for meeting all requirements of Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of work with all trades.

.4 Shop drawings transmitted via facsimile (fax) machines, or copies of same, will not be accepted for review.

1.15 RECORD DOCUMENTS

.1 Conform to General Requirements. Maintain at least two (2) sets of documents and clearly mark in RED on same as job progresses, changes and deviations from work shown so that on completion Owner will have records of exact location of ducts and equipment and record of material and equipment changes.

.2 Record all homerun conduits, junction boxes for complete lighting, power and systems on As-Built Drawings.

.3 Contractor shall obtain clean set of prints from Consultant at start of Contract Work and shall keep these prints up-to-date at jobsite, accurately recording all changes made on project and locating all services, equipment, etc. which may have been shown only diagrammatically on Contract Documents.

.4 Contractor shall ensure that as-built information is accurately recorded and shall check same. As-Built drawings shall be reviewed with Consultant at each jobsite meeting.

.5 Upon completion of Contract Work, prior to Substantial Performance inspection and after final review with Consultants, Contractor shall neatly transfer recorded information and make final As-Built submission to Consultant in the following form:

- One (1) set of clean, legible prints.
- Updated AutoCad 2004 drawings. The cost of transferring all redline markups from the PDFs to the CAD files is the responsibility and cost of the Contractor.

.6 Consultants shall be responsible for reviewing As-Built information provided by Contractor. Revise drawings to suit any comments until acceptable for submission to the Owner.

.7 The Contractor is responsible for incorporating all information from Project Addenda, Contemplated Changes Notices, Site Instructions, Change Directives and as-found existing conditions into CAD format at no extra cost to the Contract.

1.16 JOB SITE WORK SHOP AND STORAGE

.1 Supply job site office, workshop, tools, scaffolds and material storage as required to complete the work of this Division. Location of temporary buildings, use of space on site or within building shall be to later direction.

1.17 PROTECTION

.1 Securely plug or cap open ends of electrical raceways or equipment to prevent entry of dirt, dust, debris, water, snow or ice. Clean all equipment inside and outside before testing.

.2 Equipment stored on site shall be protected from weather and kept dry and clean at all times. Take care to avoid corrosion of metal parts.

.3 Protect work installed from damage. Secure all unfinished or loose work to prevent movement.

1.18 INSTRUCTIONS TO OPERATOR

.1 Instruct Building Operators in repair, maintenance and operation of Electrical Systems and associated equipment.

.2 Supply three (3) full Operation and Maintenance Instructions each in stiff cover, three-ring binder suitably indexed, separated and labeled. Operate each item of equipment in presence of Operators to ensure understanding of working parts and function of each item of equipment. Supply one complete set of "Reviewed" Shop Drawings in separate hard cover binder suitably separated and labelled for Owner's use.

.3 Operation and maintenance manuals shall be carefully prepared in co-operation with equipment manufacturers and include miscellaneous parts necessary for proper, efficient operation of all equipment.

.4 Manuals shall also include spare parts list for each type of equipment, component, control and device installed together with manufacturer's name and address so such items can be suitably identified and purchased. Include list of recommended spares.

1.19 CLEANING, LUBRICATION AND ADJUSTMENT

.1 Immediately prior to completion of work:

1. Remove all dust, dirt and other foreign matter from internal surfaces of enclosed electrical apparatus and equipment.

2. Remove all temporary protective coverings and coatings, temporary labels.

3. Clean, repair, lubricate and adjust all mechanism and moveable parts of apparatus and equipment leaving it in new condition and operating properly.

4. Balance demand loads for service and distribution feeders within 5 percent upon completion of work and after the building is in full operation.

1.20 INSPECTION AND TESTING

.1 Systems, equipment, and all major items of material shall be tested to the satisfaction of the Architect, and as required to establish compliance with plans and specifications, and with the requirements for the Supply and Inspection Authorities.

.2 Faulty and defective equipment shall be replaced with new materials. Conductors which are found to be shorted or grounded, or to have less than proper insulation resistance, shall be replaced with new conductors.

.3 Tests shall include but are not limited to the following:

1. Test of secondary voltage cables shall include megger tests to establish proper insulation resistance, and phase-to-ground resistance of cables.

2. Proper functioning of all systems.

3. Polarity tests - to establish proper polarity connections to all sockets and receptacles.

4. Test of system neutral to establish proper insulation resistance and isolation of neutral from ground except for required ground connection at Service.

1.21 CERTIFICATE OF TESTS

.1 When work is complete submit three copies of test results and a signed statement listing all tests that have been performed as required by specifications and manufacturer's instructions.

1.22 COMPLETION

.1 Provide receipts from designated representative of Owner for portable and loose materials (e.g. spare fuses, fixture re-lamping equipment and the like).

.2 Provide copy of final inspection certificate from Electrical Inspection Authority and fire alarm verification report.

.3 Provide manufacturers corrected "as built" shop drawings for all major electrical items and systems, including all shop drawings returned for modifications.

1.23 ALTERATIONS TO EXISTING BUILDING

.1 Note that certain alterations and structural changes are to be made to existing building. Architectural drawings and site are to be examined to determine extent of alterations affecting existing electrical systems. Where existing conduits and wires run through areas to be altered, to feed other parts of existing building, they shall be re-routed and reconnected to maintain their original function. Drawings do not necessarily indicate outlets, switches, receptacles, and the like, and other electrical equipment which are required to be relocated or abandoned. Provide decorative blank cover plates for obsolete outlet boxes remaining.

.2 Electrical services and auxiliary services (fire alarm, P.A. intercom, and the like) shall be maintained continuously without interruption. Interruptions to services shall be confined to periods of time to be designated by Architect, and/or Owner's designated representative. Include in tender for temporary connections, overtime labour charges, and such related allowances in order to conform with these conditions.

.3 The Electrical Contractor is responsible for removal, reinstallation, cutting and patching

of ceiling and walls as required in the existing building.

.4 Cutting directly related to electrical work, regardless of whether such work occurs in new or existing construction, shall be coordinated and paid for by Electrical Subcontractor involved, under supervision of Contractor.

.5 Where existing electrical items or systems are demolished and removed from existing construction assemblies, Electrical Subcontractor involved shall be responsible for infilling entire hole left after removal of item or system with new construction assembly to match existing. Where new electrical items or systems are installed through existing construction assemblies, Electrical Subcontractor involved shall be responsible for properly sized and accurate cutting of existing construction assembly to allow installation of new work.

.6 Include all efforts for the tracing and verifying of all branch circuits and panels as required to complete the scope of work proposed on the drawings.

1.24 PROJECT SPECIFIC NOTES

1. Obtain all approvals from public authorities having jurisdiction prior to commencing any work. Include, in the tender price, for all ESA permit and inspection fees. Arrange for and attend all inspections required as per requirements of the Electrical Safety Authority and the Building Department.

2. Examine architectural drawings and specifications and all contract documents before proceeding with the work. Any discrepancies between the drawings and specifications of all disciplines must be referred to the architect before any affected work is commenced.

3. The Electrical Contractor shall furnish all labour, material, tools, equipment, etc. required to complete all work shown on the drawings and as specified in the contract documents. The work shall be performed in accordance with rules and regulations of all authorities having legal jurisdiction over the work. This Contractor shall provide any small items of work not specifically called for but required to complete the intended installation and/or required to achieve the desired intent or functional utility.

4. Perform all work in full accordance with the Ontario Building Code, Ontario Electrical Safety Code, TDSB standards and good practices and the requirements of all other Authorities Having Jurisdiction. All work performed by this division shall be done in accordance with all manufacturer's recommendations. Obtain all available manufacturer's recommendations and comply.

5. All cutting, patching, coring, scanning, xraying, making good and fire stopping required for the work of this division shall be carried out by this division. The electrical contractor is responsible for and shall pay for any and all damage to the building and/or surrounding area incurred by work of this division.

6. Review the designated substances survey provided by the board in detail prior to commencing any work.

7. The Electrical Contractor must review and submit shop drawings for all materials to be supplied as a part of the Contract in conjunction with the General Contractor to the Architect and Electrical Consultant prior to ordering. Order only upon receipt of approval. Order, supply and install as per all comments. The Shop Drawings must be reviewed and ensured for compliance with the Contract Documents by the Electrical Contractor and General Contractor prior to submission; confirmation of review and confirmation that the submittal is in compliance with the Contract Documents is the responsibility of the Electrical Contractor and General Contractor to include in writing with each Shop Drawing Submittal. Any non-conformance of the Submittal with the Contract Documents identified by the Electrical Consultant will require a resubmission of the Shop Drawing Submittal by the Electrical Contractor prior to review. The Electrical Contractor shall bear all costs of any review by the Electrical Consultant beyond the Original Shop Drawing Submission at a cost of $250.00 CAD + HST per resubmission.

8. All materials used throughout shall be new, of best quality, C.S.A. approved, and of one manufacturer. Wherever trade names are not used to describe materials, these materials shall be of the best available quality. Obtain and pay for special ESA inspections of specified non-C.S.A. electrical equipment.

9. Provide all wiring, raceways, electrical boxes, and such components as required for a complete and operational installation.

10. All conduit shall be rigid steel or EMT with gland watertight connectors and compression type couplings, unless otherwise noted. Exposed raceways in finished areas shall be wiremold channels installed neatly in appearance, run parallel to building lines, and concentric right angle bends only shall be used. Exterior exposed conduit shall be rigid galvanized steel. Supply and install access doors as necessary due to the proposed work. All access panel ratings shall match that of the surface in which it is being installed.

11. All access panel ratings shall match that of the surface in which it is being installed. All access panels requiring supply/install as a part of the project work shall be included for in the Base Tender Price.

12. All wiring shall be of minimum #12 gauge copper, except as otherwise noted or as required based on the intended use of the device/equipment. All wiring shall be 600 Volt Type RW90. All wiring shall be run in conduit from the source to the load. BX cable may be used where permitted by code in ceiling space for final connections only and for a maximum length of 5'. Maximum voltage drop shall not exceed 2 percent.

13. Coordinate with all other trades present on site throughout the full course of construction. Lay out of all work so as not to conflict with the work of other trades. Carry out work promptly which may interfere with the work and/or schedule of any other trades.

14. After completion of the work, provide the consultant with a set of 'as-built' record drawings in pdf format prior to submission to the owner. Incorporate all changes in the pdf drawings.

15. Alterations and additions: contractors shall note that this contract is an alteration to an

existing building and as such the contractor shall thoroughly investigate the existing electrical installation and electrical, mechanical, structural, and architectural conditions prior to pricing and construction.

16. Demolition: remove all exposed conduits, branch wiring, outlets, etc. from surfaces being demolished.

17. Cleanup and garbage: the contractor is responsible for maintaining as clean of a work area as possible during construction. The contractor is responsible to clean-up and remove tools from the site at the end of every working day. Disposal of all redundant materials, devices, and equipment is the responsibility of the contractor on a daily basis.

18. All work shall be done with minimum possible interruption to the existing building systems and in the time schedule permitted by the school board. Consult with the project supervisor prior to pricing. Complete the project within the allocated schedule.

19. Paint all exposed conduit and backboxes, inside and outside of the building, to match the surrounding colour. Minimize exterior conduit run where feasible.

20. All backboxes installed indoors shall be wiremold or approved equal. All backboxes installed outside shall be of cast aluminum finish.

21. For all panels where new circuits are added, provide a new typed panel directory based on the new loads. Incorporate all existing circuit information from the existing panel directory on site in the new panel directory.

22. Unless otherwise explicitly stated in writing in the Contract Documents, all materials, labour, scope and descriptions of work described in the Contract Documents is the responsibility of the Electrical Contractor to supply and install as a part of the Base Tender Price. No materials and/or labour is to be completed under the Project Allowances unless explicitly noted as such in the Contract Documents.

23. All new raceways and wiring installed shall be concealed in the new partitions or above drop ceilings. No exposed run of raceway/wiring will be permitted whatsoever in the new construction area. In the existing building, all exposed raceways shall be wiremold unless approved in writing by the Owner.

24. All demolition and new work shall be completed in strict accordance with the Contract Documents with no deviations unless instructed by the Electrical Consultant in writing prior to execution of the work. The Electrical Consultant is not responsible, nor required, to accept any work (regardless of its compliance with code) not completed in accordance with the Contract Documents. The Electrical Contractor will be responsible, at his/her cost, of furnishing a Sealed Letter from a Professional Engineer licensed in the Province of Ontario to accept and assume responsibility for all work not completed in accordance with the Contract Documents. The cost of obtaining this letter and the retaining of the Engineer, including all associated inspection charges, is the sole responsibility of the Contractor.

25. Unless otherwise noted, all devices, equipment, material, supplies, etc. shown on the drawings or otherwise required for a fully operational system as described/illustrated on the Drawings shall be supplied and installed under this Project. It shall not be assumed that any of the devices, equipment, material, supplies, etc. shown on the Drawings are to be provided (in part or in whole) by any other Party.

26. Leave two (2) full sets of As-Built Drawings in full size (36"x48") on site at the conclusion of the project; handover to the Caretaker.

27. Panel directories shall include room numbers and names to identify the location of the device/equipment; obtain the finalized room numbering from the Architect at the time of preparation.

28. Run all raceways/wiring concealed above drop ceilings. Where there is an accessible drop ceiling, raceways shall be run in the accessible drop ceiling.

1.25 CLOSEOUT DOCUMENTS

.1 Coordinate with the General Contractor to submit a comprehensive Closeout Document Package incorporating documents from all trades in one consolidated package. Closeout Documents shall consist of one (1) 3-ring binder hard copy and 3 USBs/CDs. The Electrical Section of the Closeout Documents shall consist of the following:

(a) Electrical Contractor Warranty Letter, signed and dated. Warranty shall be for a period of twelve (12) months starting on the Date of Substantial Completion, except for all Fire Alarm Work which shall be for a period of eighteen (18) months starting on the Date of Substantial Completion.
(b) Project Shop Drawings, in consecutive order of the Consultant's number scheme.
(c) O&M Manuals for all equipment supplied on the project.
(d) ESA Inspection & 'Final' Certificates.
(e) Red-Line As-Builts (by the Electrical Contractor) and CAD As-Builts (completed by the Electrical Consultant in 2004 Format). As-Builts shall include locations of Security-System Expansion Nodes.
(f) Emergency Lighting Letter, signed and dated, stating "The emergency lighting for the project has been supplied and installed in strict accordance with the Drawings, Specifications, Contract Documents, Code Requirements, Manufacturer's Recommendations and the requirement of all Authorities having Jurisdiction. The emergency lighting system as a whole has been tested and confirmed to be in continuous operation for a consecutive period of thirty minutes or more. All emergency lighting has been tested on site and confirmed to provide illumination as per OBC requirements with no deficiencies."
(g) Fire Alarm Installation Letter, signed and dated, stating "The fire alarm system for the project has been supplied and installed in strict accordance with the Drawings, Specifications, Contract Documents, Code Requirements, Manufacturer's Recommendations and the requirement of all Authorities having Jurisdiction. All new devices and equipment has been supplied and installed in accordance with CAN/ULC-S524 and verified as per CAN/ULC-S537."
(h) Emergency Lighting illumination testing results.
(i) Fire Alarm Verification Report.

(j) Lighting Control Commissioning Report, by the Lighting Controls Manufacturer.
(k) Short Circuit Calculation, Coordination and Arc Flash Study Report, Test Report for Switchboard and Thermal Graphic Scan.
(l) Integrated Systems Testing Certification.
(m) Data Cabling Testing Report (receive from TDSB In-House Forces).

1.26 TRAINING & DEMONSTRATION

.1 At the completion of the project, provide a complete training and walkthrough of all new and/or replaced electrical systems provided as part of the project. Participants of the training and walkthrough will be established by the Owner. Responsibilities including the following:
(a) Demonstrate to the appointed Staff the intent of all new devices, equipment and system and how to operate them and maintain them in accordance with the Manufacturer's Requirements.
(b) Provide end-to-end training on how to use the new devices, equipment and systems installed for the School's day-to-day operations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Conform to Section 26 05 00 Common Work Results for Electrical.

1.2 MATERIALS

.1 Materials shall be new, of Canadian manufacture where available, first quality and uniform throughout. Submit tender based on the use of materials and equipment specified, or on the listed acceptable alternate equipment as further detailed.

.2 Electrical materials shall be C.S.A. approved and be so labeled. Material not C.S.A. approved shall receive acceptance for installation by Electrical Safety Authority (ESA) Special Inspections Branch before delivery, and modifications and charges required for such acceptance shall be included in work of this Section. Material shall not be installed or connected to the source of electrical power until approval is obtained.

.3 Confirm capacity, ratings and characteristics of equipment items being provided to supply power to equipment provided under other Sections of the work. Resolve discrepancies before such items are purchased.

1.3 MATERIAL ACCEPTANCE

.1 Acceptance of materials installed presumes that materials have not been damaged or exposed to conditions that would adversely affect performance and life expectancy.

.2 If in the opinion of the Consultant, materials have sustained damage, or have been exposed to abnormal conditions it shall be the responsibility of the Contractor to have such tests performed as deemed necessary by the Consultant to establish condition and therefore, acceptability of installed materials.

PART 2 - PRODUCTS

2.1 RACEWAYS

.1 Rigid galvanized steel conduit shall comply with CSA Specification C22.2 No. 45.

.2 Electrical metallic tubing (EMT) may be used in place of rigid conduit in dry locations subject to governing regulations, embedded in masonry walls, and concealed above suspended ceilings. Connectors shall be of gland watertight EMT type with factory-installed insulated throats and provide compression type EMT couplings (cast fittings/set-screws are not acceptable) to be forged steel.

.3 Rigid PVC conduit shall comply with CSA Specification C22.2 No. 136.

.4 Watertight flexible conduit: "Sealtite" PVC jacketed flexible steel with Hubbell-Kellum strain relief grips; shall comply with CSA Standard C22.2 No. 56.

.5 Surface wall-mounted raceways shall be Wiremold No. 4000 metallic type complete with two channels and all necessary fittings, closers, device modules, etc. Wiremold or approved equal only.

2.2 WIRE & CABLE

.1 Branch wire and cable shall comprise copper conductors, sized as noted, rated 75 deg. C., 600 volt minimum flame retardant insulation, and CSA approved for application.

.2 Wire and cable installed in conduit shall be PVC insulated Type TWH - Flame retardant and comply with CSA Specification C22.2 No. 75.

.3 Use Electrovert "Z-Type" code markers for control & communication conductors.

4. All branch wiring shall be RW90.

5 All feeder cables shall be XLPE RW90.

6. All underground feeders and branch circuits run from and to outdoor environment shall be XLPE RWU90.

2.3 DEVICES

.1 Wiring devices unless otherwise specified herein, or noted, shall be as manufactured by Hubbell, Leviton or Pass & Seymour.

.2 Light Switches for shall be of low-voltage type as scheduled on the Drawings.

.3 Occupancy sensors shall be of low-voltage type as scheduled on the Drawings.

.4 Key-operated switches shall be of low-voltage type as scheduled on the Drawings.

.5 Standard 15 Ampere, 120 volt duplex receptacles generally shall be specification grade Hubbell, Black, CSA #5-15R and tamperproof type throughout the Area of Work.

.6 Special purpose receptacles as noted on the drawings shall be Hubbell Conforming to CSA configurations (Table 46 and Table 47 of Canadian Electrical Code) for non-locking and locking receptacles. Provide attachment cap for each special purpose receptacle.

.7 "Range" receptacles shall be CSA Type 14-50R, 50 amp. 3 pole, 4 wire, grounding 125/250V flush receptacle. Provide the above with 5 foot rubber cord set, 50 amp. and connect equipment.

.8 Receptacles with integral ground fault interrupter shall be Hubbell No. GF-5252 or approved equal.

.9 Service receptacle shall be Hubbell No. 5262-RD.

.10 Clock receptacle shall have recessed fitting. Leviton No. 5261/CH. Mount as per the Modular Control Panel detail.

2.4 DEVICES - SPECIALIZED

.1 Flush floor boxes shall be Hubbell Cat. No. 3SFB-SSC 3-service box complete with devices shown on drawings.

.2 Provide low-voltage lighting control, as detailed.

2.5 DEVICE COVER PLATES

.1 Switch and receptacle and other device faceplates for flush mounted devices, generally shall be single or multi-gang as required, type 301, stainless steel, #4 brushed finish with removable protective covering.

.2 Weatherproof enclosures for outdoor receptacles shall be P&S 4600 with 4600-26 Mounting Plate, duplex ground fault receptacles and two #4609 Keys.

.3 Cover plates for other devices such as flush fan controls, telephone, etc., shall be stainless steel to match above.

2.6 PANELBOARDS

.1 See Section 26 05 20 for details.

2.7 SWITCHES

.1 Provide fusible and non-fusible switches, NEMA Type `HD' with quick-make, quick-break contacts, horsepower-rated where required, to match the motor protected. Provide holders to accept specified fuses. Switches to include mechanical cover interlocks and line side barriers.

.2 Where applicable and available, switches shall be CSA "Approved For High Service Factor".

.3 Provide safety disconnect switches adjacent to motors and other equipment when required by regulations.

2.8 FUSES

.1 Provide fuse holders in fusible equipment with a complete set of proper size Form 1, HRC Nema J or L current limiting fuses. Fusible equipment so provided shall be adapted to reject CSA Standard C22.2 No. 59 fuses. Fuses shall be Federal Pioneer - "Econolim".

.2 Provide one complete set of spare fuses for each rating and type used, unless otherwise scheduled.

.3 Apply Thomas & Betts "Kopr/Shield" conductive anti-seize compound to all fuse ferrules and holders.

2.9 CLOCKS AND PROGRAM BELLS

.1 Clocks to be synchronized analogue type 12" round surface mount on the Modular Control Panel with a white face, Black Finish Case, 12/24 hour, seep second hand, stem for correcting extended through bottom of housing, 120VAC.

Clock shall be American Time R54BHAV904-WEB complete with mounting bracket/hanger or approved equal.

.2 Program Bells shall be fully recessed, in a recessed stainless steel wall box complete with stainless steel, vandal resistant grille for physical proection. The Contractor shall verify the existing bell circuit voltage and wiring and ensure that the proposed device will suit the existing voltage and wiring configuration. Bells shall be of vibrating type, NEMA 3R rated, 10" size and CSA Certified.

Bell shall be Edwards 340-10N5 (verify voltage and AC/DC configuration of the existing bells on site prior to ordering; order new to match the existing) complete with recessed wall box and stainless steel grille c/w brushed stainless finish.

PART 3 - EXECUTION

3.1 EQUIPMENT LOCATIONS

.1 Approximate locations of electrical equipment, fixtures switches, outlets, and the like,

are given on the drawings. Refer to the architectural drawings and room elevations for application. In absence of definite detail exact location of outlets shall be determined on site as work progresses.

.2 Device plates shall cover opening left for outlet box, and plates shall be attached to boxes in an approved manner. Outlets and fixtures are to be located symmetrically, (i.e. centered in wall panels, ceiling panels or tiles, columns, between and above doors and the like).

.3 The right is reserved to alter the location of equipment and outlets a distance of up to 3 metres without involving a change to the Contract amount, providing notice is given prior to installation.

3.2 MOUNTING HEIGHTS

.1 Mounting heights of outlets, center of outlet to finished floor, except for exposed masonry construction, shall generally be as follows:

Light Switches - 1100 mm
Receptacles - 450 mm

Television Outlets - 400 mm
Data/Telephone Outlets - 400 mm
Manual Fire Alarm Stations – 1,150 mm
Panelboards – 2,000 mm to top of trim for standard panels.
Clocks - 2000 mm or 300 mm below ceiling (except where mounted in a Control Panel).
Thermostats – 1,200 mm
Fire Alarm Audible Temporal Pattern Horn/Strobes – As per CAN/ULC-S524.

3.3 HOLES & DRILLING

.1 Pneumatic hammers and percussion drills are prohibited.

.2 Where not sleeved, make holes through concrete walls and floors by core-drill only. Obtain Architect's approval before drilling.

.3 Seal holes and sleeves through floors to serve as water dam.

3.4 CUTTING & PATCHING

.1 Layout and install work in advance of other Sections for all new work. Bear all costs resulting from failing to comply with this requirement.

.2 Pay for cutting and patching and making good as required for work of this Division by reason of faulty or late work. Employ appropriate trades already engaged on the site to perform such cutting, patching and making good existing walls, floor, ceiling, etc. Before commencing, obtain Architect's approval for extent and nature of cutting. Make

good, disturbed surfaces to the Architect's approval.

3.5 EXCAVATION & BACKFILL

.1 Provide necessary excavating and backfilling inside and outside building required for work of this Division, performed as specified under another Division of the work, except as modified below.

.2 Keep excavations free from water, pump as necessary.

.3 Excavation for underground services shall be to required depths and dimension and shall be prepared as required, so that no portion of any conduit, bears directly against any rock or other hard surface.

.4 Remove and dispose of all surplus excavated material.

.5 Backfill promptly after approval of work. Prevent damage to or displacement of walls, piping, conduits, waterproofing and other work.

.6 For direct buried conduit and cable in all soil conditions excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the cable run. Fill back with a bedding

of sand.

.7 Backfill trenches within building, with clean sharp sand in individual layers of maximum 150 mm (6") thickness, compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum one foot. Hand or machine compact the balance up to grade, using approved equipment.

.8 Backfill trenches outside buildings with granular `A' gravel in layers not exceeding 150 mm (6") thickness, compacted to 100% Standard Proctor density up to grade level; manual compaction up to 450 mm (18") and mechanical compaction, using approved equipment, for the balance.

.9 Make good work where damaged by excavation and filling work of this Division. Repair any subsequent settlement of fill placed under this Division and pay all costs in replacement of other work damaged by such settlement and restoration.

3.6 CONCRETE WORK

.1 Provide concrete work where required for work of this Division in accordance with applicable requirements specified in Concrete Division 3.

.2 Provide concrete Lighting Standard Bases, required for the work of this Division. Refer to detail on drawings.

.3 Provide concrete Duct Banks required for the work of this Division. Refer to detail on drawing for typical construction details.

.4 Reinforced concrete duct banks shall be keyed into sides of foundation walls. Extend and connect reinforcing steel of duct banks to reinforcing steel of foundation wall construction to prevent failure at the junction of the pipe support and wall.

.5 Provide 100 mm (4") high housekeeping pads for all floor mounted electrical equipment, such as switchboard, distribution panels and transformer, etc.

3.7 HANGERS & INSERTS

.1 Provide necessary hangers and inserts for work of this Division.

.2 Fasten to cast-in place concrete by suitable drilled or cast-in inserts.

.3 Fasten to structural steel using bolts or welded fasteners.

.4 Do not use wood, chain, wire lashings, strap or grappler bar hangers except where noted or detailed.

.5 Support fixtures independently of ceiling suspension systems. Provide additional supports as required, which shall be fastened to building structure steel members, joists, beams, etc., but not metal pan or roof decking. Material for additional supports and their

installation shall comply with requirements of U.L.C. Refer to "List of Equipment and Materials" Vol. 2, and "Supplement" for application to rated assemblies.

.6 Support outlet and junction boxes independently of the conduits running to them where required by electrical code and where deemed necessary by the Architect, use steel angle brackets or steel rods to support outlets and fixtures, to the building structure.

.7 Drilled fastenings to concrete shall be self-drilling concrete anchors, Phillips 'Red-Head' or approved equal. The maximum weight per fastening shall not exceed 25% of manufacturer's 'pull-out' load data.

.8 Surface mounted or stem suspended fixtures fastened to non-removable ceilings, 2 hr. fire rated ceiling assemblies, or mounted between metal suspension of exposed T-grid ceilings, shall be provided with minimum of two points of attachment for each 300 mm x 1200 mm (1' x 4') luminaire, using metal `channel-bar' fastened to building structure. Attach luminaires to `channel-bar' by means of threaded steel rods. Channel-bar shall be adequately supported and of a construction to prevent deflection under load, as selected from manufacturer's published data, and to Architect's approval. `Channel-bar' shall be Unistrut, Burndy, Flexibar, Cantrough or Canadian Strut Products or approved equal.

.9 Use support clips (e.g. Caddy Type IDS) for suspension of fixtures attached to exposed T-grid ceilings. Clips shall be supported directly from building structure and not from suspended ceiling system.

.10 Provide recessed fluorescent fixtures with support frames, and plastering frames where applicable.

.11 Chain where permitted and specified for the installation of fluorescent lighting fixtures shall be No. 4, 2 mm (.080") Tenso Pattern coil steel chain, plated with a strength of 82 kg (180 lbs.) as manufactured by Dominion Chain Co. Ltd. or approved equal. Where 'S' hooks are used with chain, they shall be No. 6 type with open strength of 82 kg (180 lbs.) minimum. Attachment of chain at both ends of support shall develop full strength of chain.

.12 Support outlet boxes, junction boxes, conduit and the like, mounted on exposed steel deck roofing by means of self-tapping minimum #10 gauge screws, secured through bottom member of deck corrugation. Do not pierce top of steel deck.

3.8 PAINTING

.1 Hangers, support framing and all equipment fabricated from ferrous metals which are not protected with zinc or other suitable corrosion-resistant finish shall have at least one coat of a corrosion-resistant paint applied before shipment or immediately on arrival at the site.

.2 After installation, touch up all scratches, chips, other damage and defects in paint, using zinc chromate primer or paint or special enamels as necessary to match the original.

.3 Finish and colour of all equipment shall be coordinated to provide uniform appearance.

.4 Painting of conduits and supports and other exposed surface work will be done under Painting Section except as noted. Install materials in time to be painted together with mounting surfaces.

.5 Do not paint over nameplates.

.6 Refer to other Sections for special paint finishes of equipment.

3.9 NAMEPLATES & SCHEDULES

.1 Identify electrical equipment supplied under this Division with 3 mm thick black laminated plastic nameplate to indicate equipment controlled to provide instruction or warning. Fasten each plate with two chrome plated screws. Lettering shall be 6 mm high for small devices such as control stations and at least 13 mm high for all other equipment. Submit a list of proposed nameplates for approval before manufacture.

.2 Provide panelboards with typewritten schedules identifying outlets and equipment controlled by each branch circuit including existing panels being changed. Protect schedules with non-flammable clear plastic.

.3 Identify junction boxes, pull boxes, cover plates, conduits and the like, provided for future extension, indicating their function (e.g. power, fire alarm, communication).

.4 Verify room names and numbers prior to listing on nameplates and schedules.

3.10 BRANCH CIRCUIT WIRING & FEEDER CABLES

.1 Provide branch circuit wiring, conduits and feeders as required for Lighting, Power and Auxiliary Systems. Separate conduit systems shall be provided for feeder, lighting and power systems, for exit light system and auxiliary communication systems.

3.11 CONDUIT, RACEWAYS AND WIREWAYS

.1 Wire and cable shall be installed in conduit as follows:

Rigid galvanized steel conduit shall be used:
.1 Where noted and required by regulations.
.2 Where subject to mechanical damage.
.3 For all exposed conduit work.

.2 Electrical metallic tubing (EMT) may be used in place of rigid conduit in dry locations subject to governing regulations, embedded in masonry walls, and concealed above suspended ceilings. Connectors shall be of gland watertight EMT type with factory-installed insulated throats and provide compression type EMT couplings (cast fittings/set-screws are not acceptable) to be forged steel.

.3 Use flexible metallic conduit for connections to chain suspended and recessed fixture drops, motors and similar equipment to prevent transmission of vibration. A code-gauge green grounding conductor shall be provided for all such connections. Use "Sealtite" conduit with Hubbell-Kellum Sealtite conduit strain relief grips for all such connections at motors.

.4 Fasten every conduit and cable to structure by means of approved conduit clamps or clips. Wire lashing is not acceptable.

.5 Conceal conduits and wiring except where noted. Run exposed conduits parallel to building lines and to other conduits. Provide every empty conduit with a pull rope (3 mm polypropylene rope) and identify to designate its function (Power, Telephone, Fire Alarm and the like).

.6 Where conduit is installed in concrete slabs, obtain general approval, prior to commencing the work, on both maximum dimension and cross-overs which may be used therein.

.7 Install conduits in such a manner as to conserve head room and interfere as little as possible with free use of space through which they pass. Obtain approval for routing of same. Keep conduits at least 150 mm clear high temperature work.

.8 Conduit installed at the roof level of exposed structures, shall be run tight to roof deck, above purlins and beams.

.9 Conduit and cables for electrical work in demountable type and drywall type partitions shall enter from above, from a junction box concealed in the ceiling above and shall comprise a flexible conduit connection.

.10 All branch wiring shall be provided with a separate code gauge supplementary grounding conductor run in each conduit or duct, terminating at ground block at panelboards.

.11 Run conduit exposed in mechanical equipment rooms, electrical rooms, fan rooms, and the like, and installed after mechanical and other equipment is completed. Install fixtures, outlets, starters, etc., to clear and to suit application.

.12 Wiring, boxes, conduit fittings, etc., in hazardous areas shall conform with Ontario Electrical Code, covering explosion-proof areas. Provide conduit seals where required by these regulations.

.13 Provide housekeeping curbs around exposed conduits feeding panels, disconnect switches, starters, etc. penetrating floors in front of walls.

3.12 WIRE & CABLE

.1 Wire and cable shall not be installed at temperatures below 20°C unless "minus 40" type is used. Wiring to heating equipment shall be rated 90°C minimum, the ampacity of which shall be limited to 75°C value.

.2 Conductors used for all auxiliary systems (e.g. Fire Alarm) shall be tagged and/or colour-coded, and where applicable shall agree with manufacturer`s wiring diagrams.

.3 Minimum wire size for power wiring shall be No. 12 AWG gauge unless specified otherwise. Minimum wire size for "Common" neutral conductors shall be No. 10 AWG. Control wiring shall be #14 AWG red insulation. Maximum voltage drop between furthest outlet of any circuit, when fully energized, and panel to which it is connected shall not exceed two percent except for electric heating circuits which shall not exceed one percent.

.4 Cables shall be terminated with moisture-proof connectors, clamped to sheet metal enclosure by a single non-ferrous locknut and grounding bushing.

.5 Sheaths of multi-conductor cables shall be grounded at both cable ends.

.6 Sheaths of single conductor cables shall be grounded at supply end only. Provide a Code Gauge Grounding Conductor with each feeder cable run.

.7 Number of wires indicated for lighting and power, motor and motor control, alarm, signal, communications, and auxiliary systems is intended to show general scheme only. The required number and types of wires shall be installed in accordance with equipment manufacturer's diagrams and requirements, and with requirements of the installation, except that specification standards shall not be reduced.

.8 Solderless connectors with nylon-jacketted "Vibration-proof" screw-on wire connectors ideal "Wing Nuts", rated 600 volts shall be used for joints in Branch Wiring.

.9 Use compression joints and terminals for all control wiring; and all conductors #4 AWG and larger. Mechanical connections are acceptable at panelboards and circuit breakers where these are part of factory-assembly.

.10 Wire or cables in feeders, sub-feeders and branch circuits shall be colour-coded in accordance with Ontario Electrical Safety Code. Each end of feeder terminations (e.g. in Switchboard, Panelboards, switches, splitters and the like) Code Phase A - Red, Phase B - Black, Phase C - Blue, Neutral - White.

.11 Use C.G.E. Vulkan X-Link insulated cables for circuits protected by ground fault circuit interrupters.

.12 Include in each conduit, tubing and raceway, a code gauge green supplementary grounding conductor which shall be connected to suitable ground bus in equipment.

.13 Armoured or sheathed cables may be used only for wiring within demountable and dry wall type partitions and if additionally specified or detailed; however it shall not be directly buried in or below concrete slabs.

3.13 OUTLET, JUNCTION & PULL BOXES

.1 Use suitable electrical boxes for terminations and junctions on conduit work. Install pull boxes where necessary to permit installation of conductors. Support pull boxes, outlet boxes, panels and other cabinets independently of conduit.

.2 Provide each light switch, wall receptacle and other device with an outlet box of suitable dimensions and a faceplate. Outlet boxes shall be adapted to their respective locations.

.3 "Thruwall" and "Utility" type boxes shall not be used.

.4 Electrical boxes and panels shall be CSA approved, code-gauge sheet metal, galvanized or with suitable protective treatment. Secure covers with screws or bolts.

.5 Outlet boxes shall not be installed "Back-to-Back" in walls; separate by a minimum of 150 mm.

.6 Use "Masonry Type" outlet boxes for flush installation in masonry walls as detailed on standard Detail Drawings attached hereto.) Standard sectional boxes, 1004, 1104 and the like, shall not be used).

.7 Install surface mounted devices, in cast conduit fittings, with threaded hubs and suitable stainless steel faceplates.

.8 Paint the full length of conduits (installed above accessible and inaccessible ceilings) and main pull and junction boxes (excluding obvious outlet boxes) as per the following colour scheme:

- Lighting	Yellow
- Lighting Controls	Orange
- Power	Blue
- Fire Alarm	Red
- Telephone/Data	Green
- Public Address, Sound and Clock System	Purple

All conduits shall be painted with minimum three (3) coats of paint along the full circumference of the conduit for a clean and consistent finish. Conduits shall be painted prior to installation.

.9 In addition, each box shall be identified with a system and service designator of logic reference to the service.

3.14 ACCESS DOORS & ACCESS MARKERS

.1 Supply access doors for installation under the work of other Divison where electrical equipment requiring maintenance or adjustment or inspection is located above ceilings, within walls or behind furring; except ceilings of lay-in removable panel type.

.2 Access doors shall be 12 gauge hinged metal Stelpro Ltd. or equal #722 flush type, minimum size 300 mm x 300 mm (12" x 12") "Reach-in" 300 mm x 600 mm (12" x 24") "Crawl-in", with prime coat finish, concealed hinges, screwdriver lock and plaster key. Access doors in finished masonry or drywall construction shall be #722 less plaster key. Access doors shall be #726 in acoustic tile ceilings; #704 in drywall ceiling and #726E in plaster ceilings.

.3 Access doors in fire rated ceiling assemblies, all fire rated walls, duct shaft or in corridor walls shall be UL, ULC or WHI listed 1-1/2 hour fire rated access doors equal to LeHage #L1010 or Acudor #150B with screwdriver lock.

.4 Where lay-in removable panel ceilings requiring hold-down clips are used, access doors are not required but panels shall be secured with accessible hold-down clips and marked with Buildemup #6 RH brass paper fasteners inserted through acoustic panel and bent over. paint heads with blue enamel before installation.

.5 Obtain approval for sizes and locations.

3.15 PANELBOARDS

.1 Provide handle locking devices on circuit breakers feeding Plumbing, Heating, Ventilating equipment and controls and all auxiliary systems, time switches, and other devices as noted. Paint handles white, to permanently identify location and function. Provide 30 spare handle locking devices for future use.

.2 Circuit numbers on drawings do not necessarily correspond to the numbers on the lighting panels. Circuits sharing a common neutral shall not be connected to the same main. Panel circuit breakers which are used directly for the switching of lighting fixtures shall be grouped in consecutive numbers commencing at breaker number one.

.3 Use "Panduit" lok-strap cable ties for panelboard branch wiring.

.4 Provide empty conduits from flush panelboards, and others as noted, terminating in accessible ceiling spaces, sized to accommodate spare and space breaker provisions. One 25 mm (1") conduit for each three spare breakers or spaces.

.5 Provide two (2) 1" empty conduits c/w pull strings to the floor below ceiling space.

3.16 ELECTRIC WORK FOR OTHER DIVISIONS

.1 Examine Architectural and Mechanical (Plumbing, Heating, Ventilating and Air Conditioning) plans and specifications to determine extent of electrical work in connection with these Divisions which is to be done under the work of the Electrical Division.

.2 In general, all loose motor starters and associated controls for mechanical equipment will be supplied under Division 16 for installation and connection to both source and load side of the equipment.

.3 Co-ordinate the exact location and verify characteristics of electrical provisions for the work of the Mechanical Division.

.4 Coordinate locations of starters, motors and associated equipment with the work of the Mechanical Contractor's Sections to ensure proper location of equipment. The exact locations of conduit terminations at Mechanical units shall be determined from equipment manufactures' approved shop drawings. Conduits must be installed to enter only in the locations designated by equipment manufactures.

.5 Provide safety switches required for disconnection of remotely controlled motors, and where required at motors by C.E.C. regulations whether shown on the drawings or not. Where required at fan motors, they shall be concealed in the fan housing if possible.

.6 Provide for the 120 volt mechanical equipment where noted, all necessary wiring and connections including wiring and installation of starters, thermostats, aquastats, speed controllers and time switches controlling equipment.

.7 Where motor starters, switches and the like, are grouped together, a suitable 19 mm (3/4") thick plywood panelboard shall be provided to which all such equipment shall be secured. Provide all necessary angle iron supports for support of panelboard and paint entire assembly with two coats of fire retardant type enamel acceptable to Building Inspection Department.

.8 Provide weatherproof unfused safety disconnect switches, fastened to exterior of roof mounted units, to approval.

.9 Connect high temperature thermostats "Firestats" provided in ductwork by the Mechanical Contractor, to exhaust fan systems, to provide fan shutdown on activation.

3.17 GROUNDING & BONDING - GENERAL

.1 Ground and bond all electrical systems in accordance with provisions of the Ontario Electrical Code.

.2 Provide a grounding electrode in accordance with Section 10 of the Canadian Electrical Code.

.3 Install grounding conductors to permit the shortest and most direct path from equipment to ground. Install grounding conductors in rigid galvanized conduit with both conductor and conduit bonded at both ends. Provide bonding jumpers with approved clamps to maintain ground continuity of metallic raceway systems at all expansion joints.

.4 Ground connections to grounding conductors shall be accessible for inspection and made with approved solderless connectors bolted to the equipment of structure to be grounded. Clean contact surface prior to making connections to ensure proper metal to metal contact. Connections shall be of the type that grounds both conduit and conductor, and cap screws, bolts, nuts and washers shall be silicon bronze.

3.18 FIRESTOPPING & SEALING

.1 Make fire rated and/or watertight where applicable seals at sleeves and other opening through floors and walls where conduit/cable passing through. Sleeves to extend minimum 25mm (1 inch) from both ends of the opening.

.2 Provide firestopping protection of openings through floors and fire rated walls and ceiling assemblies. Refer to Architectural Drawings for rated surfaces.

.3 Caulk spaces between conduit, cables, bus ducts, raceways, cabletrays with "Cerafibre" 2300 F packing to Building Department approval. Pack and seal both sides of openings with Electrovert "Flameseal" putty, minimum thickness 25 mm (1"). Install in accordance with Electrovert Instruction Bulletin #3601.

END OF SECTION

PART 1 GENERAL

1.1 RELATED INSTRUCTIONS

1.1.1 Refer to Section 26 05 00, Common Work Results for Electrical.

1.2 SCOPE

1.2.1 Work includes, but not limited to:

1.2.1.1 Providing new Electrical Panels throughout the Project Site as per the Drawings.

1.2.1.2 Obtaining approvals from and cooperation with Authorities having Jurisdiction, before and commencing Work.

1.2.1.3 Preparation of all necessary Working Drawings for submission to Inspection Authorities.

1.3 INSPECTION & TESTING

1.3.1 Systems, equipment and all major items of material shall be tested to the satisfaction of the Consultant, and as required to establish compliance with plans and specifications, and with the requirements for the Authorities having jurisdiction.

1.3.2 Faulty and defective equipment shall be replaced with new materials. Conductors which are found to be shorted or grounded, or to have less than proper insulation resistance, shall be replaced with new conductors.

1.3.3 Tests shall include but are not limited to the following:

1.3.3.1 Test of power cables shall include megger tests to establish proper insulation resistance, and phase-to-ground resistance of cables.

1.3.3.2 Test of all adjustable electrical protective devices of switchgear to establish calibration and operation in accordance with Specifications and approved co-ordination curves.

1.3.3.3 Visual examination of switchgear to determine adherence to allowable manufacturing tolerance and compliance with manufacturer's recommended installation requirements.

1.3.3.4 Proper functioning of all systems.

1.3.3.5 Polarity tests - to establish proper polarity connections to all sockets and receptacles.

1.3.3.6 Calibration setting, and test-tripping, of all protective relays and devices, using "Primary-injection" equipment, in accordance with approved co-ordination schedule.

1.3.3.7 Test of all alarm devices and contacts.

1.3.3.8 Inspection after system is energized shall include infrared thermo graphic examination of

current carrying parts in switchgear, transformers, and at ducts. The Contractor shall cooperate with Inspection personnel, open all equipment enclosures to permit inspection, and make good defective conditions.

1.3.4 Testing Company

1.3.4.1 Retain the services of an independent testing company, to Consultant's approval to perform the above tests.

1.3.4.2 The testing company shall submit test results directly to the Consultant.

1.3.4.3 Include copies of tests in Maintenance and Operating Manual.

1.3.5 Certification of Tests

1.3.5.1 When work is complete, submit three (3) copies of test results and a signed statement listing all tests that have been performed as required by Specifications and manufacturer's instructions.

PART 2 PRODUCTS

2.1 ELECTRICAL PANELS:

2.1.1 Panelboards as scheduled, shall comprise "Branch" panelboards, with fixed bolted connection thermal-magnetic, quick-make, quick-break, 40oC, calibrated ULC rated `SWD' switching duty, molded-case circuit breaker branches. "Plug-in" breakers are not acceptable. Multipole breakers shall be common trip type.

2.1.2 Panelboards shall include the following features:

.1 Flush or surface trim as noted.
.2 Concealed hinges and lockable door.
.3 Combination catch and lock semi flush tumbler type - all keyed alike.
.4 Adjustable self-positioning trims.
.5 Plain trims not displaying any names or Symbols.
"Vault" type handles shall not be used except in unfinished areas.
.6 Typed schedules of circuits indicating equipment and area controlled on the backs of panel doors, in a steel trim pocket, covered with transparent non-inflammable plastic.
.7 Insulated neutral block.
.8 Supplementary ground block.
.9 Copper Bus.
.10 Isolated ground bar, as noted.
.11 Surge-suppression system, as noted.
.12 Sprinkler-proof

2.1.3 Power and Distribution type panelboards shall be breaker type, as scheduled on the drawings.

2.1.4 Unless noted otherwise, panelboards with main breakers or remote controlled switches shall be

provided with an indicating pilot lamp flush mounted in top of face trim which shall be connected to a 15 amp. circuit in the panelboard which shall be locked on and shall serve to indicate when the main breaker is in the closed position. Pilot lamp units shall be LED type or other approved types designed to provide maximum lamp life. Provide lamacoid nameplate to identify main breaker.

2.1.5 Panelboard shall be of circuit breaker type 120/208 Volt, 3 Phase, 4 Wire mains, minimum interrupting rating of 22,000A, RMS symmetrical at 208 volt.

2.1.6 All panels shall be of code gauge steel with prime coat finish for painting. All locks on all panels shall be common to one key and shall also be common to the locks on the distribution panel. The Subcontractor shall be deliver three duplicate keys to the Owners. All panel hardware shall be chrome plated. All tubs shall be a minimum of 6" deep. Where panels are surface mounted they shall be sprinkler-proofed.

2.1.7 Acceptable Manufacturers are:

.1 Eaton (Cutler-Hammer)

or equivalent from:

.2 Schneider (Square `D')

.3 Siemens

PART 3 EXECUTION

3.1 ELECTRICAL PANELBOARDS

3.1.1 Provide complete electrical service as shown on the drawings and as further described here.

3.1.2 Grounding service, equipment, feeders, and the like shall be performed in accordance with Electrical Safety Regulations.

3.1.3 Submit shop drawings of all panelboards prior to ordering.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

1.2 STANDARDS

1.2.1 ANSI/IEEE Standard 242 Recommended practice for protection and coordination of commercial power system most current edition.

1.2.2 ANSI/IEEE Standard 399 Recommended practice for power system analysis most current Edition.

1.2.3 NETA STANDARD ATS 2005: Electrical Acceptance Testing Specification for electrical power equipment and distribution system most current Edition.

1.2.4 NFPA 70-E Standard for Electrical Safety in the Work Place most current Edition.

1.2.5 IEEE STD- 1584 Guide for performing Shock and Arc Flash Hazard Calculations most current Edition.

1.2.6 Canadian Electrical Code most current Edition.

1.2.7 Ontario Electrical Safety Code most current Edition.

1.2.8 CSA Z462 Electrical Safety in the Work Place (Draft).

1.3 SCOPE OF WORK

1.3.1 The Short Circuit; Protection and Coordination and Shock & Arc Flash Studies shall be completed for all distribution system modes of operation;

1.3.2 Normal power distribution operating mode;

1.3.3 The studies need to take into account how the about power distribution system modes of operation interrelate to each other in completion of the studies and recommendations provided with the studies.

1.3.4 The following minimum Utility Design Fault Levels shall be used in completion of the studies:

1.3.5 13,800 volts the minimum Design Fault Level to be used is 500 MVA.

1.3.6 27,600 volts the minimum Design Fault Level to be used is 835 MVA.

1.3.7 The Professional Engineer, licensed to practice in the Province of Ontario, completing the studies shall confirm the noted Design Fault Levels with the Local Power Utility. The above is the minimum that shall be used in the completion of the studies.

1.3.8 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E – 2004 annex D

1.3.9 The power system(s) short circuit; protection and coordination; shock and arc flash studies shall be completed by a Professional Engineer, licensed to practice in the Province of Ontario, specializing in this field. All information required to complete these studies shall be obtained through formal requests to related Trade(s) such as the Local Power Utility and manufacturers supplying the equipment.

1.3.10 Once the required Short Circuit; Protection and Coordination and Shock & Arc Flash Studies have been completed and submitted for review by the Consultant and all clarification have been provided and the reviewed studies have been acknowledged by the Consultant. The recommendations shall be implemented by the Contractor and a letter confirming that the implementations of the recommendations have been completed shall be submitted by the Contractor to the Consultant.

1.3.11 Arc Flash Study shall be focused on achieving incident energy level "Category 2" in the main electrical room; sub electrical rooms; and other associated electrical spaces.

1.3.12 No exceptions shall be permitted with respect to these required studies.

1.3.13 The Study shall be completed by Enkompass Power and Energy Corporation or Brosz Technical Services.

1.4 DESCRIPTION OF WORK

1.4.1 The Contractor shall provide all studies as required by code and as outlined within this Specification section. The studies shall cover all electrical distribution systems and all of the various modes of operation of the electrical distribution systems.

1.4.2 The Study shall be a fully comprehensive study including the following:

.1 All Utility Equipment upstream of the Main Service.

.2 The Main Service Equipment (including the main switchboard/main distribution panel and switch).

.3 All new panelboards, transformers, motor loads and mechanical equipment installed as part of this Project.

.4 All existing panelboards, transformers, motor loads and mechanical equipment throughout the existing School.

1.4.3 No electrical distribution equipment Shop Drawings for any of the electrical distribution systems shall be reviewed by the Consultant prior to the required studies being submitted and the review process with respect to the studies being completed. Should the Contractor order any or all of the electrical distribution equipment they do so at their own risk. Should changes be required to be made to any or all of the distribution equipment the Contractor will cover all costs.

1.4.4 It is important that all requests to related trades such as mechanical, equipment supplier is completed and information obtained in less than ten (10) working days of commencing of contract.

1.4.5 No assumption shall be made where it is possible to obtain the information from the manufacturer and equipment suppliers regarding impedances, protective device time current curves and cable lengths, type and size from the Contractor.

1.4.6 The Contractor will need to provide following information to the Consultant completing the studies:

1.4.6.1 Preliminary types and cable lengths.

1.4.6.2 All of the required equipment data from the electrical equipment vendor(s);

1.4.6.3 All of the required equipment data from the generator vendor(s);

1.4.6.4 All of the required equipment data from the UPS vendor(s);

1.4.6.5 All of the required equipment data from the transformer (power and distribution transformers) vendor(s);

1.4.6.6 All protective device co-ordination curves;

1.4.6.7 All protective device ground fault curves;

1.4.6.8 All damage curves for equipment and cables;

1.4.6.9 All required electrical data for elevators;

1.4.6.10 All required electrical data for mechanical equipment; and

1.4.6.11 Other data as required and requested by the Professional Engineer completing the studies.

The Contractor shall allow for labour, materials and efforts required to obtain the above information from site. It shall not be assumed that the Owner or Consultants or any other parties will provide this information to the Contractor.

1.4.7 The " input data revised or modified " for performing studies will be required to be updated and resubmitted to the Consultant once the Contractor has finalized all of his actual electrical types and feeder lengths.

1.4.8 These studies of high important and shall be completed and submitted within 20 - 25 working days after the letter of intent has been issued to the Contractor.

1.5 SYSTEM PROTECTION AND CO-ORDINATION

1.5.1 Retain one of the designated testing companies who specialize in this type of Work to prepare an equipment coordination study and schedule for all protective devices in the system in cooperation with suppliers of all pertinent switchgears; testing covered under cash allowance.

1.5.2 The firm of testing specialists shall be responsible for calculating short circuit kA rating, checking, adjusting, calibration and setting up of all protective devices in accordance with the values shown in the reviewed coordination study under this Contract.

1.5.3 Coordinate the relays, breakers and fuses to provide selective tripping or blowing. Coordinate the breakers, fuses, protective relaying and ground fault protection so that the breaker or fuse

immediately ahead of a fault will trip or blow clearing the fault and leaving the system ahead of the tripped or blown protective device in the normal operating mode the study must also address the other distribution system modes of operation.

1.5.4 The curves shall be accompanied by the individual time current curves of each device to enable the verification of the ratings and settings used. These coordination curves shall be submitted for review and the various ratings and settings shall be made by the manufacturer's before the equipment is shipped. Review of these coordination curves will not eliminate the responsibility of the Contractor to provide correct protection and coordination.

1.5.5 Co-ordination curves shall be plotted showing the following:

1.5.5.1 Plot utility relays or fuses protecting the incoming service. This information shall be obtained directly from the Local Utility;

1.5.5.2 Main and feeder protection devices at every voltage level;

1.5.5.3 Main and feeder protection devices ground fault curves at every voltage levels;

1.5.5.4 Protection devices associated with the largest motor or refrigeration compressor; and

1.5.5.5 Protection devices associated with the emergency power distribution system; UPS power distribution system and the Co-Generation power distribution system and showing all fault levels.

1.5.6 Each co-ordination time-current curve shall include:

1.5.6.1 A single line diagram for the portion of the system involved;

1.5.6.2 Transformer and cable damage curves where applicable;

1.5.6.3 Available fault current level on the portion of the system involved;

1.5.6.4 Ground fault curves; and

1.5.6.5 Generator fault and damage curves where applicable.

1.5.7 Protection and Coordination curves shall be submitted as part of a report outlining the protection and coordination procedures, final breaker and relay settings and fuse ratings for the entire power distribution system(s) and modes of operation. The report shall clearly list all the breakers with their tag and final settings even if there are identical systems on the Project. I.e. information about the same settings can be duplicated if applicable with breaker in different locations. This list will be checked and signed off by the Professional Engineer who prepared and completed the studies.

1.5.8 Co-ordinate with the electrical equipment vendors; mechanical equipment vendors and obtain the recommended settings on protection devices (re: breaker and overloads). Incorporate this information on the associated studies.

1.5.9 The goal of this portion of the study is to achieve selective protection and coordination of protective devices including ground fault and to reduce the incident energy levels to within "Category 2" where applicable.

1.6 SHOCK AND ARC FLASH HAZARDS

1.6.1 This portion of the study shall be prepared and completed by a Professional Engineer, licensed to practice in the Province of Ontario. The study shall be based on power distribution systems diagrams and the various power distribution operating modes.

1.6.2 The Contractor shall obtain and provide all required information as required for the study to be completed.

1.6.3 The study and the report shall provide a full summary of the shock and arc flash hazard. The completion of the study shall with compliance with NFPA 70E and related standards and methods established in the industry.

1.6.4 The IEEE-1584 must be used for the calculation of the incident energy.

1.6.5 The study will ensure that worst case hazards are identified. This means that arc flash energy is calculated at the maximum fault and to include overloads conditions where applicable.

1.6.6 The study shall cover all electrical distributed equipment and distribution systems operating modes and voltage levels within the facility and site as well as the main incoming service to the building(s) and site.

1.6.7 The study will identify the arc flash boundaries, and incident energy at suggested distance of working. Determination of system operating modes and conditions that can impact short circuit currents and arc flash hazard energy levels shall be identified well in advance and shall be conveyed to the Owner and Consultant for confirmation.

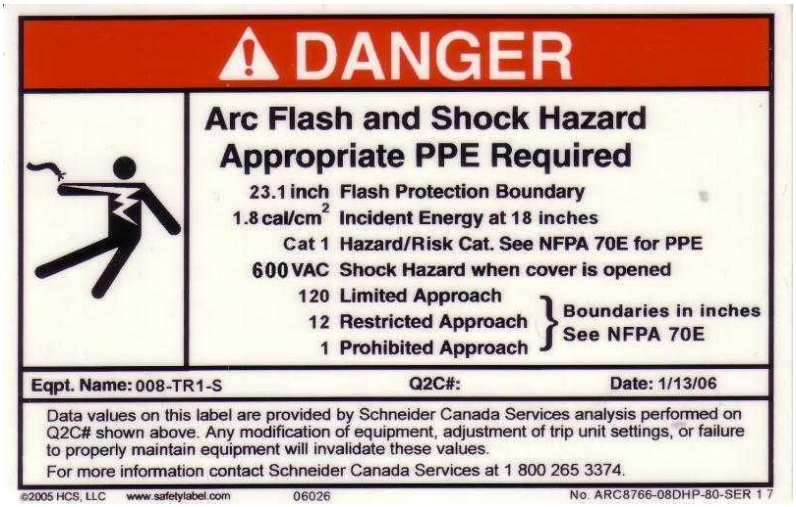
1.6.8 The study will clearly state any assumptions made for arc-fault currents. L-G ground fault and L-L-L. The worst case scenario(s) shall be reflected in the reported as minimum requirement.

1.6.9 Arc-flash labels shall be created and installed on each piece of electrical distribution equipment for all electrical distribution systems.

1.6.10 The labels shall be per ANSI Z535. The labels shall identify the hazard level and protective clothing required.

1.6.11 Safe working distances shall be based upon the calculated arc flash boundary considering incident energy of 1.2 Cal / cm2.

1.6.12 The label reflected below is an example of the required detail of what is to be on the label. A separate label shall be provided for each piece of the electrical distribution systems.



1.6.13 The shock and arc flash warning label shall have as a minimum the following information reflected on it:

1.6.13.1 Boundaries as per NFPA and CSA Z462 (Draft);

1.6.13.2 Flash Protection boundary;

1.6.13.3 Limited shock approach boundary;

1.6.13.4 Restricted shock approach boundary;

1.6.13.5 Prohibited shock approach boundary;

1.6.13.6 Personal protective equipment required to be employed and used with respect to each piece of electrical distribution equipment;

1.6.13.7 Incident Energy per IEEE 1584 recommended distance; and

1.6.13.8 Voltage value for Shock Hazard.

1.6.14 At least 24-hour training shall be provided to the staff employed at the facility to explain meaning of labels and protective equipment, and work permits for energized work. This is to ensure the implementation of the safety program that addresses the following as a minimum:

1.6.14.1 Ministry of Labour requirements;

1.6.14.2 Personal protective equipment;

1.6.14.3 Understanding of the shock and arc flash categories;

1.6.14.4 Electrical equipment labeling requirements;

1.6.14.5 Development of local Standard Operating Procedures (SOPs);

1.6.14.6 Lock out and tag out; and

1.6.14.7 Remote switching of equipment.

1.7 INSTALLATION

1.7.1 On completion of the calibration and testing, a full report shall be prepared by the testing specialists and submitted to the Consultant for review, comments and approval.

1.7.2 The report shall confirm that all protective devices have been adjusted and set in accordance with the protection and coordination study and that the protective systems provide the necessary degree of selective protection as well as selective ground fault protection.

1.7.3 The report shall include tabulation of settings and/or rating of all protective devices.

1.7.4 Each protective device shall be labelled with the proper setting for the device. Labels shall be installed or marked on the protective device behind glass windows. Fusible devices shall be labelled showing the size, type and current rating of the fuse element.

1.7.5 The firm conducting the protection and coordination study shall conduct on-site verification testing to ensure that all relays, breaker settings and fuse sizing has been set in accordance with the coordination study recommendations.

1.7.6 All shock and arc flash labels have been installed.

1.7.7 The Owner reserves the right to retain the services of an independent testing company to monitor, review and verify the results of the test report submitted by the Contractor.

1.7.8 Provide the services of electricians to assist in equipment tests performed by the independent testing companies appointed by the Owner, including thermo graphic (infrared) testing of bus bar joints and contacts of circuit breakers, etc. Remove cover plates, etc. to enable testing company to gain access to the equipment.

1.7.9 The Contractor shall be responsible to co-ordinate with equipment manufacturers to ensure that the equipment is furnished with protection as recommended in the co-ordination study.

1.7.10 Upon completion of the Project, after the commissioning stage has been completed and all commissioning deficiencies have been corrected and the Owner has acknowledged the commissioning is now complete. The Contractor shall conduct a complete thermo infrared scan of the entire electrical distribution systems. The timing of this scan shall be coordinated with the Owner.

1.7.11 The Short Circuit; protection and coordination; shock and arc flash studies shall be completed and the Consultants review process finalized in advance of any electrical equipment being manufactured, ordered and delivered to the Project.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED INSTRUCTIONS

.1 Refer to Section 26 05 00 Common Work Results for Electrical.

1.2 WORK INCLUDED

.1 Provide electrical lighting fixtures and systems scheduled, complete with drivers, mounting kits and necessary accessories required for their installation and performance.

.2 Obtain and review all information with regards to the proper installation of all lighting systems from the Manufacturer. No installation shall be completed without a thorough review of the Manufacturer's recommendations and guidelines for installation. All installations shall comply with these recommendations and guidelines as well as any other requirements mandated by Authorities having Jurisdiction and local governing codes.

1.3 DRIVER CONDITIONING

.1 All LED fixtures shall remain energized for a stabilizing period as recommended by the Manufacturer.

1.4 SHOP DRAWINGS

.1 Conform to requirements of Section 26 05 00 Common Work Results for Electrical.

.2 Submit for review an electronic submission of shop drawings containing illustrations of each fixture. Illustrations to be complete showing dimensions light distribution and mounting requirements. Illustrations to be noted to indicate special features and finishes. A copy is to be retained by the Contractor on the site, to ensure co-ordination of installation requirements.

.3 LED fixture shop drawings must indicate Driver Manufacturer and Model No. for each fixture.

.4 No light fixtures shall be ordered without the review and written approval of the Electrical Engineer. Shop drawings should indicate proposed mounting method and hardware required to facilitate a complete and safe installation.

PART 2 - PRODUCTS

2.1 REFERENCE NUMBERS

.1 Catalogue reference numbers given for individual fixture types are intended as a guide when read with the description and the fixture as finally applied. Verify catalogue references with description and coordinated with installation conditions, with particular regard to ceiling construction details, type and finish before ordering fixtures.

2.2 LENSES

.1 Plastic lenses in lighting fixtures shall be acrylic with minimum thickness of 3 mm (0.125 inches) and, providing flame spread and smoke density ratings, complying with applicable Federal and Provincial Codes; Ontario Fire Marshal's Fire Safety Design Standard; and the Ontario Building Code. Paragraph 3.1.13.1 (1).

.2 Removable components of fixtures (louvres, lenses, wire guards, and the like) to be limited to maximum 1220 mm (48") in length.

2.3 FIXTURE SCHEDULE

Refer to Drawings for Specifications.

2.4 LIGHTING HARDWARE

.1 The Contractor must supply and install all light fixtures as per the Manufacturer's recommendations as well as to the satisfaction of all Authorities having Jurisdiction, Code requirements, the Architect, and the Electrical Engineer.

.2 Include, in the tender price, for all lighting hardware required for a complete and safe installation.

.3 Lighting hardware includes, but isn't limited to, the mounting hardware required for each fixture. The Contractor is responsible for reviewing architectural finishes in all areas and providing lighting and mounting hardware to suit.

.4 All parts used as a part of the installation must be of the same manufacturer as the respective light fixture. Wherever available, all parts must be unique to the respective fixture and purchased with the light fixture from the same supplier and manufacturer.

2.5 PHOTOMETRIC

.1 The Electrical Contractor is responsible for obtaining a complete photometric of the entire area of lighting installation, both interior and exterior, prepared by a professional, third-party specializing in such work. All fixtures of all types shall be depicted on one layout. Refer to Architectural drawings for ceiling heights. Submit a copy of the interior and exterior photometric with the shop drawing submittal for the light fixtures. The Electrical Contractor in conjunction with the Manufacturer remains responsible for the accuracy of the photometric results and acceptance of fixtures based on this.

.2 Photometric statistics shall be prepared for each zone/room. Statistics such as max/min and average footcandle readings shall be included in the photometric submittal.

.3 Photometric shall take into account site condition impacts such as partitions, washroom stall partitions, suspended ceilings, reflectances, etc.

2.6 APPROVED EQUAL PRODCUTS

.1 The Contractor is permitted to provide alternate products to the base product specified as long as the alternate fixture is equal or superior to the base bid product in all specifications. The Contractor remains responsible for ensuring compliance of the alternate product to the base specifications outlined above.

.2 All alternate fixtures must be reviewed and approved in writing by the Electrical Engineer or Owner **during pricing**. No substitutions will be permitted to the base product upon award of the Contract.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide two new safety chains per light fixture for all light fixtures through the existing and new school. Mount from the building structure. Provide unistrut supports throughout as necessary to support the safety chains where obstructions (ductwork, etc.) might prohibit installation without Unistrut.

3.2 RECESSED FIXTURES

.1 Provide plaster and/or framing rings for recessed fixtures (except for `Lay-in Tee-Bar' types) the installation of which shall be the responsibility of this Section.

3.3 SUSPENSION STEEL

.1 Provide angle-iron channels welded to the top side of bottom-chord of the L.S.S.J.'s in the Gymnasium for securing light fixtures.

.2 Provide supports for light fixtures from separate uni-strut members attached and/or secured to building structure. No supports shall be attached to metal deck.

3.4 SITE AIMING

.1 Position and aim adjustable lighting equipment as directed on the site. Position outdoor units after daylight hours as directed. Provide labour and materials necessary to accomplish this.

3.5 COMPLETION

.1 Fixtures shall be clean at the time of final acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Refer to Section 26 05 00 Common Work Results for Electrical.

.2 All specifications must be read in conjunction with the Electrical Drawings.

.3 The drawings and specifications must be read in conjunction with all front-end and tender documents (RFQ, etc.) issued by the Board and/or its representative along with the Drawing and Specification package.

1.2 WORK INCLUDED

.1 Provide emergency lighting fixtures and systems scheduled, complete with lamps, and all necessary accessories required for their complete installation, performance, and on-going operation.

.2 Additional details of 'Work Included' may be found throughout the specifications and/or drawing package.

1.3 SHOP DRAWINGS

.1 Conform to requirements of Section 26 05 00.

.2 The Contractor must submit electronic copies of all shop drawings for the Engineer's review and approval prior to ordering anything. The shop drawing package must include shop drawings for the following (as applicable):

- .1 Exit Signs
- .2 Remote Heads
- .3 Battery Units

Each package must contain illustrations of each fixture. Illustrations are to be complete showing dimensions light distribution and mounting requirements. Illustrations to be noted to indicate special features and finishes. A copy is to be retained by the Contractor on the site at all times, to ensure co-ordination of installation requirements. The Contractor must work with the Manufacturer to provide a photometric study based on the proposed design and the selected devices/equipment. CAD will be made available by the Engineer for the Contractor to use.

PART 2 - PRODUCTS

2.1 REFERENCE NUMBERS

.1 Catalogue reference numbers given for individual fixture types are intended as a guide when read with the description and the fixture as finally applied. Verify catalogue references with description and coordinated with installation conditions, with particular regard to wall or ceiling construction details, type and finish before ordering fixtures.

2.3 EMERGENCY LIGHTING SYSTEM

.1 Emergency Lighting Battery Units:

.1 Provide Emergency Lighting Units and Wiring Systems as noted.

.2 Supply and install the battery units. The battery unit will supply the rated load for a minimum of **one hour** to 87.5% of the rated battery/voltage. The unit shall be rated 120 or 347V, 60 Hz and be CSA No.141 listed. The charger shall be fully computer tested and its charge voltage factory set to + or – 1% tolerance. A pulse type charger shall be employed to promote long battery life and reduce the potential for grid corrosion. The charger shall provide continuous high charge to recharge the battery. When the battery is at full capacity the charger will shut off. The pulse charge shall be current limited and precisely regulated by an electronic circuit which samples 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. 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 will disconnect the battery at end of the discharge. The unit will come complete with the Distinction™ Series diagnostics micro-controller board option. The unit shall self-test for 1 minute every 30 days, 10 minutes on the 6th month and 30 minutes every 12 months. The unit shall be furnished with a sealed dust tight relay, a selectable test switch 1 minute, 5 minutes, 10 minutes or 20 minutes and diagnostics LED indicator lights to continuously monitor the status of the unit: battery failed, battery disconnect, charger failure, lamp failure, service alarm, AC "ON" and charger "ON".

.3 Wall mounted unit shall be provided with recessed back box and mounting template to allow pre-installation feeds of A.C. input and D.C. output. Both A.C. input and D.C. output shall enter unit through back face without any visible cable or conduit feeds. Provide wall mounted shelf for each battery unit.

.4 Provide a 120 volt input circuit for each unit wired to un-switched circuit indicated. Wire to exit signs from battery units. Size conductors to all remote lamps to provide maximum voltage drop of three percent.

.2 Emergency Single Remote Heads:

.1 As scheduled on drawings.

.3 Emergency Dual Remote Heads:

.1 As scheduled on drawings.

.4 Exit Sign (without built-in battery unit & remote heads):

.1 .1 As scheduled on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Do not install or energize lamps until directed by Consultant which generally shall be just prior to occupancy of the building by the Owner.

.2 Provide wiring in conduit and install devices in accordance to all Manufacturer recommendations and instructions. Advise the Consultant of any discrepancies or conflicts between the instructions set out in these drawings and specifications and the Manufacturer's recommendations and instructions prior to commencing work.

.3 Connect remote heads to the respective battery unit as indicated on the drawing. Read all notes on the drawings prior to commencing work.

.4 Provide remote heads as specified and as required for compliance with the Ontario Building Code. Install remote heads in the locations as shown on the drawings. Note that in most cases, the proposed location of new heads do not match the location of existing devices. The Contractor must locate remote heads in the new positions as proposed. The Contractor must make allowance for minor revisions to the system, including relocations and re-aiming, as required upon review of the testing results. Generally, all wiring shall be provided in accordance with the Manufacturer's requirements and be minimum No. 10 AWG. The wire size might need to be increased to satisfy voltage drop requirements. Verify voltage drops requirements with the Manufacturer prior to installation.

.5 Prior to installation of any devices, verify the existing conditions around the proposed location and ensure there are no conditions that restrict visibility of exit signs, may affect coverage of emergency lighting, or atmospheric or climate conditions that may affect the operation of new devices (unheated areas, moist/damp air, etc.). Advise the Consultant in writing of all such conditions prior to installation and seek instruction prior to proceeding.

3.2 SITE AIMING

.1 Position and aim adjustable lighting equipment as directed on site and to obtain light levels as required by code. Position outdoor units after daylight hours as directed. Provide labour and materials necessary to accomplish this.

.2 Locate and aim emergency lighting remote heads to optimally illuminate egress route to meet or exceed all code requirements.

3.3 COMPLETION

.1 Fixtures shall be clean and 100% operational at the time of final acceptance.

.2 Upon a complete installation of the systems as proposed on the drawings, as per all code requirements, and to the satisfaction of all Authorities having Jurisdiction, commission and test the new system in entirely with the Manufacturer's Representative. Make allowance for adjustments as required by the Manufacturer or Authorities having Jurisdiction. Provide a letter to the Consultant that the system is complete, has been tested, adjusted (as required), and is in proper operating condition. Testing shall be performed during non-daylight hours.

.3 Upon completion of installation, engage a professional third-party agency to complete an illumination level test throughout all areas of the building where the installation has taken place. The Contractor must work with the third-party agency to properly aim remote light heads, recording light level readings on a record set of floor plans, calculating light level readings, and issuing to the Consultant a letter stating that the emergency lighting levels meet the requirements of the Ontario Building Code. Notify the Owner and Consultant at least ten (10) days prior to the proposed testing and verification data and schedule a time and date that is acceptable to all.

.4 The Contractor is responsible for engaging a professional third-party agency to complete a voltage drop test testing the voltage at each panel as well as the voltage at the most remote fixture.

.5 Include (in the tender price) for the hiring of all third-party agencies (including, but not limited to, the Manufacturer's representative) as required by the drawing and specifications.

END OF SECTION

PART 1: GENERAL

1.0 Section Includes
- A. Lighting Control Components and Systems:
    1. Line Voltage Wall Switches Low Voltage Wall Switches and Sensors
    2. Occupancy / Vacancy Sensors Detection
    3. Power Interfaces
    4. Line Voltage Wall Switches and Sensors
    5. Wireless Devices and Systems

1.1 Related Requirements
- B. Section 26 50 00 – Lighting Systems

1.2 References
- A. Underwriters Laboratories (UL):
    1. UL 916- Energy Management Equipment
    2. UL 924 - Emergency Lighting and Power Equipment
    3. UL 1472 – Standard for Safety Solid-State Dimming Controls
- B. National Fire Protection Association (NFPA):
    1. NFPA 70 - National Electric Code
- C. IEC 61000-4-2 Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques-Electrostatic Discharge Immunity Test; 2008
- D. NEMA WD 7-2011: Occupancy Motion Sensors
- E. NEMA SSL 7A: Phase Cut Dimming
- F. FCC Part 15 and equivalent ISED / NOM

1.3 Administrative Requirements
- A. Coordination
    1. Coordinate placement of daylight and occupancy sensors to achieve optimum performance. Proper sensor placement should be coordinated with others to avoid obstructions that would interfere with maintaining prescribed light levels
    2. Coordinate the work to provide luminaires and lamps that are compatible with the lighting controls to be installed
    3. Notify architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work

1.4 Submittals
- A. Submit under provisions of the Electrical General Requirements.
- B. Specification Conformance Document. Clearly define where the equipment submitted for review:
    1. Meets specification exactly as specified
    2. Meets specification as an alternate with clear definition of compliance
- C. Shop Drawings include
    1. CAD renderings of the device with precise dimensions
    2. System schematic/typical riser diagrams
- D. Product Data Sheets

1.5 Project Closeout Documentation
- A. Provide a factory published manual

1. Warranty
2. Technical support contact
3. Electronic manual on manufacturer's website for free download

1.6 Quality Assurance

A. Manufacturer Qualifications:
   1. 20+ years of experience designing and assembling lighting controls.
   2. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.
   3. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues.
   4. On-Site Support: Manufacturer capable of providing on-site response time within the continental United States
   5. Service Contracts: Manufacturer capable of providing service contracts for continued on-site and remote support of the lighting control system post-installation for terms up to 10 years from substantial completion.
B. All devices are 100% factory function tested prior to delivery
C. Compliant with the requirements of NFPA 70
D. All power components UL listed for required loads

1.7 Project Conditions

A. Only install equipment after the following site conditions are maintained:
   1. Ambient Temperature 14 to 105 degrees F (-10 to 40 degrees C); unless specified extended temperature operation within the product specification sheet.
   2. Relative Humidity less than 90% non-condensing
B. Standard electrical enclosures are permanently installed
C. Equipment is protected from dust, debris and moisture

1.8 Warranty

A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace (same device or equivalent), materials, and devices that fail to perform as specified within extended warranty period.
B. Five (5) years from the date of shipment

PART 2: PRODUCT INFORMATION

2.1 Manufacturers

A. Acceptable: Acuity Brands Lighting, Inc. – System: SensorSwitch Brand
B. Basis of controls design Manufacturer: Acuity Brands, One Lithonia Way, Conyers GA 30012 Steven Downs Manager of Senior Product Markets or Dennis Hoskins, Director of Product Market.

   One of the following may be acceptable with approval if compliant with this specification:
   1. Sensorswitch
   2. Cooper
   3. Hubbell
C. Substitutions: Not Permitted

4. All substitutions must be submitted in writing for approval at least 14 days prior to bid date.
5. Proposed substitute products must be documented with a line by line compliance review

2.2 General:

A. Provide system hardware that is designed, tested, manufactured, warranted by a single manufacturer
B. Operational Life: At least 10 years expected life while operating within the specified ambient temperature and humidity range
C. Power Failure Memory: automatically store system settings and recover from a power failure without requiring user input.

Occupancy Detection Technology Requirements:

D. The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
E. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or based sensing technologies shall not be accepted.
F. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
G. Dual technology sensors shall have one of its two technologies do not require motion to detect occupancy. Acceptable dual technology includes PIR / Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect mothing (PIR/Ultrasonic) shall not be acceptable.
H. All sensing technologies shall be acoustically passive meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic based sensing technologies shall not be accepted.
I. Sensors shall offer a settable minimum on timer of at least 15 minutes, to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.
J. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes.
K. Allow adjustments to the occupancy time delay based on owner preference, fixture life extension or increase energy savings. Should be done in consultation with the building owner and specifying engineer.
L. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens, and shall not require initial or subsequent field adjustment of detection sensitivity.
M. All sensor setting adjustments shall be digital; comprising of a one or more user interfaces: Push-button, Visual Light Infrared, RFID or Bluetooth Programming methods

N. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

2.3 Low Voltage Wall Switches

A. Shall be capable of the following:

1. Accept 12-24VAC/VDC
2. Suitable for installation in a single-gang switch box
3. Support On / Off / Dimming and 3-way Connection
4. single and dual pole options
5. Programmable via push button programming with visual LED visual feedback

B. Product Series

1. SPODM(A)
2. SWS
3. WSD LV

2.4 Line Voltage Wall Switches

A. Shall be capable of the following:

1. Shall accept Class 1 wiring directly.
2. Devices will operate as On / Off and Dimming (pending model variant)
3. Dimming devices shall be 0-10V sink devices
4. Multi-way switches allow for 3-way, 4-way and up to 9 connections.
5. All Multi-Way devices On / Off loads will operate and respond in unison.
6. Multi-way devices with dimming loads will operate in unison when initiated by a dimming device
7. Multi-way device is a class 1 low voltage data bus and must not be used with a standard toggle switch.
8. Count down timer capabilities
9. Single and dual pole options

B. Phase Dimming Wall Switches;

Shall be capable of the following:

1. Shall accept Class 1 wiring directly.
2. Devices will operate on / off and dimming various load types: LED, Incandescent, CFL, ELV and MLV per the designated load rating based on support technology
3. Compatible with NEMA SSL 7A

C. Product Series

1. PTS(A)
2. SPODMR(A)
2. SPODMRA MWO
3. SPODMR(A) WR
3. SPODMRA SSA (wireless)
4. WPD
5. ASD

2.5 Line Voltage Wall Switch with Occupancy Sensor

A. Sensor shall provide wall-to-wall PIR occupant movement supporting small (hand motions) and large (walking motion) detection .
B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 1.1, Occupancy Sensor Technology Requirements).
C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
D. Sensors shall be capable of switching both 120 VAC and 277 VAC (models allowing 120-277 VAC input) and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.
E. Light Commercial devices will be designated as 120 VAC and lower load rating compared to commercial based products.
F. Sensor shall recess into single gang switch box and fit a standard GFI opening.
G. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection internally and intrinsically through its mounting strap.
H. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
I. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology (only exception is versions with lighted push-buttons).
J. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected to function.
K. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.
L. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via one or more user interfaces push-button, visual light, Bluetooth programming without requiring removal of cover plate or tools of any kind.
M. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.
N. All models shall be capable of both Auto-On, Manual On, and Partial-On operation.
O. All models shall be capable of a "Reduced Turn On" operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.
P. All models shall have a "Predictive Off" mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.
Q. All models shall be capable of disabling override switch.
R. Multiple switches controlling the same load (3-way or 4-way applications) shall use multi-way based devices.
S. The following SensorSwitch models numbers color and optional features like dimming and out-of-box default behaviors are specified within the product datasheets. The list below is subject to change.
T. Product Series
    1. WSRA (PIR)
    2. WSRA 2P FAN (PIR, Dual Relay)
    3. WSX(A) (PIR)

4. WSX(A) MWO (PIR)
5. WSX(A) 2P (PIR, Dual Relays, Auto On Pole 1/Manual On Pole 2)
6. WSX(A) PDT (PIR/Microphonics)
7. WSX(A) MWO PDT (PIR/Microphonics)
8. WSX(A) PDT 2P (PIR/Microphonics, Dual Relays, On Pole 1/Manual On Pole 2)
9. WSX(A) SA (PIR, Manual On by default; programmable)
10. WSX(A) MWO SA (PIR, Manual On by default; programmable)
11. WSX(A) PDT SA (PIR/Microphonics, Manual On by default; programmable)
12. WSX(A) MWO PDT SA (PIR, Manual On by default; programmable)
13. WSX(A) VA (PIR, Manual On by default)
14. WSX(A) MWO VA (PIR, Manual On by default)
15. WSX(A) PDT VA (PIR/Microphonics Manual On by default)
16. WSX(A) MWO PDT VA (PIR/Microphonics Manual On by default)
17. WSX NL (PIR, lighted push-button, neutral required)
18. WSX PDT NL (PIR/Microphonics, lighted push-button, neutral required)
19. WSD LV (PIR, low voltage, power pack required)
20. WSD PDT LV (PIR/Microphonics, low voltage, power pack required)

2.6 Wall Switch Occupancy Sensors – Large Areas

A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 40 ft (12.19 m).
B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 1.1, Occupancy Sensor Technology Requirements).
C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz. A version capable of switching 347 VAC shall also be available. Load ratings shall be 13A each pole, ¼ HP motor load.
E. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
F. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
G. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
H. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.
I. Sensor shall be the following SensorSwitch model numbers. Device color and optional features as specified.
J. Product Series
    1. LWS(H) (PIR)
    2. LWS(H) 2P (PIR, Dual Relays)
    3. LWS(H) PDT (PIR/Microphonics)
    4. LWS(H) PDT 2P (PIR/Microphonics, Dual Relays)

2.6. Low Voltage Occupancy Sensors

A. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 2.2, Occupancy Sensor Technology Requirements).
C. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, to provide a high degree of RF immunity.
D. Sensors shall interconnect with other sensors and power/relay packs with class 2, three-conductor wire.
E. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 mA so that up to 14 sensors may be connected to a single power pack.
F. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
G. Each designated zone shall contain one sensor with a SPDT class 2 auxiliary relay, providing an input to building automation system (BAS). All sensors in designated zone shall communicate to sensor with relay for status to BAS. Sensor relay coil shall energize in the unoccupied state to load share the low voltage current from power pack. Note that power pack must be installed on the Line side of the local toggle switch for auxiliary relay to work properly.
H. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
I. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.
J. Sensors with a recessed profile are acceptable substitutes for above ceiling mount sensors (e.g. CM => RM)
K. Fixture mounted box sensors are acceptable substitutes for above ceiling mount sensors (e.g. CM => CMB)
L. Sensors shall be the following SensorSwitch model numbers.
    1. CM (PIR, Ceiling Mount, Standard Range)
    2. CM PDT (PIR/Microphonics, Ceiling Mount, Standard Range)
    3. RM (PIR, Ceiling Mount, Extended Range)
    4. RM PDT (PIR/Microphonics, Ceiling Mount, Extended Range)
    5. WV 16 (PIR, Corner Mount, Wide View)
    6. WV PDT 16 (PIR/Microphonics, Corner Mount, Wide View)
    7. HW 13(PIR, Wall Mount, Hallway View)
    8. HMB 10 (PIR, Box Mount, High Bay Aisle Way)
    9. MSD
    10. MSOD
    11. TLS

2.7 Power Packs

A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.

B. Power pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
D. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types, and be rated for 400,000 cycles.
E. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.
F. MP20 used as a dry contact relay to connect BMS, HVAC, Fan, etc.…
G. Power packs shall be the following SensorSwitch model numbers.
    1. PP20 (Single Pole)
    2. SP20 (Secondary Pack)
    3. MP20
    4. PP16 Shunt
    5. PP5LV Shunt
    6. PP5 SSA (wireless)

2.8 Line Voltage Occupancy Sensors

A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
B. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 2.2, Occupancy Sensor Technology Requirements).
D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
F. Multiple sensors controlling the same load shall be wired in parallel.
G. For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
H. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off 50/60 Hz power. Many devices include intermediate voltage ratings at 220 and 230 VAC. A version capable of

switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.

J. Specific sensors capable of switching 5 Amps of two-phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.

K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.

L. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.

M. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.

N. Sensor settings may be programmed via pushbutton or via mobile application, check the most recent datasheet for more information.

O. Sensors shall be the following SensorSwitch model families.
   1. CMR / CMR 2P (Standard Range 360□, PIR, Ceiling Mount – Single / Two Pole)
   2. CMR PDT / CMR PDT 2P (Standard Range 360□, PIR/Microphonics Dual Technology, Ceiling Mount – Single / Two Pole)
   3. CMRB / CMRB 12P (Extended Range 360□, PIR, Fixture Mount Box – Single / Two Pole)
   4. WVR 16 / WVR 16 2P (Wide View, PIR, Wall Mount – Single / Two Pole)
   5. WVR PDT 16 / WVR PDT 2P (Wide View, PIR/Microphonics Dual Technology, Wall Mount – Single / Two Pole)
   6. HMRB 10 (High Bay End-of-Aisle, PIR, Fixture Mount Box)
   7. HWR 13
   8. LSXR
   9. SBGR
   10. SBOR

P. Sensors with a recessed profile are acceptable substitutes for above ceiling mount or fixture mount sensors (e.g. CMR=> RMR)

2.9 Indoor Photocells and Daylight Harvesting Controls

A. Low voltage photocell shall accept 12 to 24 VAC or VDC and provide a SPDT relay for interface with remote switching system. Sensor shall interface with occupancy sensors, directly with power pack, or other system as shown.

B. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

C. Photocell set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Further adjustment may be made manually if needed.

D. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

E. Low voltage dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more fixtures).
F. Low voltage dimming sensor's set point shall be automatically calibrated through the sensor's microprocessor by initiating the "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
G. Combination photocell/dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control the on/off function as well as the dimming function of 0 to 10 VDC dimmable ballasts.
H. Combination photocell/dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating the "Automatic Set-point Programming" procedure. Min and max dim settings as well as set point may be manually entered.
I. Dual zone option shall be available for photocell, dimming, or combination units. The second zone shall be controlled as an "offset" from the primary zone and shall be the zone farthest from the natural light source.
J. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.
K. Line voltage versions of the above described dimming sensors shall be capable of powering off 120/277 VAC. Many devices include intermediate voltage ratings at 220 and 230 VAC check product specification sheet for more details
L. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching 5 Amps of two phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.
M. Sensors shall be the following SensorSwitch model numbers.
    1. CM PC (Photocell, On/Off, Low Voltage, Ceiling Mount)
    2. CM ADC (Dimming Photocell, Low Voltage, Ceiling Mount)
    3. CM PC ADC (Combination Photocell/Dimming Sensor, Low Voltage, Ceiling Mount)
    4. CM PC DZ, CM ADC DZ, or CM PC ADC DZ (Dual Zone, Low Voltage)
    5. CMR PC (Photocell, On/Off, Line Voltage, Ceiling Mount)
    6. CMR ADC (Dimming Photocell, Line Voltage, Ceiling Mount)
    7. CMR PC ADC (Combination Photocell/Dimming Sensor, Line Voltage, Ceiling Mount)
    8. CMR PC DZ, CMR ADC DZ (Dual Zone, Line Voltage)
    9. LSXR PC
    10. SBOR PC
N. Sensors with a recessed profile are acceptable substitutes for above ceiling mount or fixture mount sensors (e.g. CMR PC => RMR PC)
   Fixture mounted box sensors are acceptable substitutes for above ceiling mount sensors (e.g. CMR PC => CMRB PC)

2.10 Wireless Devices and Systems

A. Automatically sync for system operation
    1. Shall conform to SOC2 criteria
    2. Must not use a predefine PIN.
B. Send and receive messages for real-time operation and feedback
C. Use industry standard RF protocols (list is subject to change)
    1. Bluetooth Devices must be listed with the Bluetooth SIG organization
    2. Conform to Enocean communication requirements
D. All devices are FCC / Industry Canada compliant with most devices certificated under Mexico's IFETAL and European Union CE check product specification for more detail.
E. Settings shall be programmable via push-button or mobile device application (Apple iOS and Adriod Operating Systems).
F. The following SensorSwitch family of devices: color and optional features are specified within the product datasheets.
    1. SensorSwitch AIR Product line Family of Devices
        a. SPODMRA SSA
        b. WSXA SSA
        c. PP5 SSA
        d. CMS SSA
        e. Fixture Embedded under nomenclature SSAIR and SSAIRVTX
    2. BTP Family of Devices
        a. Haleon BTP
        b. LSX BTP
        c. SBG BTP
        d. SBO BTP
    3. RDT Family of Devices
        a. SPODMR(A) WR
        b. CM WR
G. There are many lighting fixture families with embedded SensorSwitch wireless controls. All wireless devices and fixtures shall have accurate markings per its certification compliance

PART 3: EXECUTION

3.1 Installation

A. Follow manufacturer's instructions for all installation steps
B. Provide a complete installation per Contract Documents
C. Where applicable proved FAQs and Quick Start Guides

3.2 Startup and Programming

A. Provide telephone support via toll free line
B. Factory trained service available for purchase
C. Where applicable training video and elearning content

3.5 Maintenance

A. Factory trained service technicians available within the continental US
B. Offer integrated help on-screen and via online videos
C. Factory telephone support via toll free line

END OF SECTION

CONTENTS

SECTION	TITLE
PART 1 - GENERAL	
1.0	General
2.0	Contractor
3.0	Manufacturer
4.0	Qualifications
5.0	Equipment Warranty
6.0	Service Facilities
7.0	Features & Functions
8.0	Training
PART 2 - PRODUCTS	
2.1	Console
2.2	Peripheral Devices
2.3	Source Equipment
2.4	Wall Display Unit
2.5	Night Ringer
2.6	Terminal Blocks
2.7	Conductors
2.8	Uninterruptible Power Supply
2.9	Spares
2.10	Wired Master Clock System
2.11	Assistive Listening System
PART 3 - EXECUTION	
3.1	Division of Work
3.2	Equipment Manufacturer Representative
3.3	Installation

PART 1 - GENERAL

1.0 GENERAL

1.0.1 All model numbers listed here-in pertain to the Bogen Multicom 2000 system unless otherwise noted. System shall have expanded to have 20% spare capacity above the actual number of connected circuits, unless noted otherwise.

1.0.2 Approved Manufacturers:

- Existing P/A Rack is of Bogen Multicom 2000 Make/Model from Baldwin Sound.

1.0.3 Reserved.

1.0.4 Equipment shall be housed in a 61" upright metal rack, unless the system requires more than 120 room capacity, in which case the rack shall be a double rack. Rack shall have minimum of two (2) detachable belt supports from wall. Rack shall be c/w 4 casters. Front two casters shall be lockable and the back two casters shall be fixed.

1.0.5 The only acceptable source components are to remain.

1.0.6 Field wiring should terminate to a "crossover" BIX termination. The rack side of the bix will terminate to 25 pair Amphenol cables with male plugs. The rack would be equipped with 25 pair female Amphenol cables, so that the rack can be detached from the field wiring by undoing the Amphenol plugs.

1.0.7 System shall be programmed for paging zones as shown the drawings, and time zones as negotiated with the Principal.

1.0.8 All devices, components, wiring material etc. is to be new unless noted otherwise.

1.0.9 All wiring must be FT6. All vertical runs of wire must be in conduit, wiremold or wire trough. Horizontal wiring, if it is running in an enclosed ceiling space may be pulled using open wiring techniques, provided it is held up off the T-bar ceiling grid by means of J hooks. In existing areas, any exposed wiring & in areas with drywall or plaster ceiling must be run in painted conduit or raceway (Wiremold).

1.0.10 All surface mounted conduits and boxes shall be finished with a coat of primer and two coats of enamel paint. Color of paint to match existing surface.

1.0.11 Contractor shall provide relay circuitry to mute the local GP system in event an all-call announcement is made from the main PA system.

1.0.12 System programming shall be a discussed with and approved by the Principal. However the following programming format should be adhered to:

Corridor and washroom speakers on each floor should be connected to a separate port.

Outdoor horns should be connected to a separate port and programmed as a separated zone.

Each classroom would be connected to its own individual port and programmed with its own room number as the programmed phone number.

1.0.13 No volume controls shall be installed.

1.0.14 All rooms must have an enhanced house phone and a speaker. The system should be programmed so each room is capable of calling the office, calling another room. (There should be no call switches).

1.0.15 A speaker is required in the office area to monitor what is being sent out.

1.0.16 A wall display is required for the office if there is more than one secretary. The wall display works in conjunction with an enhanced house phone only (it will not work with an administration phone).

1.0.17 Each floor of corridor speakers should be on a separate circuit. Washroom speakers should be tied in with corridor speakers, unless otherwise noted and there is a call station, in which case there would be a separate circuit.

1.0.18 Outdoor speakers should be programmed as a separate zone so announcements are not broadcast to the neighbourhood.

1.0.19 Speakers in gyms and outside horns should be protected by wire guard.

1.0.20 Operational manuals and as-built drawings as per Electrical General Requirements.

1.0.21 Include for work schedule to be after hours and weekends. During weekdays, only activities possible and mutually agreeable to school operation will be accepted.

1.0.22 The new system shall have its own internal clock, used for timed activities/bell scheduling. No reliance on input from an existing timing device (program bell system, etc.) shall be used.

2.0 CONTRACTOR

2.0.1 The contractor shall furnish all equipment, accessories and material required for the installation of a comprehensive communication system in strict compliance with these specifications and applicable contract drawings. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this specification.

2.0.2 The communications system shall be DOC approved and have C.S.A or Electrical Safety Authority Approval and must comply with all Electrical Codes.

2.0.3 The system is to be designed and configured for maximum ease of service and repair. All major components of the system shall be designed as a standard component of one type of card cage. All internal connections of the system shall be with factory keyed plugs designed for fault-free connection. The printed circuit card of the card cage shall be silk screened to indicate the location of each connection.

3.0 MANUFACTURER

3.0.1 The manufacturer shall be such who has been regularly engaged in the manufacture of communication systems for at least thirty (30) years. The equipment described herein and furnished per these specifications shall be the product of one manufacturer. All reference to model numbers and other detailed descriptive data is intended to establish standards of design, performance and quality, as required. Equipment manufactured by Bogen Communications, Inc.

4.0 QUALIFICATIONS

4.0.1 The system shall be supplied by the manufacturer's authorized contractor who is qualified in the proper installation, operation and service of the system. Certification shall be submitted verifying that the contractor is the manufacturer's authorized contractor.

4.0.2 Contractor shall attend mandatory job walk.

5.0 EQUIPMENT WARRANTY

5.0.1 The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment which has been subject to misuse, abuse, negligence, accident, or unauthorized modification.

6.0 SERVICE FACILITIES

6.0.1 The contractor shall make available, and maintain a satisfactory service department capable of furnishing equipment inspection and service. The contractor shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.

7.0 FEATURES AND FUNCTIONS

7.0.1 The communication system shall be a Bogen MULTICOM 2000, and shall provide a comprehensive communication network between administrative and staff locations. The central processor and switching unit shall be of the modular plug-in printed circuit board type, using HMOS microprocessor and TTL logic and HCMOS memory and sensing. HCMOS circuitry shall be protected with transient suppression devices on all inputs and outputs. Nonvolatile EPROM shall store permanent memory and nonvolatile EEPROM shall store field-programmable memory. System which uses a

battery to maintain system configuration information shall not be acceptable.

The system shall provide no less than the following features and functions:

7.0.1.1 Telephonic communication, complete with DTMF signaling, dial tone, ringing and busy signals, and data display on administrative stations, shall use two wires (one is ground). Systems which use more than two wires for communication, tones and data display shall not be acceptable.

7.0.1.2 Amplified-voice communication with loudspeakers shall use a shielded audio pair (shield can be used as one of the two required conductors for phone or call-in switch).

7.0.1.3 The system shall be available in the following configurations:

7.0.1.3.1 Wall-mounted in a custom enclosure. Station capacity shall be from 24 to 120 stations in increments of 24.

7.0.1.3.2 Rack-mounted. Station capacity shall be from 24 to 240 stations in increments of 24. All telephone stations shall have the ability to support displays.

7.0.1.3.3 Rack-mounted and integrated with Bogen Multi-Graphic Series 2223 or Series 2233 equipment. In this configuration, MULTICOM 2000 system station capacity shall be expandable up to 240 stations and 240 telephonic stations in increments of 24. The Multi-Graphic system equipment provides the following: redundant intercom and paging functions, one or two additional program channels, additional Multi-Graphic functions, and unlimited Multi-Graphic-only station capacity. It shall be possible, by use of a separate call-in switch, to annunciate only to the Multi-Graphic portion of the system without using additional station ports within the Multicom 2000 system.

7.0.1.4 The system shall consist of ANY COMBINATION OF staff, enhanced staff, and administrative stations (minimum of one administrative telephone required per system).

7.0.1.4.1 Staff stations shall consist of wall- or ceiling-mounted loudspeakers with call-in switches or handsets.

7.0.1.4.2 Enhanced staff stations shall consist of DTMF dialing telephone sets.

7.0.1.4.3 Administrative stations shall consist of DTMF dialing telephone sets with a four line by 16-character LCD display panel. They shall be equipped with a standard 12 key push button dialing key pad. Additionally, there shall be nine dedicated function

keys, three programmable "soft keys", and ten programmable "speed dial" keys. The unit shall also feature a hands-free speaker phone. The user shall maintain control over the ring volume, speaker phone volume, and the handset volume. Phones utilizing membrane-type keypads or requiring special function keys to perform common functions shall not be accepted as an equal. Optionally, a loudspeaker may be connected at each administrative station location.
There shall be provision to monitor the status of the outside lines interconnected to the system. It shall also be possible to place outside line calls on hold by use of the "hold key".

7.0.1.4.4 Enhanced staff and administrative stations shall have the option of including a loudspeaker.

All types of stations shall utilize the same type of field wiring. Future station alterations to require only station type change, not field wiring or system head-end alterations. All field wiring and system head-end equipment shall support any type of station, at the time of installation. If the enhanced capabilities of the administrative stations are required, an additional two conductors shall be provided to each administrative station to facilitate this purpose. All contractor proposals shall reflect this capacity. Failure to submit and bid this project in this manner will be deemed as being in direct conflict of these specifications and will be rejected.

There shall be no limit to the number of administrative display stations within the total capacity of the system (e.g. a 240 station will support 240 administrative display stations).
It shall be possible at any time to change the type of station at any location without extensive rewiring. Systems which limit the quantity of each station type, or require future additional equipment and/or system expansion to provide additional administrative telephones shall not be accepted as an equal.

7.0.1.5 The system shall be a global switching system, providing eight (8) unrestricted simultaneous private telephone paths. The system shall also be capable of providing up to eight (8) simultaneous amplified-voice intercom paths. One amplified intercom path shall automatically be provided with each increment of 24 stations of system capacity. All hardware, etc., required to achieve the maximum number of amplified-voice intercom channels for this system shall be included in this submittal. Amplified-voice intercom channels shall provide voice-activated switching.

Systems requiring the use of a push-to-talk switch on administrative or enhanced staff telephones shall not be acceptable. There shall be an automatic level control for return speech during amplified-voice communications. The

intercom amplifier shall also provide control over the switch sensitivity and delay times of the VOX circuitry.

7.0.1.6 It is of utmost importance that emergency calls from staff stations receive prompt attention. It is, therefore, important that there be an alternate destination in case the call does not get answered at the primary location. To this end:

7.0.1.6.1 Staff generated Emergency calls shall be treated as the highest system priority. Therefore, all Emergency calls shall annunciate at the top of the call queue of their respective administrative telephone(s). Should that emergency call go unanswered for 15 seconds, the call should re-route to an alternate speaker station then prompt the caller to make a verbal call for help. During the transfer, the original administrative telephone shall continue to ring the distinctive Emergency ring. Should the Emergency transfer to station have an associated administrative telephone, it too shall ring the distinctive Emergency ring.

7.0.1.6.2 The Emergency transfer to station shall be field programmable.

7.0.1.6.3 Should the original administrative telephone be engaged in a non-emergency conversation, its conversation shall be automatically terminated, indicated with an alert tone, and then reconnected to the station which generated the Emergency call.

7.0.1.6.4 Should the administrative telephone be engaged in an Emergency conversation, successive emergency calls shall log into the call queue as well as transfer to the emergency transfer station for their verbal call for help. Upon termination of the initial emergency conversation, the next one shall immediately ring the administrative telephone.

7.0.1.6.5 Systems failing to transfer unanswered Emergency calls or failing to immediately connect to the administrative telephone shall not be deemed as equal.

7.0.1.7 There shall be a system facility-wide emergency all-call feature. The emergency all-call shall be accessed by dialing "911" from designated administrative phones or by the activation of an external contact closure which shall give the third audio program input emergency status.

The Emergency "911" all-call function shall have the highest system priority and shall override all other loudspeaker related functions including time tone distribution.

Considering that emergencies are to be treated with the highest level of

concern, systems in which the Emergency-All-Call page from an administrative telephone is not the highest priority shall not be deemed as equal.

Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access emergency functions.
The emergency all-call shall capture complete system priority, shall be transmitted over all speakers. It shall also activate an external relay, which can be used to automatically override other systems.

Systems without emergency all-call, or systems with all-call that cannot be activated by external means, or which do not capture complete system priority or activate an external relay, shall not be acceptable.

7.0.1.8 There shall be at least four built-in dedicated emergency alarm tones. Each may be accessed by dialing a three-digit number (912 through 915) from designated administrative telephones. These emergency tones should be separate from the time tones. Systems using external alarm generators, or having less than four emergency alarm tones shall not be acceptable.

Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access emergency alarm tones.

7.0.1.9 There shall be four (4) external-function relay driver outputs, accessible from designated administrative telephones by dialing a four digit number. These outputs remain set until accessed and reset at a later time. The user shall have the ability to review the status of each relay driver. This feature may also be preprogrammed by the user so that automatic activity of this driver occurs. This feature shall be supported by a plain English menu, prompting the user through the fields without requiring the user to remember any dialing sequences. Systems which require the user to remember any dialing sequences. Systems which require the user to remember complicated dialing schemes or prompt the user via cryptic commands shall not be deemed equal. Systems without relay driver outputs for control of external functions shall not be acceptable.

Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access external relay functions.

7.0.1.10 There shall be a program-material interface included, which shall accept up to three (3) Bogen D-Series program modules. Systems requiring an external program source interface shall not be acceptable.

7.0.1.11 There shall be an optional outside line feature. The optional circuitry shall interface with the station ports of an external telephone system, and shall provide facilities for up to eight (8) incoming lines which shall be designated by the user to ring "day" and "night" enhanced staff or administrative stations. Where an administrative station is designated to receive outside line calls, the phone shall ring with a unique tone and the outside line number shall appear on the display panel. The option shall also provide the ability to make outside line calls from enhanced staff or administrative stations. This ability shall be programmable for each phone and there shall be three (3) access levels: no access, restricted access (local calls only), or unrestricted access (local and long-distance calls). This feature shall be capable of supporting DIL, DISA and a password protected DISA function.

Security is of the utmost concern. The password DISA feature shall be accessible only from an off-premise security office which monitors the facilities security system. It shall function as follows: Upon confirmation of the password DISA number, the system shall allow security personnel to dial access any station and monitor the activity without the pre-announce and the privacy tones. This will then allow the security office to determine exactly what actions need to be taken. The monitoring security personnel shall have provision to access other stations should the perpetrator move locations.

7.0.1.12 The system shall provide for field-programmable three or four digit architectural station numbers.

7.0.1.13 An architectural-number/station-number cross-reference shall be field-accessible to facilitate service.

7.0.1.14 There shall be an automatic level control for return speech during amplified-voice communications.

7.0.1.15 Each station loudspeaker shall be assignable to any one, any combination, or all of eight (8) paging zones. Systems with less than eight (8) paging zones shall not be acceptable.

7.0.1.16 Each station loudspeaker shall be assignable to any one, any combination, or all, of eight (8) time-signaling zones. Systems with less than eight (8) time-signaling zones shall not be acceptable.
NOTE: Systems which use the same light zones as both page zones and time zones shall not be acceptable.

7.0.1.17 THERE SHALL BE EIGHT (8) TIME-SIGNALLING SCHEDULES WITH A TOTAL OF 1024 USER-PROGRAMMED EVENTS. Each event shall sound one of eight (8) user-selected tones. It shall be possible to assign each schedule to a day of the week, or manually change schedules from an

authorized administrative telephone. Systems which do not provide eight (8) time-signaling schedules shall not be acceptable.

7.0.1.18 An internal program clock (with battery back-up) shall be included, allowing a total of 1024 user-programmed events. It shall be possible to synchronize the program clock with an external master clock. Systems which do not provide an internal program clock not meeting these specifications shall provide an external program clock that does. This external program clock shall then synchronize daily with the system clock to ensure that all time displays are the same.

7.0.1.18.1 There shall be eight (8) time signaling schedules. It shall be possible to assign each schedule to a day of the week, or manually change schedules from an authorized administrative telephone.

7.0.1.18.2 Each event shall be able to be directed to any one or more of the eight (8) time-signaling zones.

7.0.1.18.3 Each of the eight (8) time zones shall have a programmable "tone duration" unique unto itself. For example: the gymnasium shall receive a time tone for ten (10) seconds while the rest of the facility receives a tone for five (5) seconds.

7.0.1.18.4 Each event shall sound one (1) of eight (8) user-selected tones. Each event may utilize a different time tone. It shall be utilized to send the gymnasium, shop classes, and pool (if necessary), a separate time tone to indicate "clean up". Minutes later the entire facility can then receive the same time tone to indicate class change.

7.0.1.18.5 Each of the eight (8) distinct time tone signals may be manually activated by selected administrative telephones. These tone signals shall remain active as long as the telephone remains off-hook, or until cancelled from the keypad.

Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter the next digit. In this way, the user shall not be required to memorize complicated key sequences in order to access manual time-tone functions.

Systems which do not provide eight (8) time signaling schedules or do not provide automatic activation of schedules shall not be acceptable.

7.0.1.19 There shall be a zone-page/all-page feature that is accessible by selected enhanced staff and administrative stations.

7.0.1.19.1 There shall be automatic muting of the loudspeaker in the area where a page is originating.

7.0.1.19.2 There shall be a pre-announce tone signal at any loudspeaker selected for voice paging. Upon picking up the receiver and dialing "#", a menu shall appear on the display prompting the user to enter the next digit. In this way, the user shall not be required to memorize complicated key sequences in order to access paging functions.

7.0.1.20 There shall be a voice-intercom feature that is accessible by selected enhanced staff stations and all administrative stations.

7.0.1.20.1 There shall be a periodic privacy tone signal at any loudspeaker selected for amplified-voice communication. These tones shall only occur when the user on the telephonic end is silent for more than fifteen seconds. The fifteen second timer shall reset itself each time the telephonic user finishes speaking. This shall eliminate the periodic interruption of open voice communication, while maintaining monitor signaling to the personnel at the speaker end of the conversation.

7.0.1.20.2 There shall be a pre-announce tone signal at any loudspeaker selected for voice-intercom communication.

7.0.1.20.3 Privacy and pre-announce tone signals shall be capable of being disabled during system initialization.

7.0.1.20.4 There shall be an automatic switch-over to private telephone communication should the person at the loudspeaker pick up his handset.

Upon picking up the receiver and dialing the first digit of the number of the station to be called, that number shall appear on the display along with a loudspeaker symbol, prompting the user to enter the next digits. There shall be no confusion as to the type of conversation that is to be established.

7.0.1.21 There shall be a telephonic communication feature which is accessible by all enhanced staff and administrative stations.

There shall be an audible ring signal announcing that a call has been placed to that station.

Upon picking up the receiver and dialing "*", a telephone symbol shall appear on the display, prompting the user to enter the number of the station to be called. There shall be no confusion as to the type of conversation that

is to be established.

7.0.1.22 There shall be an automatic disconnect of staff handsets left off-hook to prevent them from tying up communications channels. The station shall receive a busy signal and shall automatically disconnect after 45 seconds. Systems not preventing idle off-hook telephonic stations from tying up communication channels shall note and specifically submit an alternate method and equipment list to achieve the same function.

There shall be an automatic disconnect of administrative and enhanced staff stations to prevent them from tying up communications channels. When a station goes off-hook and does not initiate a call within ten (10) seconds, the station shall receive a busy signal and shall automatically disconnect after 45 more seconds. Systems not preventing idle off-hook telephonic stations from tying up communication channels shall note and specifically submit an alternate method and equipment list to achieve the same function.

7.0.1.23 There shall be an automatic disconnect of administrative and enhanced staff stations to prevent them from tying up communications channels. When a station goes off-hook and does not initiate a call within ten seconds, the station shall receive a busy signal and shall automatically disconnect after 45 more seconds.

7.0.1.24 Staff and enhanced staff stations may be programmed to ring an administrative telephone during day hours and another administrative telephone during night hours. Day and night hours shall be user-programmable. Assignment of staff stations shall not be restricted to any particular administrative station. Systems that limit the number and assignment of staff call-in to particular administrative station or groups of administrative stations shall not be acceptable.

7.0.1.25 Each staff station shall be programmable for three levels of call-in, as follows:

Level 1 - Normal/Emergency
Level 2 - Urgent/Emergency
Level 3 - Emergency

7.0.1.25.1 Staff stations programmed for access level 1 or 2 shall be able to initiate an emergency call by repeated flashing of the hook switch or repeated pressing of the call-in switch. Systems which require additional switches and/or conductors to initiate an emergency call shall not be acceptable.

7.0.1.25.2 Emergency calls from staff stations shall interrupt a non-emergency call in progress at the designated administrative phone. The administrator shall receive a warning tone and be connected to the emergency caller. The disconnected party shall

receive a busy signal. Systems which do not provide emergency call interrupt shall not be acceptable.

7.0.1.25.3 It shall be possible to connect a single push emergency call-in switch to any staff or enhanced staff station, without effecting normal station operation.

7.0.1.25.4 In addition to any of the above, it shall be possible to provide a single push Emergency Call In button, regardless of the stations functional level described above.

7.0.1.26 Calls from staff stations shall be logged into queue for the designated administrative telephones.

Administrative phones shall ring for a period of 45 seconds when they receive a call, and then stop ringing.

7.0.1.26.1 Each queue shall first be sorted according to call priority (emergency calls, then urgent calls, and then normal calls). Calls are sorted within each priority level on a first-in first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems which do not sort calls according to priority and order received shall not be acceptable. 1) The display shall simultaneously show up to four calls pending. Additional calls, beyond four (4), shall be indicated by an arrow pointing down thus prompting the user that additional calls are waiting.

7.0.1.26.2 It shall be possible to answer any incoming call simply by picking up the handset while it is ringing. It shall not be necessary to hit any buttons to answer a call.

7.0.1.26.3 "Single-Button" response. It shall be possible to answer any incoming staff call after the ringing has stopped by pressing a single button (key) on the administrative telephone. The system shall automatically call the first station shown on the display.

7.0.1.26.4 If there are any remaining calls on the queue when the administrative phone is hung up, a re-ring signal shall sound at the phone alerting the user to their presence.

7.0.1.26.5 It shall be possible to scroll through the call-waiting queue and answer calls in any order. It shall be possible to delete all unanswered normal and urgent calls. Simply pressing the "*" button twice shall auto-dial the station appearing in the top of that current display window.

7.0.1.26.6 Unanswered normal and urgent calls shall remain in their

respective queues for a user-programmable length of time, then be automatically deleted. Emergency calls shall be deleted from their queue only by answering the call.

7.0.1.26.7 Other than Emergency calls, the user shall have the ability to answer calls in random order. Emergency calls shall be responded to in the order in which they are received.

7.0.1.27 Enhanced staff stations shall receive dial tone upon going off-hook. Outgoing calls are made by dialing the desired station. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switch-over from loudspeaker to private telephone communication should the person pick up his handset.

Enhanced staff stations shall be programmable for one (1) of three (3) levels of system access, as follows:

7.0.1.27.1 Level 4 shall permit dialing any administrative station, toggle program material on/off at their location by use of the telephone dial pad, have access to outside lines (if so authorized), but designated to receive outside line calls, and call-forward to other enhanced staff phones or administrative phones. They shall also have the ability to be programmed to restrict dial access to any other stations telephonic device only.

7.0.1.27.2 Level 5 capabilities of the level 4 station plus dial any administrative or staff station phone or loudspeaker and make conference calls or transfer calls.

7.0.1.27.3 Capabilities of the Level 5 station plus single-zone page and all-zone page. All enhanced staff stations shall be able to initiate an emergency call by flashing the hook switch or utilizing a dedicated Emergency-Call switch. The Emergency-Call switch shall generate the pulses necessary to create an Emergency Call in. Emergency calls shall ring the designated day/night administrative station. If the emergency call is not answered within a predetermined time period the loudspeaker at the calling station will be connected to the emergency station. Telephones with dial pads in the classrooms shall have the ability to generate emergency calls in addition to their normal functions. Systems which do not allow for Emergency call generation directly from a dial type telephone shall supply separate call switches to meet this function.

7.0.1.28 Enhanced staff stations shall be able to make a normal call to any administrative telephone by dialing the number. Enhanced staff stations shall also be able to initiate an emergency call by flashing the hook switch. Emergency calls shall ring the designated day/night administrative station and then their speaker will be connected to the emergency station if not

answered within a predetermined time period.

7.0.1.29 Administrative stations shall receive dial tone upon going off-hook. Outgoing calls are made by dialing the desired stations. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switch-over from loudspeaker to private telephone communication should the person pick up his handset. Additionally, the user may answer the call via built in speaker phone, merely by selecting such.
System functions are accessed by going off-hook and dialing "9". Further operations are menu assisted in all cases. All administrative telephones shall permit the following operations:

7.0.1.29.1 Direct-dial private two-way telephone communications with other administrative stations, enhanced staff stations and handset stations. This shall not be limited by any station grouping and shall not occupy more than a single communication path.

7.0.1.29.2 Direct-dial two-way amplified-voice communications with any station loudspeaker. This shall not be limited by any station grouping and shall not occupy more than a single communication path.

7.0.1.29.3 Toggle reception of program material on/off at their speaker station by use of the telephone dial pad.

7.0.1.30 Administrative stations shall be equipped with a 4-line by 16-character alphanumeric display panel.

7.0.1.30.1 The display shall normally show the time-of-day and day of week, the current time signaling schedule, and the numbers of up to four stations calling in along with the call-in status of each station (normal, urgent, emergency). Enhanced administrative stations will additionally display the status of the interconnected outside lines and maintain the ability to place those calls on hold. When dialing from the administrative phone, the display shall indicate the station number and type of station (loudspeaker or handset) being dialed.

7.0.1.30.2 The display shall also provide user-friendly menu selections to assist the operator when paging and distributing program material. Displays shall be in English with internationally recognized symbols for maximum ease of use. Systems which require the operator to memorize long lists of operating symbols or control codes shall not be acceptable.

7.0.1.31 Administrative stations shall be programmable for three levels of system access, as follows:

7.0.1.31.1 Level 7 - Shall permit dialing any station in the system, turn program material on/off at their location, scroll, erase and auto-dial call-waiting queue, make conference calls and transfer calls, call forward to other administrative stations, make all-zone pages and emergency all-zone pages, have access to outside lines and be designated to receive outside line calls.

7.0.1.31.2 Level 8 - Capabilities of the Level 7 station plus select and distribute/cancel program material to and combination of stations, paging zones or all zones; set/reset alarm/external functions and zone page.

7.0.1.31.3 Level 9 - Capabilities of Level 8 station plus bump or join a conversation in progress, manually initiate time tones and have access to system and station programming functions (when accompanied by a valid password).

7.0.1.32 Program selection, and its distribution or cancellation shall be accomplished from a designated administrative telephone, with the assistance of the menu display system. Distribution and cancellation shall be to any one, or combination of speakers, or any zone(s), or all zones. Systems which rely on switchbanks to perform the above functions shall not be accepted as an equal.

7.0.1.33 It shall be possible, via an administrative telephone, to manually initiate any of eight (8) tones. The tones shall be separate and distinctly different from the emergency tones. The tone selected shall continue to sound until it is cancelled, or until the administrative phone is placed back on-hook.

7.0.1.34 Each administrative telephone shall maintain a unique queue of all stations calling that particular phone.

7.0.1.34.1 Program selection, distribution or cancellation shall be accomplished from a designated administrative telephone, with the assistance of the menu display system.

7.0.1.34.2 Select shall be from any one of three possible audio program inputs, or none.

7.0.1.34.3 Distribution and cancellation shall be to any one, or combination of speakers, or any zone(s), or all zones.

7.0.1.34.4 Upon selecting a program source, the selecting administrator's loudspeaker shall automatically activate and function as a monitor speaker. The loudspeaker shall remain active as long as the administrator is in the program

selection/distribution/cancellation menu of the display.

7.0.1.34.5 It shall be possible to, at any time, select, redirect or cancel the program distribution to any station, zone or all locations.

7.0.1.34.6 Systems which require the office personnel to leave their work station and go into the equipment cabinet simply to accomplish these functions shall not be acceptable.

7.0.1.34.7 Systems which rely solely on switch banks to perform the above functions shall not be accepted as an equal.

7.0.1.34.8 Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access program distribution functions.

7.0.1.35 System programming shall be from an administrative telephone with Level 9 access. All system programming data shall be stored in nonvolatile memory. A valid password shall be required to gain access to the following programmable functions:

7.0.1.35.1 Set Day and Time.

7.0.1.35.2 Program time-signaling events, time signaling schedules, and assign schedules to days of the week.

7.0.1.35.3 Program time signaling zones.

7.0.1.35.4 Program paging zones.

7.0.1.35.5 Manually change time signaling schedules.

7.0.1.35.6 Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access system-programming functions.

7.0.1.36 System initialization shall be accomplished from an administrative telephone with Level 9 access. All system initialization data shall be stored in nonvolatile memory. A password (separate from the password necessary for system programming) shall be required to gain access to the following system initialization parameters:

7.0.1.36.1 Bell duration for each time zone.
7.0.1.36.2 Queue timeout.
7.0.1.36.3 Day start/night start time.
7.0.1.36.4 Designate emergency station.

7.0.1.36.5	System programming password.
7.0.1.36.6	Architectural dialing.
7.0.1.36.7	Privacy beep.
7.0.1.36.8	Preannounce tone.

7.0.1.37 Station Initialization shall be accomplished from an administrative phone with Level 9 access. All station initialization data shall be stored in nonvolatile memory. A password (separate from the password necessary for system programming) shall be required to gain access to the following station initialization parameters:

7.0.1.37.1 Set station access level.

7.0.1.37.2 Set station architectural number.

7.0.1.37.3 Set day administrator.

7.0.1.37.4 Set night administrator.

7.0.1.37.5 Assign access to outside lines.

7.0.1.37.6 The system shall be capable of being interfaced with either an on-site or off-site computer for system configuration programming and system diagnostics. It shall be possible to change the baud rate of the system.

Diagnostics shall also be built into the administrative telephones and accessible only by authorized personnel. Diagnostics shall indicate passes and failures of system memory, system clock, all audio busses, tone generators, dtmf generators and decoders and the integrity of the field wiring.

The diagnostics feature shall be completely menu driven. It shall be possible to individually select the test and card, or all to run diagnostics on. This shall be a standard feature of the system and supplied at the time of installation. It shall be accessible only by authorized stations and personnel.

7.0.1.37.7 Systems not capable of supporting the computer interface for programming and diagnostics, nor supportive of built-in diagnostics for the end user shall not be deemed as equal.

7.01.38 The system shall provide the capacity to control remotely located telemedia video sources via any dtmf type telephone in the system. Telemedia video sources which may be controlled shall include any infrared controllable; video cassette recorder, video laser disk, and cable television converter box. The telemedia control panel shall also have the ability to control infrared controllable; compact disk players, cassette players, AM/FM tuners, or any

other infrared controllable source/device.

NOTE: Video sources, television, and an MATV system shall be provided, however, they are specified elsewhere.

7.0.1.38.1 There shall be LED's mounted on the face panel of the telemedia control panel to indicate that a source has been reserved, power is applied to the telemedia control panel, the telemedia control panel is in the learn mode, or that there has been an error in the programming of the telemedia control panel.

7.0.1.38.2 The telemedia control panel shall have the ability to learn and reproduce the infrared commands of any source the user wishes to control. This ability shall not be limited to only VCR's and video laser disk players. As this feature will allow the user to alter or replace any source in the future without the worry of source control compatibility, it is essential that all telemedia control panels submitted include this capability. Those submissions which include telemedia control devices which do not have the ability to learn source control commands will not be accepted as equal to that which is specified.

7.0.1.38.3 The telemedia control panel shall be a microprocessor based, self-contained unit capable of learning, storing and then reproducing the infrared control commands of up to four different sources. The telemedia control panel shall be capable of learning, storing, and then reproducing up to thirty different commands for each of the four different sources. The learned commands shall be stored in nonvolatile memory.

7.0.1.38.4 It shall be possible to standardize the telephone button/feature assignment of all the different sources to be controlled, example: 1-play, 2-stop, 3-pause, 4-rewind, 5-fast forward, etc., for all of the sources. This way, in conjunction with the reconnect command, the user is not necessarily required to be aware of which source they are actually controlling.
This standardized telephone button/feature assignment is crucial to the ease of operation of this system. All submittals shall indicate whether or not the button to feature assignment is a standard function of the system. If it is not a standard function of the system, the submittal shall indicate precisely how this function is to be accomplished. Failure to submit alternate button standardization shall be deemed as being in direct conflict with these specifications and, therefore, not equal to that which is specified.

7.0.1.38.5 Telemedia control from the classroom shall be accomplished

via DTMF telephone and wireless hand held infrared remote control. As it is imperative that the instructor maintain the ability to move freely about the room while maintaining full interactive control of the telemedia source, systems failing to provide this feature shall be deemed unacceptable unless an alternate method of achieving the same is submitted for and receives prior approval.

The hand held remote control shall be labelled with all common VCR and video disk functions in addition to all common television controls. A single hand held remote control shall be utilized to control both the telemedia source(s) and the in room television.

7.0.1.38.6 The system shall be capable of supporting multiple telemedia control panels. It shall not be necessary for the telemedia control panel to be located in the central communications rack.

7.0.1.38.7 There shall be an administrative telephone with a plain English menu driven display located in the media center for use by the media center personnel. This station may have an associated loudspeaker. In addition to the media control features, this telephone shall support all other system feature and functions.

7.0.1.38.8 It shall be possible for the media personnel, from their administrative display telephone, to preassign any telemedia source to any station. This pre-assignment shall be aided by a plain English menu prompting the media personnel through the various programming options. Programming capabilities are review source/station assignment (if any), enter source/station assignment, delete source/station assignment, and exit.

Once a source has been reserved for a station, all other staff stations are completely locked out the control of that source.

After a telemedia source has been reserved for a specific station, that station shall need only to depress their "9" button twice to be (re)connected to their preassigned source, thus eliminating the need to remember the telemedia source station number.

7.0.1.38.9 Access to a specific telemedia source is achieved, using the classroom telephone, by dialing the extension number of the desired source OR, if preassigned by the media personnel, simply by depressing the "9" button twice.

7.0.1.38.10 To (re)connect to the telemedia source the user simply shall remove the telephone handset from its cradle and dial the

reconnect code, "99". Systems which require the user to remember exactly which source they are to be using are too complicated and, therefore, in direct conflict with these specifications. Submittal of systems which do not offer the above specified reconnect command shall precisely indicate an alternate method of how the above specified reconnect command is to be accomplished.

7.0.1.38.11 Upon access of the telemedia source the user shall receive a continual confirmation beep to indicate continued access and control of the source. Upon activation of a function, the user shall be sent a double pulse of the confirmation tone to indicate the command was recognized and processed. The user shall be capable of continuing to enter functions as long as they remain off hook.

7.0.1.38.12 Once the telemedia source has been reserved or accessed, the user may connect and disconnect at their discretion. The user may hang up the telephone without releasing the telemedia source to other users. While the telephone is in the on-hook condition, no link within the system shall be occupied.

7.0.1.38.13 The telephone and/or speaker shall remain available for all normal station activities and communications while telemedia source reception is in process. Systems which require that a link be maintained throughout the duration of the sources use or that restrict the use of any of the stations functions shall not be deemed as equal.

7.0.1.38.14 Release of the telemedia source shall be accomplished by either the media personnel or the source/station user. It shall be possible to release the source from either location via telephone or manually from the media center.

7.0.1.38.15 A telemedia source control panel shall be located in the media center to accept direct commands from the classroom telephones and convert them into source control commands. The interface between the telemedia control panel to any of the sources shall not require any modification to the source or the telemedia control panel as this would void any warranty.

7.0.1.38.16 The telemedia control panel shall be a "smart" device, in that it shall be capable of learning the control commands of any infrared controllable source. Those systems which rely on "universal" or preprogrammed type remote controls are limited to their library of controllable sources and quickly become obsolete.

It is absolutely imperative that the end user maintain the ability to change, replace, or upgrade their sources without having to upgrade or change any other equipment.

All submittals shall indicate if their submitted telemedia control panel is capable of learning infrared control commands. If it is not capable, the submission shall precisely indicate an alternate method of achieving the same result without subjecting the end user to future expenses beyond simple source changes.

7.0.1.39. There shall be a computer and associated software supplied to support a video clock and scrolling message center. These images are to be distributed facility wide via an unused channel on the MATV system.

7.0.1.39.1 The clock image shall be user selected analog or digital, displaying the time; hour, minute, seconds and the date. The image shall inconspicuously move about the television screen. The user shall have the ability, via pull up menus on the computer, to alter the colors of the foreground and the background displays of the clock and scrolling message.

The computer/clock image shall be corrected and synchronized continually by the program clock of the head-end communications system to assure that the time display and the distribution of time tone are synchronized. Systems failing to synchronize the video clock with the facility time signaling schedule shall not be accepted as equal.

7.0.1.39.2 A message center shall be provided to display, in scrolling fashion, one line messages beneath the video clock. It shall be possible to scroll the video messages from left to right, right to left, top to bottom, bottom to top and from the center to the left and right. The user shall have the ability, via pull- up menus on the computer, to alter the scroll mode.

7.0.1.39.3 The user shall have the ability to create, delete, edit and schedule multiple message files with as many messages as they chose in each file. It shall then be possible to schedule the precise time at which each file is to be displayed. There shall be no limit to the number of message files created, nor the number of messages in each file. The user shall have the ability, via pull-up menus on the computer, to create, delete, edit and schedule the messages and the message files.

7.0.1.39.4 Creating, deleting, editing and scheduling a message file shall not require the user to interrupt the active message file distribution. The system shall allow the active message file to be deleted, edited and scheduled while remaining on line, thus

without interruption or indication of alteration to the viewers.

7.0.1.39.5 The user shall have the ability to change the scroll rate of the messages being displayed by the message center. This shall be adjustable from one second to ninety nine seconds. The user shall have the ability, via pull-up menus on the computer, to alter the scroll rate of the message center message.

7.0.1.39.6 A video bulletin board shall be provided to display, facility wide, bulletin board type messages. These bulletins shall utilize the entire television screen. The software for this video bulletin board system shall support unlimited bulletins and bulletin files.

7.0.1.39.7 The user shall have the ability to create, delete, edit and schedule multiple bulletin board files with as many bulletins as they chose in each file. It shall then be possible to schedule the precise time at which each file is to be displayed. There shall be no limit to the number of bulletin board files created, nor the number of bulletins in each file. The user shall have the ability, via pull-up menus on the computer, to create, delete, edit and schedule the bulletins and the bulletin board files.

7.0.1.39.8 Creating, deleting, editing and scheduling a bulletin board file shall not require the user to interrupt the active bulletin board distribution. The system shall allow the active bulletin board file to be deleted, edited and scheduled while remaining on line, thus without interruption or indication of alteration to the viewers.

7.0.1.39.9 The user shall have the ability to change the scroll rate of the bulletin board being displayed by the electronic bulletin board. This shall be adjustable from five seconds to ninety nine seconds. The user shall have the ability, via pull-up menus on the computer, to alter the scroll rate of the bulletin board.

7.0.1.39.10 When both the video clock/message center and the video bulletin board are supplied, they shall both be run simultaneously from a single IBM or compatible computer. Both the video clock/message center and the video bulletin board shall be displayed simultaneously on a single computer video monitor.

7.0.1.40 The contractor shall make available, and maintain a satisfactory service department capable of furnishing equipment inspection and service.

7.0.1.41 The contractor shall be prepared to offer a service contract beyond the warranty period.

7.0.1.42 The contractor shall instruct personnel designated by the owner in the proper use, basic care and maintenance of the equipment. Such training shall be provided as an integral component of the system.

7.0.1.43 The contractor shall warrant the system to be new and free of defects in material and workmanship, and will, within one year from the date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment which has been subject to misuse, abuse, negligence, accident or unauthorized modification.

8.0 TRAINING

8.0.1 The contractor shall instruct personnel designated by the owner in the proper use, basic care, and maintenance of the equipment. Such training shall be provided as an integral component of the system. Training shall be minimum of 2 hours.

PART 2 - PRODUCTS

2.1 CONSOLE

The following show the model numbers for components from approved integrated P. A./ In-house Phone system manufacturer.

2.1.1 Bogen Multicom 2000 P/A Rack

2.1.2.1 Baldwin Sound is responsible for upgrading the existing P/A Rack to TDSB's Current Standards and as necessary to accommodate the Addition and Renovation.

2.2 PERIPHERAL DEVICES

2.2.1 ADMINISTRATIVE DISPLAY PHONE

2.2.1.1 The administrative telephone display panel shows the time of day and day of week, the current time signalling schedule, and the station numbers and call-in priority of staff stations that have called that particular administrative station. A single key response is used to scroll the display and auto dial response calls. A two key actuation is required to erase normal and urgent calls. Depending upon the system access level, an administrative station can use display menus to activate zone pages, alarm signals and external functions, as well as select program sources and distribute or cancel a program to any or all speakers or zones.

.1 Bogen: Model MCDS4

2.2.1.2 Administrative stations have the option of dialling either the loudspeaker or phone at each station location. An automatic switch from phone-to-intercom to phone-to-phone communication is made when the staff handset is lifted. The administrative station shall contain ten user programmable speed dial function/ locations and also three user programmable "soft key" locations. There shall be hands-free speaker phone.

2.2.1.3 A built-in program clock, with battery back-up, is included to automatically control class change or other signals. The clock may be synchronized with a master clock. 1024 events may be programmed into the system's eight time signalling schedules.

2.2.2 ENHANCED STAFF STATIONS

2.2.2.1 Enhanced staff stations can dial administrative stations, initiate emergency calls, and enable or disable the reception of program material at their location. Depending upon the level of system access, enhanced staff stations can dial other staff stations, perform all-call, zone pages, and conference call and call transfer. Provide as shown on the plans.

.1 CETIS Teledex A105

2.2.2.2 Stations can be assigned to initiate calls at three levels; normal/emergency, urgent/emergency, and emergency. Emergency calls ring the administrative phone with a special tone and will interrupt a non-emergency call in progress. An integral emergency announce feature (no external amplifier necessary) gets prompt attention when needed by routing unanswered emergency calls to a designated emergency station. Emergency calls continue to ring until answered.

2.2.2 STANDARD HANDSETS

2.2.2.1 Standard Handsets shall be Teledex E-Series Analog Corded (EA110N0T).

2.2.3 SPEAKERS

2.2.3.1 Wall mounted classroom speakers, 8", 25V, each c/w control transformer and backbox.

.1 Bogen: model Enforcer E86CWT5SA c/w backbox EBB8SS,

2.2.3.2 Ceiling mounted speaker and grilles, 8" 25V,

.1 Bogen: model Enforcer E86CWT5SA c/w tee supports WBS8T725 and EBB8SF enclosure,

2.2.3.3 Wall mounted bi-directional speakers.

.1 Bogen: model McBride 8229-75-25,

2.2.3.4 Horns shall be of weatherproof type,

.1 Bogen: model SPT-15A, or Enforcer EMH15,

2.3 SOURCE EQUIPMENT

2.3.1 Existing to Remain

2.4 WALL DISPLAY UNIT

2.4.1 Provide a wall display unit in the school's main office for administration communication.

2.4.1.1 Properly locate the unit in such a location that best suit the office layout such that staff in the main office can easily read off information to be shown on the display unit. Run two pair #22 AWG and one pair #18 from the unit to the system rack.

.1 Bogen: model MCWD,

2.5 NIGHT RINGER

2.5.1 Provide the weatherproof heavy duty push button and horn station by the entrance of the school.

2.5.1.1 Connect the station to the new integrated P. A./ in-house Phone System and configure the system in such a manner that it will be activated automatically between 5:00 p.m. and 10:00 p.m. after the normal school hours. When the push button is pressed during the operating hours, the night ringer will generate a different tone through all hall P. A. speakers in the school. Personnel can then pick up any in-house phone in the school and key in an access code to answer the call.

.1 Quam CIS4/25 Series.

2.5.1.2 Provide a switch and a dual element LED at the system rack to override the automatic timer and allow the night ringer to active 24 hours a day. LED in green represents the auto mode and LED in red represents the override mode.

2.5.1.3 Provide a lamacoid label to identify the use of the station with 1/4" high etched texts.

2.5.1.4 Exact location and operating time of the night ring station shall be coordinated with the school prior to roughing-in and programming.

2.6 TERMINAL BLOCKS

2.6.1 All conductors in all terminal cabinets, equipment rack, etc., shall be terminated on Siemens 66M1-50 punch blocks or approved equal.

2.7 CONDUCTORS

2.7.1 Wiring shall be of FT6 type and be run individually and directly from each of the speakers and in-house phone sets to be installed in classroom, staff room, private office, lunch room, etc. to the rack.

2.7.2. Cabling specifications shall be as per the following:

1) For Classrooms- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252),
2) For Hallways- 1 twisted pair jacketed #18 AWG FT6 (Provo 999182),
3) For Outside horns- 1 twisted pair jacketed #18 AWG FT6 (Provo 999182),
4) For Strobe DC- 1 twisted pair jacketed #18 AWG FT6 (Provo 999182),
5) For Admin Phone- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252),
6) For Remote Wall display- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252) plus 1 twisted pair jacketed #18 AWG FT6 (Provo 999182), and
7) For Night Bell Door Station- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252).

2.8 UNINTERRUPTIBLE POWER SUPPLY

2.8.1 Supply and install an UPS unit at the system rack for stand-by power during power failures. UPS shall be sized to provide power supply for a minimum of 20 minutes time under the full load condition.

2.8.2 Consultant shall check the capacity of the UPS upon completion of work. Any UPS that does not carry the back-up power capacity as per specification shall be replaced at the contractor's expenses.

2.8.3 Provide a separate 15A 120V circuit just for the new integrated P. A./In-house Phone system to suit requirements. Circuit shall be fed from an existing appropriate power panel. Provide an updated typed panel directory for the affected panel for reference.

2.8.4 The UPS shall be from "Eaton" Model #9PX1500RT, Battery shall be from "Eaton" model #9PXEMB48RT. Provide a power outlet strip with surge suppressor (Eaton Eclipse Pro 83501).

2.9 SPARES

2.9.1 Provide two (2) handsets and two (2) speakers as spare parts if the Board so requests at no charge to the Contract.

2.10 WIRED MASTER CLOCK SYSTEM

2.10.1 Supply and installation of a new Wired Master Clock System shall be completed by the Electrical Contractor.

2.10.2 Note that all new clocks at this school will be part of a new wired master clock system (Sapling 24V RS485 2-Wire Clock System):

a. Provide Sapling Master Clock, Model SMA-3S0-1004-1 at the PA rack.
b. Provide Sapling Converter Box, Model SCB-100-000-1 at the PA rack.
c. Sapling 12" round analogue clock, Model SAM-1BS-12R-4 (Classrooms, Offices, etc.).
d. Sapling 16" round analogue clock, Model SAM-1BS-16R-4 (gym).
e. Sapling wire guard for gym clock(s), Model SAG-1200.

f. Wire - 1 Pair 16 AWG jacketed FT6 (Provo 999162). Both power and correction signal are combined on this one pair.
g. Clocks can be daisy chained. Provide a home run per floor.
h. Field Clocks wire back to converter box (1 run per floor). Master clock connects to the converter box.
i. Both master and converter box shall be connected to a new receptacle on a dedicated circuit.

2.11 ASSISTIVE LISTENING SYSTEM

2.10.1 In the Gymnasium, provide an Assistive Listening System supplied by Baldwin Sound Systems. System shall consist of:

a. The system shall be a complete, large-area, easy-listener, wireless FM, narrow-band system for use in the Gym.
b. The transmitter shall be CSA-approved, connected to speakers or line outputs of the gymnasium sound system. System shall transmit one (1) of the 40 FCC- and DOC approved band channels on the 72 to 76 MHz band. Transmission range of approximately 91 m (300′) complete with remote large-area antenna.
c. Receiver should be powered by two (2) AA rechargeable Nickel-Cadmium batteries, with On/Off control output jacks accepting one of the listening accessories, and be FCC- and DOC-approved.
d. Charger/organizer shall be capable of recharging twelve (12) receivers at one time complete with external, CSA-approved wall transformer.

PART 3 - EXECUTION

3.1 DIVISION OF WORK

3.1.1 While all work included under this specification is the complete responsibility of the contractor, the division of actual work listed following shall occur.

3.1.2 The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed completely by this contractor. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative. The entire responsibility of the system, its operation, function, testing and complete maintenance for one (1) year after final acceptance of the project by the owner, shall also be the responsibility of the installing contractor and manufacturer's authorized representative.

3.2 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

3.2.1 All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.

3.2.2 The manufacturer's representative shall have completed at least ten (10) projects of

equal scope, giving satisfactory performance and have been in the business of furnishing and installing sound systems of this type for at least five (5) years. The manufacturer's representative shall be capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

3.2.3 The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed.

3.2.4 The contractor shall furnish a letter from the manufacturer of the equipment, which certifies that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of one (1) year after final acceptance of the project by the owner.

3.3 INSTALLATION

3.3.1 Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.

3.3.2 Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T & B "Ty-Rap" cable. Edge protection material ("cat-track") shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.

3.3.3 Cable identification: Cable conductors shall be color coded and individual cables shall be individually identified. Each cable identification shall be a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height.

3.3.4 Shielding: Cable shielding shall be connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.

3.3.5 Provide complete "in service" instructions of system operation to school personnel. Assist in programming of telephone system.

END OF SECTION

PART I – GENERAL

1.1. Description

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for the inspection and construction of concrete paving and curbing as shown on the Construction Drawings and as described by the Contract Specifications.

.2 Comply with the requirements of the Tender Document and General Conditions.

1.3. Quality Assurance

.1 The contractor must have a minimum of 5 years experience in concrete work.

.2 All materials must conform to CSA A23.1-94. A copy must be kept on site at all times during construction.

.3 Furnish the Landscape Architect with a certificate prepared by the Ready-Mix concrete suppliers stating that all requirements regarding strength, slump, air entrainment, mix, materials and ratio have been met and maintained.

.4 Prior to pouring concrete, obtain the approval of the Landscape Architect of all form work, placement of reinforcing steel, consolidation of subgrade and placement and consolidated of granular base.

.5 When required by the Landscape Architect, have all concrete tested for compressive strength, slump and air content, in accordance with CSA A23.2-94. Submit test reports in duplicate and pay all costs incurred.

.6 Ensure work complies with the Ontario Building Code and all pertinent local by-laws and regulations. These shall govern in case of conflict with the specification. Obtain and pay for all necessary permits before starting work.

1.4. Product Delivery, Storage and Handling

.1 Store all materials in accordance with CSA A23.1-94 latest edition.

.2 Store reinforcing steel on racks or skids. Protect from contamination by dirt or other materials.

.3 Store forms off the ground and sufficiently supported to prevent warping or distortion. Protect from contaminations by oil, grease, water, earth, etc.

.4 All concrete is to be ready mixed at plant and transported to the site by truck in accordance with CSA A23.1-94. Hand mixed concrete is not allowed unless approved in writing by the Landscape Architect prior to the start of work.

.5 Convey concrete from the mixer to the place of final deposit as rapidly as possible, with as little rehandling as is practical. Avoid segregation and/or loss of material.

.6 Place concrete in final position and at such a rate that it remains plastic at all times and flows readily between reinforcement, into all corners and crevices and around all embedded fixtures. Pour in a continuous operation between expansion joints.

.7 Thoroughly clean all equipment, used for mixing or transporting of concrete, of all hardened concrete and foreign material prior to placing concrete.

.8 Do not allow concrete to be contaminated by foreign materials. Do not use retempered concrete unless approved in writing, by the Landscape Architect.

.9 Obtain the approval of the Landscape Architect of the type, number and method of use of mechanical vibrators. Do not operate a vibrator for longer than 10 seconds in any one location.

.10 Maintain constant control to ensure that finished concrete is dense, uniform, free of air holes or honeycombs and that no segregation of aggregates and cement paste occurs.

1.5. Job Conditions

.1 Protect all concrete surfaces from damage or harmful effects of weather, water, mechanical shock or trespassers until concrete is properly cured.

.2 If temperature is expected to drop below 5°C, place and protect concrete in accordance with AC1.605.

1.5. Inspection

.1 Obtain the approval of the Landscape Architect of the layout, compacted sub-grade, compacted granular base, formwork and reinforcing before proceeding with subsequent work.

PART II – PRODUCTS

2.1. Materials

.1 Granular A and Granular B: granular material conforming in all respects to OPSS 1010, latest edition.

.2 Portland cement: standard grey portland cement, conforming to CAN/CSA-A5/A8/A362-93 type 10 normal.

.3 Aggregates: nominal size as specified and conforming to CSA A23.1-94.

.4 Water: clear and free of deleterious substances or efflorescing salts.

.5 Air entraining admixtures: conforming to ASTM C 260-94 and of approved manufacturer.

.6 Reinforcing steel: conforming to CSA G-30.12-M77 for bars, CSA G30.5-M83 for welded steel wire mesh and OPSS 1440.

.7 Expansion joint filler: premoulded bituminous impregnated fibre board conforming to ASTM D1751-73 of thickness and depth specified.

.8 Curing Compounds: clear liquid chlorinated rubber to ASTM C309 and OPSS 1315.

.9 Formwork: conforming to CSA A23.1-94 and AC1- 347 and of sound wood, in good condition and equal or better than No. 2 grade construction spruce and/or 19mm Douglas

Fir plywood, with the surface treated to produce a smooth concrete finish. Plywood to be CSA 0/2/.

2.2. Mixes

.1 Mix concrete materials in accordance with CSA CAN3-A23.1M-77, in the proper proportions and ratios to provide a finished product as specified. Concrete mix shall meet the following requirements: Compressive strength 32 MPa at 28 days; 100mm slump at point of deposit; air entrainment 6% (+ or - 1%), 0.45 Water and Cement Ratio. Unless noted otherwise on the drawings or details, all concrete is to be 32 MPa strength.

.2 With the exception of air entraining agents, other mixtures may only be used with the written approval of the Landscape Architect. The use of agents to lower the freezing point of the mix will not be permitted.

PART III – EXECUTION

3.1. Preparation

.1 Excavate to the minimum specified depths, after compaction, as shown on the drawings. Maintain sub-grade parallel to finished grade in all cases.

.2 Fine grade subgrade eliminating uneven areas and filling low spots. Remove all debris. Excavate all soft and unstable areas in subgrade and backfill with Granular “B”.

.3 Compact subgrade uniformly to minimum ninety-eight percent (98%) Standard Proctor Density. Arrange for testing of fill materials and compaction. When required and as directed by the Landscape Architect, the Contractor shall, at his own expense, sprinkle water to assist in compaction.

.4 The Granular “B” base shall be applied in maximum 74mm (3 inches) layers, graded, rolled and compacted in accordance with OPSS Division 3.

.5 In the event of delay between completion of subgrade and commencement of application of stone base, the Contractor shall re-grade and re-compact subgrade at his own expense if so ordered.

.6 Keep materials clean and free of deleterious materials at all times.

.7 Maintain final grade of granular base course parallel to finished grade.

.8 Submit written test reports.

.9 Contractor to ensure that all concrete columns are vibrated to eliminated all voids.

3.2. Granular Base

.1 Spread the specified granular materials in horizontal layers not exceeding 150mm loose depth and compact to 98% Standard Proctor Dry Density. In areas where compaction by roller is not possible, compact with approved mechanical or hand tamping devices to the specified density.

.2 Build up thickness of each material to the minimum compacted thickness as specified on the drawings.

.3 Ensure that granular does not become contaminated by deleterious material.

.4 Correct all irregularities or depressions resulting from rolling and compact until the granular surface is smooth, uniform and true to line and grade.

.5 When required by the Landscape Architect, have the compaction of the granular materials tested by an approved, independent testing firm. Submit 2 copies of the test results to the Landscape Architect and obtain his approval prior to pouring concrete. Pay testing costs incurred.

3.3. Form Work

.1 Erect forms in such a manner as to facilitate dismantling and removal without damaging concrete.

.2 Erect forms true to line and level in accordance with the drawings, and sufficiently braced to maintain their form and alignment when concrete is placed.

.3 Prior to each pouring operation, coat affected form surfaces with an approved form separating material.

.4 Provide for all openings, sleeves, hangers, anchors and ties to be cast into the concrete.

.5 Do not use treated plywood for exposed surfaces more than 5 times. Do not use plywood if surface is damaged.

.6 Obtain the approval of the Landscape Architect of all form work before proceeding

3.4. Reinforcement

.1 Before placing reinforcement, clean all loose scale, dirt and any other coating that would destroy or reduce bonding to concrete.

.2 Place all reinforcement accurately in accordance with the drawings and/or approved shop drawings. Use approved chairs, spacers, hangers or ties to secure the reinforcing in position.

.3 Unless directed otherwise, provide the following minimum concrete cover over reinforcing:

a) 75mm where concrete is deposited against soil.

b) 50mm for bars larger than 10m and 40mm for bars smaller than 10m where concrete is exposed to weather.

.4 Obtain the approval of the Landscape Architect of all reinforcing before proceeding.

3.5. Joints

.1 Locate expansion joints as shown on the drawings or at max. intervals of 6.0m, between new concrete and all new or existing rigid structures, and either side of all driveway sections. Joints must be cast in place.

.2 Execute construction joints in accordance with AC1-301 and as detailed on the drawings. Thoroughly clean the joint surface of all laitance and wet thoroughly and slush with a coat of cement grout immediately before placing new concrete.

.3 Except for expansion joints, continue reinforcing uninterrupted through joints, unless shown otherwise on the drawings or directed by the Landscape Architect.

.4 Stop reinforcing on each side of expansion joints. Where dowels are indicated, cast one half into one side of the joints. The exposed half shall be machined smooth and heavily greased before placing adjoining sections.

.5 Locate control joints as shown on the drawings or at a max. spacing of 2.0m. Ensure joints are to a minimum depth of 1/4 the thickness of the concrete. Make joints by one of the following methods:

a) Sawed joints

b) Hand formed and hand tooled

c) Inset joints placed in plastic concrete

.6 No offsets will be allowed between adjacent sections of joint fillers and no plugs of concrete will be permitted anywhere within an expansion joint.

.7 Apply joint sealant in accordance with the manufacturer's directions. Ensure joints are clean and free of any foreign substances before sealing. Clean any sealant spilled on concrete surface immediately.

3.6. Placing of Concrete

.1 Place concrete by approved means and using approved equipment.

.2 Do not place concrete until formwork and grades have been inspected by the Owner or Landscape Architect.

.3 Transport concrete from mixer to point of deposit, and place in final position as quickly as possible to prevent separation and loss of materials.

.4 While placing concrete, compact thoroughly and uniformly by approved means to ensure a dense homogeneous structure free of air pockets, and honeycombs and closely bonded with reinforcement.

3.7. Finishing

.1 Treat and finish all surfaces as directed or specified and in accordance with CSA CAN3-A23-1-M77.

.2 Strike off and float all exposed paving surfaces as soon as possible after consolidation and in accordance with recommendations of the Portland Cement Association. Execute final finishing as specified on the drawings or as directed by the Landscape Architect.

.3 Ensure finished surface is true to line and level as shown on the drawings. Walks are to be sloped as per grading plans.

.4 All irregularities greater than 6mm under a 3000mm straight edge, operated parallel to the centre line, must be repaired.

.5 Obtain the approval of the Landscape Architect of finished surfaces before starting curing operations.

.6 Immediately after stripping formwork, obtain the approval of the Landscape Architect before commencing patching, finishing or curing operations.

.7 The extent, method and type of mix for patching shall have the approval of the Landscape Architect before commencing work. Ensure patching mix contains an approved bonding and waterproofing agent and that it is installed in accordance with the manufacturer's specifications.

3.8. Curing

.1 Keep concrete moist for at least 3 days after placement, in accordance with CSA CAN-A231-M77.

.2 Method of curing shall be as specified or by one of the following approved methods if not specified:

a) Moist curing

b) Waterproofing paper or white polyethylene sheeting

c) White liquid membrane compound

d) Combination of above methods

.3 Moist curing: use burlap or approved equal. Ensure it is thoroughly wet when applied and kept continuously wet and in full contact with the surface during the curing period.

.4 Waterproof paper or white polyethylene sheeting: ensure sheet is large enough to cover entire concrete surface. Secure to prevent displacement during curing period. Immediately repair any tears or holes.

.5 White liquid membrane compound: apply at the rate of 1 litre per 5 square meters after final finishing and all free water has disappeared. Keep membrane compound agitated to prevent settling of compound. Apply membrane compound to edges immediately after formwork is removed. Ensure a continuous and unbroken membrane cover is applied.

3.9. Clean-up

.1 Clean and remove all concrete spills from the site and make good any disturbance.

End of Section

PART I – GENERAL

1.1. Description

.1 This section specifies the supply and installation of all site furnishings including benches, chairs, tables and all other site furnishings.

.2 Comply with all requirements for the General Requirements – Section 01 00 00.

1.2. Shop Drawings

.1 Submit detailed shop drawings. Incidate sizes, materials and fastening methods.

1.3. Quality Assurance

.1 All installation of site furnishings will be carried out by experienced personnel under the direction of a skilled foreman and in strict accordance with all drawings, and manufacturer's specification.

1.3. Submittals

.1 The contractor will make available a colour and finish sample of all site furnishings for approval by the Owner or Landscape Architect.

1.4. Product Delivery, Storage & Handling

.1 Protect all materials from harmful exposure during transportation to the site.

.2 Upon delivery, store all materials off the ground and protect from adverse conditions to prevent deterioration, damage, or impairment of structural or other essential properties.

.3 All damaged or deteriorated materials will be rejected and must be removed from the site immediately.

1.5. Site Examination

.1 The contractor shall report to the Landscape Architect, in writing, of any conditions or defects encountered on the site during or before construction, upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until such conditions or defects have been investigated and corrected.

.3 Where required, layout all furniture locations on the site and give timely notice to the Landscape Architect to allow for inspections before commencing work.

PART II – PRODUCTS

2.1. Materials

.1 All furnishings are to be as specified on drawings. Confirm colours with the Landscape Architect prior to ordering.

PART III – EXECUTION

3.1. Installation

.1 All site furnishings to be installed as per the manufacturer's specifications and details.

.2 Layout as per drawings and subject to the approval of the Owner or Landscape Architect.

End of Section

PART I – GENERAL

1.1. Scope of Work

1. This section specifies requirements for supply and installation of granular material as required for under curbing, walkways, and anywhere else specified.

1.2. Materials

.1 19mm (3/4") crusher run limestone granular base for all paving unless specified otherwise in drawings:

Sound, hard, durable, crusher run limestone free from clay and organic matter, to meet the following gradation:

Sieve Number	Per Cent Passing
19 mm	100
13 mm	80 - 100
4.75 mm	45 - 65
2.0 mm	32 - 50
0.425 mm	12 - 26
0.075 mm	0 - 8

.2 Water for compaction to be clean and potable.

1.3. Grading and Inspection of Underlying Sub-Grade

.1 Grade the sub-grade as necessary to conform with elevations and sections before placing granular material.

.2 Compact graded sub-grade with roller of approved mass and type, to 98% Standard Proctor Density.

.3 Check for unstable areas and make good.

.4 Check for areas requiring additional compaction and make good. Pay particular attention to areas behind curbs and on slopes.

.5 Notify the Landscape Architect of unsatisfactory conditions. The Landscape Architect may order a compaction test by an independent testing company to be paid for from the testing allowance.

.6 Do not place granular base until finished sub-grade surface is inspected and approved by the Landscape Architect.

1.4. Placement

.1 Place granular material only on a clean, unfrozen surface, properly shaped and free from snow, ice, standing water or organic matter.

.2 Place granular material to minimum compacted thickness of 150 mm under all new paving surfaces, as shown on the drawings or as directed in the field by the Landscape Architect.

.3 Should additional granular layers be required to achieve the grades and profiles shown, place layers in maximum 150 mm uniform compacted lifts. Shape each layer to a smooth contour and compact to the specified density before the succeeding layer is placed.

1.5. Compacting

.1 Compact to a density not less than 98% Standard Proctor Density in accordance with ASTM D698-70 or latest revision.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtaining specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

1.6. Field Quality Control

.1 Inspection and testing of granular base will be carried out by designated testing laboratory as determined by the Landscape Architect. If testing proves faulty compaction or materials and re-testing is required, such re-testing will be paid for by the Contractor.

.2 Finished rolled surface of granular base to be free from humps and hollows, and maintain positive drainage. All edges to be smooth, straight and regular to leave a look of tidiness and minimize clean-up.

.3 Finished base surface shall be within +/- 10 mm of required grade but not uniformly high or low.

Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.4 For all pavement surfaces, granular base to be parallel to finished grades to specified tolerance. Receive approval of granular base from the Landscape Architect prior to placement of surface materials.

End of Section

PART I – GENERAL

1.1. Description

.1 This section specifies asphalt paving for playground areas and walkways.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.2. Quality Assurance

.1 The contractor or sub-contractor must have a minimum of 5 years experience in asphalt paving work.

.2 Plants providing asphalt paving mixture under this contract must conform to OPSS 310-04-02 to 04 inclusive.

.3 Spreading equipment must meet the requirements of OPSS 310-04-05 to 07 inclusive.

.4 All asphalt paving work must be carried out to the OPSS 310-05-01 to 07 inclusive.

.5 Provide a copy of all subsections, listed above, on site at all times.

.6 Testing of asphalt cement, when required by the Owner, will be carried out, at no extra cost, to the contract and will be executed in accordance with ASTM D-140, latest edition.

.7 Testing of asphalt emulsion, when required by the Landscape Architect, will be carried out, at no extra cost, to the contract and will be carried out in accordance with ASTM-D244. Sampling procedures will follow ASTM-D140.

.8 Engage an independent, approved testing firm to carry out compaction tests on the completed granular base, one test per 100m^2 of area. Submit 2 copies of the test results to the Landscape Architect and obtain his approval prior to commencing asphalting operations. Pay all testing costs.

.9 Ensure that asphalt cement, asphalt primer and asphalt emulsion conform to the standards set out in the drawings and specifications.

1.3. Product Delivery, Storage & Handling

.1 Store granular materials in areas designated by the Landscape Architect.

.2 Minimum temperature of asphalt is to be 130°C immediately after spreading and prior to rolling.

1.4. Job Conditions

.1 Do not commence paving operations unless the surface temperature is steady at, or rising above 2°C.

.2 Proceed with paving operations only during favourable weather conditions and on a dry base.

.3 Suspend all paving operations if the temperature drops below 2°C.

.4 Spread subsequent paving courses within 12 hours after spreading and compaction of the previous course.

.5 Where existing asphalt paving is to receive resurfacing, ensure that all areas of cracked or broken asphalt are removed and patched satisfactorily with new asphalt prior to proceeding with resurfacing operations.

.6 Protect all adjacent areas and structures, particularly planted areas, from contamination by asphalt materials. Make good all damage.

1.5. Inspection

.1 Stake out paving locations and obtain approval from the Landscape Architect before proceeding.

.2 Obtain approval from the Landscape Architect of the finished sub-grade before proceeding.

.3 Obtain approval from the Landscape Architect of the paving base before proceeding.

PART II - PRODUCTS

2.1. Materials

.1 Granular A: granular material conforming in all respects with OPSS 1010.

.2 Granular B: granular material conforming in all respects with OPSS 1010.

.3 Coarse aggregates: a crushed rock, slag or gravel or combination thereof, free of clay, silt and other deleterious materials.

.4 Fine aggregates: composed of clean, hard, durable particles of natural sand, manufactured sand or screenings resulting from the crushing of rocks, stone or gravel and free of clay, silt or other deleterious materials. Fine aggregate for HL3 and HL4 must contain a minimum of 10% passing the 10mm screen and retained on the #4 sieve.

.5 Mineral filler: finely ground particles of limestone, hydrated lime or other mineral dust approved by the Landscape Architect, free of clay, silt and other deleterious material.

.6 Asphalt cement: conforming in all respects with OPSS 310-1150.

.7 Joint painting material: slow setting asphalt emulsion, type SS-1 conforming to OPSS 306.

.8 Line marking paint: an acrylic emulsion type “traffic” paint conforming to C.B.S.B. 1-GP-74, colour to be yellow or white as noted.

2.2. Mixes

.1 Paving mixture: a hot mix, hot laid asphaltic concrete, of the type specified, and installed to the minimum compacted thickness shown on the drawings and composed of coarse and fine aggregates, mineral filler, and asphalt cement uniformly mixed.

PART III – EXECUTION

3.1. Preparation

.1 Excavate to the minimum specified depths, after compaction, as shown on the drawings. Maintain sub-grade parallel to finished grade in all cases.

.2 Fine grade subgrade eliminating uneven areas and filling low spots. Remove all debris. Proof role all exposed subgrade material in order to delineate any possible soft pocket within the subgrade. If soft pocket exists, need to be replaced with the acceptable granular material.

.3 Compact subgrade uniformly to minimum ninety-eight percent (98%) Standard Proctor Density (SPMDD). Arrange for testing of fill materials and compaction. When required and as directed by the Landscape Architect, the Contractor shall, at his own expense, sprinkle water to assist in compaction.

.4 In the event of delay between completion of sub-grade and commencement of application of stone base, the Contractor shall re-grade and re-compact sub-grade at his own expense if so ordered.

.5 Keep materials clean and free of deleterious materials at all times.

.6 Maintain final grade of granular base course parallel to finished grade.

.7 Submit written test reports.

.8 Where existing asphalt is to be resurfaced, clean all surfaces of soil, dust, leaves or other debris prior to paving. Ensure surface is free of standing water.

3.2. Installation

.1 Spread the specified granular materials in horizontal layers not exceeding 150mm loose depth and compact to 98% Standard Proctor Maximum Dry Density (SPMDD). In areas where compaction by roller is not possible, compact with approved mechanical or hand tamping devices to the specified density.

.2 Ensure that granular does not become contaminated by deleterious material.

.3 Build up thickness of each material to the minimum compacted thickness as specified on the drawings.

.4 Correct all irregularities or depressions resulting from rolling and compact until the granular surface is smooth, uniform, and true to line and grade.

.5 Paint all curbs, gutter walls, vertical faces of existing pavement, and all structures in actual contact with the new asphalt with a sealing coat of SS-1 emulsion. Provide a closely bonded, water tight joint.

.6 Lay and spread all paving courses by means of approved equipment.

.7 Immediately after spreading and screeding, check the surface and correct all irregularities before compacting.

.8 Ensure all joints are straight, clean, vertical and free of broken or loose materials. Cut back existing asphalt to provide a clean vertical surface. Paint the vertical surfaces of all joints with a thin, continuous coating of type SS-1 emulsion.

.9 Compact each paving course, with approved rolling equipment, in accordance with the appropriate OPSS. Begin compaction operations as soon as possible after placement when asphalt will bare the weight without checking or undue displacement. Keep roller wheel moist so as not to pick up material. Keep all equipment clean and in good condition.

.10 Hand tamp with hot tampers in areas not accessible to rolling equipment.

.11 Where hand-spreading is necessary, this shall be done simultaneously with machine-spreading or immediately afterwards to ensure a good bond.

.12 Hand tamp all edges adjacent to grass or planting beds to a 45° angle. Establish straight edge by the use of a string line. Where edge is not straight, lay in a smooth curve to the radii indicated. Where finished edge is not satisfactory, at the option of the Landscape Architect, the edge may be repaired by sawcutting to a 45° edge to the required line. Cut edge must be painted with liquid asphalt.

.13 After final rolling, surfaces shall be smooth and true to the specified grade and crown with the thickness of the courses varying no more than 6mm from that shown on the drawing. At the option of the Landscape Architect, unsatisfactory surface roughness on the asphalt may be corrected by the application of a coat of hot liquid, at the contractor's expense.

.14 Ensure a minimum surface slope of 2% or as specified, away from edges and curbs and towards catch basins on all asphalt re-surfacing operations.

.15 Ensure the surface is free from depressions greater than 6mm under a 3000mm straight edge.

3.3. Joints

.1 All joints made during paving operations shall be straight, clean, vertical and free of broken or loose material. Where joints occur between new courses and existing previously laid down courses, the existing course shall be cut back sufficiently to provide a clean vertical surface.

.2 Vertical faces of all joints shall be painted with a thin continuous coating of SS-1, to provide a tight, waterproof bond.

.3 All locations where new asphalt meets existing structures and paving shall be considered a joint. Make all joints in accordance with OPSS Division 3 and paint with a thin, uniform, continuous coating of joint painting material SS-l Emulsion or approved equal.

.4 All joints shall be coated with tack coat before the adjacent asphalt is laid if the previous section has been in place for more than two hours.

.5 Transverse joints shall be cut back at least one foot and painted with tack coat before paving proceeds.

.6 Where tack coat has been applied, it shall be allowed to dry to a tacky texture before the asphalt is laid against it.

3.4. Edges

.1 New surfaces shall blend smoothly and flush with existing surfaces, steps, tops of curb, etc.

.2 Low or defective areas shall be cut out immediately and replaced with fresh hot mixture, placed and compacted to blend with surrounding areas and thoroughly bonded to it.

.3 Install temporary forms, where necessary, in order to maintain straight, continuous edges of asphalt where shown.

.4 Where surfaced area abuts seeded, sodded, earth or grass areas, and no step or curb occurs, edges of asphalt paving shall be finished with 45 degree angle edge neatly formed and tamped as detailed. Grass edges shall be restored with 200mm (8") of topsoil and appropriate sod or seeding mixtures to the satisfaction of the Landscape Architect. Extent of restoration shall be from edge of walkway to limit of area disturbed by construction or as directed in cut or all situations slopes meeting walkway shall not exceed 3:1.

3.5. Line Painting

.1 All lines to be painted with acrylic asphalt paint at widths as specified on drawings. Colour as specified on drawings.

.2 Avoid splashing or spattering paint on the surface.

3.6. Clean-up

.1 At the completion of asphalt operations and prior to final inspection, clean all curbs, catch basins, manhole covers, walls, and other structures to remove contamination by asphaltic or other materials resulting from the work.

End of Section

PART I - GENERAL

1.1 General Instructions

.1 This section specifies streetbond SB150 pavement coating on asphalt surfaces.
.1 Refer to Appendix B for Technical Data sheet.

PART II - PRODUCTS

2.1 Acceptable Manufacturers

.1 Unless otherwise specified, materials shall be manufactured by Streetbond and supplied by – Hub Surface Systems.

2.2 Materials – Streetbond Coatings

.1 **StreetBond® SB150** is a two part premium epoxy - modified, acrylic, waterborne coating specifically designed for application on asphalt pavements. It has a balance of properties to ensure good adhesion and movement on flexible pavement, while providing good durability. **StreetBond® SB150** is durable in both dry and wet environments.

.2 **StreetBond® Colorant** is a highly concentrated, high quality, UV stable pigment blend designed to add color to **StreetBond® SB150** coatings. One unit of Colorant shall be used with one pail of **StreetBond®** coating material

2.3 Equipment for Streetbond Application

.1 The equipment described has been designed specifically for optimal application of StreetBond® coatings. Other equipment may or may not be suitable and could compromise the performance of the StreetBond® coatings and/or reduce crew productivity.

- The **SB Flex Sprayer** is a proprietary coating sprayer supplied by Intech Equipment andis capable of applying the **StreetBond®** coatings to the asphalt pavement surface in athin, controlled film which will optimize the drying and curing time of the coating. A **GracoRTX** and **RapidSprayerII** sprayer may also be used.
- The **StreetBond® Coatings Mixer** is a motorized mixing device designed to ensureefficient and thorough blending of the **StreetBond®** components
- **Backpack or Hand - Held sprayer** to apply the diluted **StreetBond® AdhesionPromoter Concentrate.**
- The **RapidFinisher II** is an electric powered broom through GRiD Solutions USA whichcan be used in the application of **StreetBond®** coatings to improve productivity. It isespecially useful on larger projects.

PART III - EXECUTION

3.1 General

.1 **GENERALStreetBond® coating** shall be supplied and applied on non - textured asphalt surface by an **Siplast StreetBond® Select Contractors** in accordance with the plans and specifications or as directed by the Owner. Do not begin installation without confirmation of an Accreditation Certificate. Specifications for the execution of the **StreetPrint®** system can be found at streetbond.

3.2 Pre-Conditions

.1 **Prerequisites for New Asphalt Pavement**

A durable and stable asphalt pavement mix design installed according to best practices over a properly prepared and stable substrate is a pre - requisite for all long - lasting asphalt pavement surfaces. The application of **StreetBond®** does not change this requirement.

.2 **Pavement Marking Removal: recommended guidelines**:

Pavement markings may be removed by sandblasting, water - blasting, grinding, or other approved mechanical methods. The removal methods should, to the fullest extent possible, cause no significant damage to the pavement surface.

The Owner shall determine if the removal of the markings is satisfactory for the application of **StreetBond®** coatings. Work shall not proceed until this approval is granted.

.3 **Surface Preparation**

The asphalt pavement surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.

3.3 Application of Streetbond Coatings

.1 The **Applicator** shall use the **SB Flex Spray System** or suitable texture coatings sprayers to apply the **StreetBond®** coatings.

.2 The asphalt pavement surface shall be completely dry and thoroughly cleaned prior to application of the coatings.

.3 The coating application shall proceed as soon as practical upon completion of the imprinting of the asphalt pavement where applicable.

.4 For polished asphalt, **StreetBond® Adhesion Promoter** should be applied directly to the asphalt and allowed to dry completely prior to the first layers of coating.

.5 For concrete surfaces, **StreetBond® WB Concrete Primer** or **StreetBond® QS Concrete Primer** should be applied and allowed to cure prior to the first layers of coating. Please consult Technical Data sheets for more details on applications.

.6 The first layer of coating shall be spray applied then broomed to work the coating material into the pavement surface. Subsequent applications shall be sprayed then broomed or rolled. Each application of coating material shall be allowed to dry to the touch before applying the next layer.

.7 The **Contractor** shall apply the **StreetBond®** coatings only when the air temperature is 50°F / (10°C) and rising and will not drop below 50°F / (10°C) within 24 hours. Noprecipitation should be expected within 24 hours.

3.4 Coating Coverage and Thickness

.1 Coating coverage and thickness is as outlined in **TABLE 4** (see Appendix A). Actual coverage may be affected by the texture of the asphalt pavement substrate and the imprint pattern selected. There will be less coverage with the first layer and higher coverage with subsequent layers.

3.5 Recommended Coating Coverage Rates

.1 **Additional layers** of **StreetBond® SB150** coatings may be used to provide additional buildthickness in high wear areas such as vehicle wheel paths and turning areas.

.2 A maintenance program may be required for applications exposed to:

- abrasive materials (such as salt and sand)
- abrasive equipment (such as snow removal equipment)
- Studded winter tires

.3 See Appendix A for **Table 5**: Coating Coverage Rates

3.6 Pavement Markings

.1 Apply all game markings and pavement markings indicated on the Contract Drawings using StreetBond compatible marking materials.

.2 Layout, dimensions, colours and line widths shall be as shown on the Contract Drawings.

.3 Markings include but are not limited to:
- Basketball court markings
- Four-square markings
- Hopscotch markings
- Parking stall markings

PART IV – MEASUREMENTS AND PAYMENT

4.1 Measurement

.1 The measured area is the actual area of asphalt pavement where **StreetBond®** has been applied, measured in place. No deduction will be made for the area(s) occupied by manholes, inlets, drainage structures, bollards or by any public utility appurtenances within the area.

4.1 Payment

.1 Payment will be full compensation for all work completed as per conditions set out in the contract. For unit price contracts, the payment shall be calculated using the measured area as determined above.

End of Section

TECHNICAL SPECIFICATIONS:

Product Name	**:**	**AGL SARATOGA 60**
Application	**:**	**Residential, Commercial, Municipal, Playgrounds**
Producer	**:**	**Artificial Grass & Landscaping Inc. (AGL)**
Production Process	**:**	**Tufted cut pile**
Pile Material	**:**	**100% PE monofilament, micro-curled**
Yarn Dtex	**:**	**7.250Dtex / 14 ply**
Quality	**:**	**100% European product, free of heavy metals and toxics.**
Primary Backing	**:**	**100% PP, UV stabilised, approx 160 gr +/- 10%**
Coating	**:**	**SBR latex, approx 685 gr. / m2 +/- 10%**
Water Permaebility	**:**	**approx. 60 inches per hour**
Pile Height	**:**	**1-3/4”**
Total Height of Construction	**:**	**approx. 1-7/8” +/- 10%**
Pile Weight	**:**	**60 oz/sq. yd.**
Total Weight of Construction	**:**	**approx. 79.5 oz/sq.yd. +/- 10%**
Stitch Gauge	**:**	**3/8” gauge**
Stitches per linear metre	**:**	**230 +/- 10%**
Stitches per square metre	**:**	**24.150 +/- 10%**
Filaments per square metre	**:**	**676.200 +/- 10%**
Light Fastness	**:**	**Bluescale 1-8 > 7 (according to DIN 54004)**
Colour Fastness	**:**	**Greyscale 1-5 >4 (according to DIN standard)**
Primary Fibre Colour	**:**	**Field Green + Olive Green**
Thatch Fibre Colour	**:**	**Field Green + Jute**
Installation Method	**:**	**Loose laid on bound or unbound subbase**
Roll Width	**:**	**13 feet (3.962m)**
Roll Length	**:**	**100 feet (30.48m)**

PART I – GENERAL

1.1 Description of Work

.1 Work under this section includes the supply, delivery, preparation, installation, and finishing of synthetic turf surfacing systems including all base preparation, infill materials, accessories, and related components required to complete the installation.

.2 The work includes but is not limited to:

- Supply and installation of synthetic turf systems.
- Preparation of granular base and subgrade as required.
- Installation of shock pad where specified.
- Installation of seams, adhesives, and anchoring systems.
- Installation of infill materials where applicable.
- Final grooming and finishing of turf surface.

.3 The completed surface shall provide a durable, safe, and consistent synthetic grass system suitable for landscape, recreational, or athletic applications as indicated in the contract documents.

1.2 Stipulated Uses

.1 Synthetic turf systems specified under this section shall be suitable for the following applications:

- Landscape areas
- Recreational play areas
- Playgrounds
- Institutional exterior spaces
- Dog park or pet relief areas where applicable
- Low-impact sports and recreation areas where specified.

.2 Products specified shall be Saratoga 60, as approved basis-of-design products.

1.3 Quality Control

.1 Installer shall have a minimum of 5 years documented experience in the installation of synthetic turf systems of similar scope.

.2 Installation contractor shall demonstrate successful completion of at least three (3) similar projects within the past five years.

.3 All materials shall be installed in accordance with:

- Manufacturer’s written instructions
- Industry best practices
- Relevant ASTM standards
- Ontario Building Code where applicable.

1.4 Warranty

.1 Provide manufacturer’s written warranty covering:

- Fiber integrity

• UV degradation
• Material manufacturing defects

.2 Warranty period shall be Ten (10) years from date of substantial completion.

.3 Installer shall provide a two (2) year workmanship warranty covering installation defects.

1.5 Delivery, Storage and Handling

.1 Deliver materials in original unopened packaging bearing manufacturer identification.

.2 Store turf materials in a clean, dry area protected from:

- Direct sunlight
- Moisture
- Physical damage.

.3 Turf rolls shall be stored flat and protected from deformation prior to installation.

1.6 submissions

.1 Submit the following to the Consultant for review prior to installation:

- Product data sheets
- Technical specifications
- Shop drawings indicating layout and seam locations
- Samples of turf fiber and backing system
- Infill material specifications where applicable
- Installation methodology.

.2 Provide minimum 300 mm x 300 mm samples upon request.

1.7 Testing Requirements

.1 Synthetic turf shall meet relevant ASTM performance standards including but not limited to:

• ASTM D2859 – Flammability
• ASTM F1551 – Water permeability
• ASTM D1335 – Tuft bind
• ASTM D5034 – Tensile strength

.2 Additional testing may be required by the Consultant where project conditions warrant.

1.8 Site Conditions

.1 Verify site conditions prior to installation.

.2 Do not proceed with installation under the following conditions:

• Frozen subgrade
• Saturated base materials
• Severe weather conditions.

.3 Subgrade shall be properly compacted and graded prior to base installation.

PART II – PRODUCTS

2.1 Acceptable Products

Approved Basis of Design:

.1 AGL Grass – Saratoga 60 Synthetic Turf

or approved equivalent meeting the same performance characteristics.

2.2 Materials

Synthetic Turf System shall consist of:

.1 Polyethylene monofilament fibers.

.2 Primary backing: Dual layered woven polypropylene backing.

.3 Secondary backing: Polyurethane or latex backing system.

.4 Face weight: Minimum 60 oz per square yard.

.5 Pile height: As specified.

2.3 Infill Materials (Where Applicable)

.1 Not applicable for this application

2.4 Shock Pad (Where Specified)

.1 Prefabricated shock pad system.

.2 Thickness - 10 mm (3/8") as specified in drawings

2.5 Subgrade Materials

Granular Base System shall consist of:

.1 150mm depth Base layer 19mm Clear stone

.2 50 mm depth 9.5mm Clear stone installed above 19mm Clear stone where specified.

PART III – EXECUTION

3.1 Site Preparation

.1 Verify subgrade elevation and compaction.

.2 Remove debris, vegetation, and unsuitable materials.

.3 Install granular base in lifts and compact to specified density.

3.2 Turf Installation

.1 Install turf in accordance with manufacturer's installation guidelines.

.2 Align turf rolls to ensure consistent grain direction.

.3 Seams shall be secured using manufacturer-approved seam tape and adhesive.

.4 Secure perimeter edges using mechanical fastening or adhesive systems as required.

3.3 Final Surface Finish

.1 Groom turf surface using power broom equipment.

.2 Ensure consistent fiber orientation.

.3 Verify surface is level and free of wrinkles or irregularities.

3.4 Cleanup

.1 Remove all waste materials and construction debris from site.

.2 Clean adjacent surfaces affected by installation activities.

.3 Leave site in clean conditions suitable for intended use.

End of Section

PART I – GENERAL

.1 Manufacturer or Agent
Playcare & Design Inc.
12830 Britannia Rd.
Milton, ON. L9E 0V3
www.fibertop.ca / andy@fibertop.ca

.2 Provide Fiber Weave material in areas indicated on plans.

PART II - MATERIALS

.1 Impact Surfacing: Engineered Cedar Wood Fiber Impact Surface: Fiber Weave.

.2 Composition: Fiber Weave
Recently harvested North American Cedar softwood comprised of virgin "off-the-log" material only.
a. Free of soil, leaves, twigs or other contaminants, which could hasten decomposition.
b. Free of any chemical treatments and/or additives.
c. Free of recycled wood from pallets or construction debris.
d. Free of tramp and heavy metals.

.3 Dimensions
a. Randomly sized.
b. Gradation, sieve analysis, ASTM 136, cumulative passing by weight
1) ¾" sieve: 99% - 100%
2) 3/8" sieve: 75% - 100%
3) No.16 sieve 0% - 15%
c. Sized to promote drainage.

.4 Properties
a. Moisture absorption: maximum of 150% by weight.
b. Moisture content: 25% to 60% by weight.
c. Impact attenuation: ASTM 1292, Procedure C: 12" thickness rated to 12'.
d. Accessibility: tested compliant with ASTM 1951
e. Product quality: tested compliant with ASTM 2075-10 – Engineered Wood Fiber Standard.

.4 Compliance
a. Complies with CAN/CSA-Z614
b. Complies with ASTM F1292, F1951-09b, F2075-10a.

PART III - QUALITY CONTROL

.1 Surfacing shall be a mix of random-sized, engineered wood fibers. Standard wood chips or bark mulch **will not be acceptable**.

.2 Supplier must provide test results for impact attenuation in accordance with ASTM F1292 Standard Specification for Impact Attenuation for Surface Systems Under and Around Playground Equipment. Results must be provided for new material and for 12-year-old material.

.3 Testing must show “g” ratings of not more than 155g for the 200mm thick system, or 120g for the 30mm system at 12’ fall heights, and HIC values of less than 1,000 for both new and 12-year-old material.

.4 Supplier must provide test results in accordance with ASTM F1951 (formerly PS83) Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

.5 Supplier must certify that the surface meets the intent of the *Accessibility for Ontarians with Disabilities Act.*

.6 Supplier shall provide manufacturer's standard warranty for the specified Fiber Weave system.

.7 In Canada supplier must meet CSA guidelines.

PART IV - EXECUTION

.1 Install the drain system, Mats, and the wood fiber material in accordance with manufacturer’s instructions and specification drawings.

.2 Avoid contamination of the wood fiber material with sand, gravel, mud, or native soil.

.3 Installation
a. Refer to system installation instructions supplied with the Fiber Weave product.
b. Precaution: dust or fibers may cause eye, skin & respiratory irritation. If ventilation is unavailable or inadequate during installation, use NIOSH-certified disposable or reusable particulate respirator with an efficiency rating of N95 or higher.
Note: Fiber Weave contains no controlled substances. MSDS documentation is not required for this product.

End of Section

PART 1 - GENERAL

1.1 Regulatory Requirements

.1 Do work of this Section in accordance with Chain Link Fence details within the provided drawings, except where requirements specified herein are more stringent, follow specified requirements.

1.2 Reference Standards

.1 Install chain link fence in accordance with CAN2-138, 3M980 unless otherwise specified.

PART 2 - PRODUCTS

2.1 Materials

.1 Concrete:

1. Meet requirements of Section 03300.

2. Concrete mix designed to produce 25 MPa minimum compressive strength at 28 days and containing 20 mm maximum size, 5 mm minimum size coarse aggregate, with water cement ratio to CAN3 -A23.1-M77 Table 7 for Class A exposure and 60 mm slump at time and point of deposit. Air entrainment to CAD3 -A23.1-M77 Table 8.

.2 Chain link fence fabric: 50 x 50 mm, 6 gauge galvanized steel mesh.

.3 Posts and rails: ASTM A120 Standard butt-weld schedule 40 pipe:

.1 Line posts: 60.3 mm outside diameter (O.D.)

.2 Terminal and corner poses: 88.9mm O.D.

.3 Top rail and braces: 42.2 mm O.D.

.4 Bottom rail: 42.2 mm O.D.

.5 Tie wire fasteners: single strand, aluminum coated or galvanized steel wire, 5 mm diameter.

.6 Tension bar: 5 x 19 mm minimum galvanized steel.

.7 Tension bar bands at 305mm O.D. (on centre) aluminum.

.8 Fittings and hardware: cast aluminum alloy or galvanized steel. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail. Turnbuckles to the drop forged.

.9 Zinc pigmented paint: to CGSB 1-GP-178 Ma.

2.2 Finishes

.1 Galvanizing:

1. Electrostatically paint all components to match fabric color.

2. Pipe: 600 g/m2 minimum to ASTM A90.

3. Fittings: to CSA G164-M1981.

PART III - EXECUTION

3.1 Preparation and Examination

.1 Investigate location of underground services in area of fence to avoid interference and damage. Notify Landscape Architect prior to start of installation in case of conflict.

.2 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

3.2 Erection of Fence

.1 Erect fence along lines indicated, plumb, level, free of kinks and buckles and with posts accurately aligned.

.2 Excavate post holes minimum 250 mm diameter and 1.4 m. deep for corner and end posts by methods approved by Landscape Architect. Bulb bottom of holes for corner, end and gateposts and for intermediate posts at every [60] m along fence line.

.

.3 Space line posts 3m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not exceeding 150m. If distance is greater than 150m between end or corner posts on straight continuous lengths of fence over reasonably smooth grade.

.5 Install additional straining posts at sharp changes in grade and where directed.

.6 Install corner post where change in alignment exceeds 10°.

.7 Install end posts at end of fence.

.8 Place concrete in postholes than embed posts into concrete to minimum 1 m. depth. Extend concrete 50mm above ground level and slope to drain away from posts. Form top 105 mm of post foundation; rub smooth and round edges of exposed concrete. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured a minimum of 5 days.

.10 Install horizontal brace between posts and nearest line post, placed in centre of panel. Install braces on both sides of corner and straining posts in similar manner.

.11 Install top rail between posts and fasten securely to terminal posts and secure waterproof caps and overhang tops.

.12 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands space at 305mm intervals. Knuckled selvage at bottom. Twisted selvage at top

.13 Secure fabric to top rails, line posts and bottom rail with tie wires at 450mm intervals. Give tie wires minimum two twists.

.14 Restore grading, disturbed by fencing installation, to original condition.

*The contractor is required to submit shop drawings that provide details for erecting the fence.

3.4 Touch up

.1 Repair damaged galvanized surfaces. Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of approved zinc pigmented paint to damaged areas.

End of Section

PART I – GENERAL

1.1. Description

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for the inspection and construction of pressure treated privacy fence, gates and associated wood screening structures.

.2 Comply with all the requirements of the General Requirements – Section 01 00 00.

1.2. Site Examination

.1 The Contractor shall report to the Landscape Architect, in writing, any conditions or defects encountered on the site during, or prior to construction, upon which the work of this Section depends and which may adversely affect its performance.

.2 The Contractor shall not commence work until such conditions or defects have been investigated and corrected.

.3 Commencement of work shall imply acceptance of surfaces and conditions and no claim for damages or extras resulting from such conditions or defects will be accepted thereafter.

1.3. Qualifications

.1 All work described in this Section, and pertaining to exposed wood work shall be executed by skilled tradesmen, under supervision of an experienced carpentry foreman and in full accordance with specifications and best trade practice.

1.4. Inspection

.1 Prior to commencement of work, submit evidence that the specified compaction of sub-grade and granular base courses has been obtained in areas where woodwork is to be installed.

.2 Obtain approval of all materials before proceeding with work. Immediately remove rejected materials from site.

.3 Complete all lay out work and set finished grades and obtain approval before proceeding with work.

.4 Give timely notice when inspections are required.

.5 All treated lumber which has been pressure treated shall bear the inspection and classification label of the Underwriters' Laboratories of Canada.

.6 Pressure treatment shall be with approved water-borne preservatives in accordance with C.S.A. 080.P5, latest editions.

.7 All woodwork shall be inspected and approved by the Landscape Architect before finishing.

1.5. Materials

.1 General

.1 All exposed wood shall be CLS lumber and conform to the latest standard grading rules of the National Lumber Grades Authority (NLGA).

.2 All lumber shall be selected for uniform appearance and be free of splits, cracks, open knots and warps.

.3 All lumber shall be inspected and approved by the Landscape Architect before incorporating onto work. Rejected materials shall be removed from the site immediately.

.4 Glues used shall be approved waterproof glues.

.5 All hardware to be hot dip galvanized.

.6 All exposed fasteners shall be ceramic-coated #10 Robertson screws unless noted otherwise on the drawings.

.2 Wood fence components shall be pressure treated Western Red Cedar in the sizes and configurations indicated on the drawings. Select appearance grade in the following nominal sizes, and as detailed:

25 x 100 mm	(1 x 4)	50 x 150 (2 x 6)
25 x 150	(1 x 6)	50 x 200 (2 x 8)
50 x 50	(2 x 2)	100 x 100 (4 x 4)
50 x 100	(2 x 4)	150 x 150(6 x 6)

.3 Vertical fence boards shall be 25x150 mm pressure-treated Western Red Cedar installed as detailed on the drawings, including required overlaps, rails, trim members and accent plates.

1.6. Storage and Delivery

.1 All materials shall be protected from the weather during transportation to the work site.

.2 Upon delivery on the site, all materials shall be stored off the ground and shall be adequately protected from adverse conditions to prevent deterioration, damage, or impairment of structural and other essential properties.

.3 All materials damaged or deteriorated will be rejected and shall be removed from the site immediately.

1.7. Protection

.1 Protect all work from damage resulting from construction.

.2 Make good all damages at no extra cost to the Owner.

1.8. Maintenance of Guarantee

.1 Maintain all wood work from time of installation until acceptance of work.

.2 Be responsible for all damages during period of maintenance and make good at no extra cost.

.3 Guarantee woodwork for two (2) years from date of client acceptance.

1.9. Substitutions

.1 Substitutions for the materials specified, will be permitted only when approved in writing by the Landscape Architect.

.2 Submit request for substitution in writing and be prepared to submit sample of proposed substitution, when required by the Landscape Architect.

.3 Proposed substitutions shall meet the requirements of the specifications in every respect.

.4 When a substitution results in a change in cost, submit cost details when applying for substitution. Be prepared to submit complete cost breakdown when requested by the Landscape Architect.

1.10. Installation

.1 Prepare footings for posts as per the detailed drawings. Footings are to be trowelled clear on top of slope for drainage. Excess concrete to be removed and not left around footing.

.2 Construct and install fences and play walls to line and level, as detailed and shown on drawings. All work shall be plumb and in accordance with best trade practice.

.3 Round all exposed edges smoothly and sand wood work smooth and clean before finishing.

.4 In areas where fence is to be erected on fill, compaction to be 95% standard proctor density.

.5 All field cuts, notches and drilled surfaces shall be treated with an approved wood preservative immediately after fabrication.

1.12. Clean-Up

.1 After completion of woodwork, remove all debris and excess materials off the site and maintain area neat and tidy.

.2 Clean all contaminated surfaces resulting from painting and finishing work.

.3 Make good all damage to other work resulting from carpentry work.

End of Section

PART I – GENERAL

1.1. Description

.1 This section specifies the supply and placement of Armour Stone for on site seating features.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.2. Site Examination

.1 The Contractor shall report to the Landscape Architect, in writing, of any conditions or defects encountered on the site during or before construction, upon which may adversely affect its performance.

.2 Do not commence work until such conditions or defects have been investigated and corrected.

1.3. Inspection and Certification

.1 Obtain approval of layout work for Armour Stone before proceeding with work.

.2 Have all excavation for work inspected prior to installation of Armour Stone features.

.3 The Landscape Architect shall approve the stake out provided by the Contractor or otherwise designate the extent of all areas requiring the placement of Armour Stone features. The quality of the Armour Stone placement shall be approved by the Landscape Architect.

PART II – PRODUCTS

2.1. Delivery and Storage

.1 Delivery and storage of material shall be done in a neat and orderly fashion, all to the satisfaction of the Landscape Architect.

.2 Stockpile existing topsoil or fill materials in locations designated by the Owner or Landscape Architect.

.3 Obtain Armour Stone from approved supplier as stipulated by Landscape Architect.

2.2. Maintenance and Guarantee

.1 Maintain all Armour Stone work from time of installation until acceptance.

.2 Upon completion of all Armour Stone including related work, the Contractor shall furnish a written guarantee in a form approved by the Consultant that shall extend over a period of one (1) year from the date of substantial completion.

.3 During the guarantee period, the Contractor shall repair, replace or otherwise remedy, to the Landscape Architect's satisfaction, all defects due to faulty materials and/or workmanship. All work shall be carried out in full accordance with the drawings and specifications. Where there is substantial Armour Stone settlement, the Contract shall bring the settled area back to grade and replace and raise the Armour Stone as stipulated by the Landscape Architect.

2.3. Materials

.1 Armour Stone used will be free from deterioration by water action or weathering and will be as per dimensions on the drawings.

.2 Armour Stone is to be obtained from an approved supplier. Sample to be provided. The contractor is to supply any additional rocks of the required size if stockpile on site is insufficient.

PART III – EXECUTION

3.1. Installation

.1 The Contractor shall excavate and prepare an even, firm foundation for Armour Stone seating boulders. Boulders shall be founded on undisturbed or compacted subgrade as indicated on the Contract Drawings. Depressions shall be filled and compacted to provide a stable bearing surface. Install boulders with a minimum of one-fifth (1/5) of the boulder height below finished grade and ensure all boulders are stable and free from movement after installation.

.2 Overlapped stone to laser cut to match the radius as per plan.

.3 Grind all sharp edges and corners to minimum 6 mm radius.

3.2. Protection

.1 Take into account anticipated weather conditions and degree of exposure of site in setting requirements for protection in regards to erosion.

.2 Carry out Armour Stone seating construction so that each phase of work is not left exposed for an undue period of time. Follow schedule submitted to Landscape Architect.

.3 Landscape Architect may order excavation to be stopped or placing final protective stone layers to be advanced depending on anticipated weather conditions.

3.3. Clean-up

.1 Upon completion, remove all surplus excavated and graded materials from the site, and leave site clean and tidy. Make good all disturbance to approval of Landscape Architect.

End of Section

PART I - GENERAL

1.1. Description

.1 This section specifies the supply and placing of topsoil as per drawings.

.2 Comply with all requirements of the General Conditions.

1.2. Quality Assurance

.1 Topsoil work to be carried out by experienced personnel under the direction of a skilled foreman and in strict accordance with all drawings.

1.3. Product, Delivery, Storage and Handling

.1 In-situ topsoil: protect all areas of in-situ topsoil that are to remain in place from compaction by machinery and/or workers for the duration of the construction period.

.2 Stockpiled site topsoil: Topsoil stripped from site to be stockpiled in a location as indicated on the drawings or in a location approved by the Landscape Architect. Shape and grade stockpile in a manner that will reduce erosion from rain and wind. If required by the Contract Administrator, provide additional sediment and erosion controls.

.3 Imported topsoil: Topsoil imported on-site is to be stockpiled in a location as indicated on the drawings or in a location approved by the Landscape Architect. Shape and grade stockpile in a manner that will reduce erosion from rain and wind. If required by the Contract Administrator, provide additional sediment and erosion controls.

1.4. Soil Testing

.1 If required by the Contract Administrator, the soil shall be tested for N, P, K and minor element values, soluble salt contents, organic matter content and pH value.

.2 If required by the Contract Administrator, in-situ soil shall be tested for compaction levels with a soil compaction meter (penetrometer) in pounds-per-square-inch (psi).

.3 Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Contract Administrator.

.4 The contractor shall submit the soil analysis report to the Contract Administrator prior to the commencement of. When the source of such topsoil is exhausted, topsoil from a new source shall not be used until it is tested, and approved by the Contract Administrator.

1.5. Inspection

.1 The Contractor shall verify that the final site grades are in accordance with the grading plan. Obtain the approval of the Contract Administrator of the finished topsoil surface.

.2 The Contractor shall give timely notice, in writing, that all work has been completed and maintenance period is to begin.

1.6. Guarantee

.1 Soil testing for N, P, K and minor element values, soluble salt contents, organic matter content, pH value and compaction shall be conducted after installation if deemed

necessary by the Contract Administrator. Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Contract Administrator. Perform all remedial actions as recommended by the soil testing results and approved by the Contract Administrator.

PART II - PRODUCTS

2.1. Materials

.1 Topsoil: a fertile, friable, natural loam; containing not less than 4% organic matter for clay loams and not less than 4% organic matter for sandy loams to a maximum of 15%. Topsoil must be capable of sustaining vigorous plant growth, free of subsoil contamination, roots and stones over 25mm diameter, reasonably free of weeds (as determined by the Contract Administrator), and having a pH ranging from 6.0 to 7.5.

PART III - EXECUTION

3.1. Preparation

.1 Scarify the existing ground surface to a depth of 25mm before placing additional topsoil.

3.2. Spreading of Topsoil

.1 Spread dry topsoil during dry weather over approved, dry, unfrozen subgrade where sod is to be installed.

.2 Fine grade topsoil eliminating rough and low areas and to ensure positive drainage.

.3 Roll topsoil with a 50 kg roller to compact and retain surface. Finished compacted depth of prepared topsoil to be minimum 150mm for sodded areas, 450mm for planting areas, or as indicated on the drawings and details. Do not over-compact soil.

.4 Provide a finished topsoil surface that is smooth and firm against footprints with a fine, loose texture before sod or other plantings are placed. Topsoil compaction not to exceed 200 PSI.

3.3. Protection after Completion

.1 Erect protective barriers and post signs where necessary and maintain same until performance acceptance.

.2 Remedy all damages, wash-outs and eroded areas resulting from weather, improper protection, excessive compaction, or other causes.

3.4. Clean Up

.1 The Contractor must leave the site in a neat and orderly condition upon completion of work on a daily basis, all to the satisfaction of the Contract Administrator.

End of Section

0PART I - GENERAL

1.1. Description

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for inspection and placement of sod over topsoil as shown on the Construction Drawings and as described by the Contract Specifications.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.3. Quality Assurance

.1 The contractor must have 5 years experience in sodding work.

1.4. Product, Delivery, Storage and Handling

.1 Deliver sod to site within 24 hours of being harvested and lay sod within 48 hours thereafter, depending on suitable weather conditions and in accordance with good horticultural practice.

.2 Small irregular or broken pieces of sod will not be accepted.

.3 Prevent sod from drying out on site.

1.5. Sample

.1 Complete the installation of one sample panel of sod of a minimum 25 m^2 (one side minimum 2.0m) and have inspected and approved by the Contract Administrator prior to proceeding with the balance of sodding operations. All other work shall conform to this approved sample.

1.6. Soil Testing

.1 The soil shall be tested for N, P, K and minor element values, soluble salt contents, organic matter content, and pH value, and amended to meet the recommended requirements of the soil testing agency.

.2 If required by the Contract Administrator, in-situ soil shall be tested for compaction levels with a soil compaction meter (penetrometer) in pounds-per-square-inch (psi).

.3 Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Contract Administrator.

.4 The contractor shall submit the soil analysis report to the Contract Administrator prior to the commencement of the works. Where the soil analysis report identifies deficiencies or requires remediation to meet minimum soil quality requirements, the Contractor shall, at no additional cost to the Owner, remediate the soil strictly in accordance with the report recommendations and obtain approval from the Contract Administrator prior to placement on site. Failure to comply with the approved soil analysis recommendations shall entitle the Contract Administrator to reject the topsoil and require its removal and replacement with compliant material, at the Contractor's expense. When the source of such topsoil is exhausted, topsoil from a new source shall not be used until it is tested, and approved by the Contract Administrator.

1.7. Inspection

.1 The Contractor shall verify that the final site grades are in accordance with the grading plan. Obtain the approval of the Contract Administrator of the finished topsoil surface before proceeding with sodding.

.2 The Contractor shall give timely notice, in writing, that all work has been completed and maintenance period is to begin.

1.8. Acceptance

.1 Maintain sod in good condition until acceptance.

.2 At the time of acceptance, the grass must not be more than 50mm high. Minimum acceptable cut height is 45mm. All sod must have a healthy and even stand of grass, free of thin, poor or burned-out patches.

.3 Acceptance will be given when the sod is properly rooted, free of bare and dead spots and reasonably free of weeds in the opinion of the Contract Administrator.

.4 Acceptance will not be given if the topsoil and/or sod layer are excessively compacted (compaction exceeding 200 PSI).

.5 Replace any deteriorated sod with new sod at the direction of the Contract Administrator.

.6 The Contractor is responsible for a minimum of three cut of grass or as many cuts as required until acceptance.

1.9. Guarantee

.1 Submit written guarantee that all sodding shall be guaranteed for a period of two (2) years commencing on the date of acceptance of substantial performance.

.2 During the guarantee period, the Contractor shall make monthly inspections and replace all sod which is dead, or is not in a healthy vigorous growing condition.

.3 Soil testing for N, P, K and minor element values, soluble salt contents, organic matter content, pH value and compaction shall be conducted if issues with sod growth and/or health are widespread or persistent. Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Contract Administrator. Perform remedial actions as recommended by the soil testing results and approved by the Contract Administrator.

PART II - PRODUCTS

2.1. Materials

.1 Grass sod: Certified No.1 grade cultivated turf grass sod with a composition of 50% Kentucky Blue Grass and 50% Blue Cultivar either “Fylking” or “Baron” or as specified on the drawings, grown and sold in accordance with NSGA classifications. At the time of sale it must have a strong, fibrous root system and be free of stones and burned or bare spots. Damaged and broken pieces shall not be laid and shall be removed from the site immediately.

.2 Sod pegs: 25mm x 25mm x 230mm (minimum length). Ensure pegs are long enough to securely anchor sod.

.3 Topsoil: a fertile, friable, natural loam; containing not less than 4% organic matter for clay loams and not less than 2% organic matter for sandy loams to a maximum of 15%. Topsoil must be capable of sustaining vigorous plant growth, free of subsoil contamination, roots and stones over 25mm diameter, reasonably free of weeds (as determined by the Contract Administrator), and having a pH ranging from 6.0 to 7.5.

PART III - EXECUTION

3.1. Preparation

.1 Rototill all areas that are to receive new sod. Cultivate to a minimum depth of 100mm. Remove all rocks, roots and grass or weed clumps from the surface.

.2 Compact surface to 85% Standard Proctor Dry Density.

.3 Scarify to a depth of 25mm before placing additional topsoil or sod.

3.2. Spreading of Topsoil

.1 Spread dry topsoil during dry weather over approved, dry, unfrozen subgrade where sod is to be installed.

.2 Keep topsoil 25mm below finished grade for sodded areas.

.3 Fine grade topsoil eliminating rough and low areas and to ensure positive drainage.

.4 Roll topsoil with a 50 kg roller to compact and retain surface. Finished depth of prepared, compacted topsoil to be minimum 150mm. Do not overcompact soil.

.4 Provide a finished topsoil surface that is smooth and firm against footprints with a fine, loose texture before sod is placed. Topsoil level shall not be compacted beyond 200 PSI.

3.3. Installation

.1 Lay sod with tight butt joints. Do not leave any open joints or overlap adjacent pieces of sod. Alternate joints on each row of sod.

.2 Ensure finished sod surface is flush with adjoining grass areas, pavement or top surface of curbs.

.3 On slopes steeper than 4:1, lay sod perpendicular to the slope and peg each row at intervals of not more than 600mm on each side of the sod strip. Drive pegs flush with surface of sod.

.4 Immediately after installation, water the sod with sufficient quantity of water to penetrate the sod and the top 50mm of the underlying topsoil.

.5 Apply 8-32-16 slow release commercial fertilizer at the rate of 22 kg per 1000 square metres.

.6 When sod has dried sufficiently to prevent damage, roll all sodded areas to ensure a good bond between sod and topsoil. Imperfections in the surface should be corrected prior to the laying of the sod and not by rolling with a heavy roller.

.7 Protect all newly sodded areas with warning signs or barricades.

3.4. Protection after Completion

.1 Assume full responsibility for protection of all sodded areas from all sources until performance acceptance.

.2 Erect protective barriers and post signs where necessary and maintain same until performance acceptance.

.3 Remedy all damages, wash-outs and eroded areas resulting from weather, improper protection, excessive compaction, or other causes.

3.5. Clean Up

.1 The Contractor must leave the site in a neat and orderly condition upon completion of work on a daily basis, all to the satisfaction of the Contract Administrator.

End of Section

PART I – GENERAL

1.1. Description

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for the inspection, maintenance and planting of trees, shrubs, ground covers and perennials as shown on the Construction Drawings and as described by the Contract Specifications.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.2. Quality Assurance

.1 Planting work is to be carried out by experienced personnel under the direction of skilled foreman and in strict accordance with the Specifications and best horticultural practice.

1.3. Product Delivery, Storage and Handling

.1 Supply manufactured items such as super phosphate, fertilizer tablets, mulch, etc., in standard containers, clearly indicating contents, weight, component analysis, and the name of the manufacturer.

.2 Store manufactured materials, subject to deterioration, in a weatherproof place on site and in such a manner that their effectiveness is not impaired.

.3 Supply plant materials as specified on the plant list. Confirm quantities as specified on the drawings, plant list and bid form. Report any discrepancies.

.4 Dig materials specified “B.R.” (bare root) on the plant list, while in a dormant state and with the majority of the root system intact. Immediately after digging, wrap the roots in wet burlap and keep burlap wet during transport and storage.

.5 Provide all material, specified “B. & B.” (balled and burlapped) on the plant list, with a solid, earth root ball, wrapped in burlap.

.6 Provide all material, specified “WB” (wire basket) on the plant list, with a solid, earth root ball, bound by a wire basket.

.7 Do NOT plant material with broken or abraded trunks or branches, or with broken or cracked root balls, or plants which are strongly desiccated, as they will be subject to rejection upon arrival on the project site.

.8 Provide root balls of the following minimum sizes to meet the corresponding tree size. Ensure the root ball is large enough to accommodate at least 75% of the fibrous root system.

Deciduous Trees Caliper	Minimum Root Ball Diameter
50 mm	75 cm
60 mm	80 cm
70 mm	85 cm
80 mm	90 cm
90 mm	100 cm
1.00 m	60 cm
1.50 m	60 cm

Coniferous Tree Height	Minimum Root Ball Diameter
1.75 m	65 cm
2.00 m	70 cm
2.25 m	75 cm
2.50 m	80 cm

.9 Cut all roots cleanly when digging plants. Split roots are not acceptable. Cut roots even with the edges of the root ball.

.10 Protect all plant material from damage and breakage. Protect all parts of the plant material from drying out from the time of digging until they are installed.

.11 Do not transport plant material in an open truck unless it is adequately protected from sun and wind.

.12 Carefully tie in all branches before transporting.

.13 Pad all points of contact between plant material and equipment.

.14 Heel in any plant material that cannot be planted during the current day's operations.

.15 Keep all roots and root balls moist prior to planting.

.16 Do not remove labels attached to plants, until after final inspection.

1.4. Soil Testing

.1 If required by the Landscape Architect, the soil shall be tested for N, P, K and minor element values, soluble contents, organic matter and pH value.

.2 Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Landscape Architect.

.3 The Contractor shall submit the soil analysis report to the Consultant prior to the commencement of work. Where the soil analysis report identifies deficiencies or requires remediation to meet minimum soil quality requirements, the Contractor shall, at no additional cost to the Owner, remediate the soil strictly in accordance with the report recommendations and obtain approval from the Contract Administrator prior to placement on site. Failure to comply with the approved soil analysis recommendations shall entitle the Contract Administrator to reject the topsoil and require its removal and replacement with compliant material, at the Contractor's expense. When the source of such topsoil is exhausted, topsoil form a new source shall not be used until it is tested, and approved by the Landscape Architect.

1.5. Job Conditions

.1 Proceed with planting operations during suitable weather conditions.

1.6. Planting Program

.1 Submit a planting program indicating:
a. Source of plant material.
b. Quantities and type of plant material.
c. Shipping dates.
d. Site delivery dates.
e. Proposed planting dates.

.2 Obtain approval of the planting program prior to shipment of plant material.

1.7. Substitutions

.1 Supply and install plant material as specified on the plant list. Substitutions with other plant material will only be allowed with the written approval of the Landscape Architect.

.2 Give timely notice, in writing, to the Landscape Architect when applying for substitutions.

1.7. Inspections

.1 Make plant material available for inspection at source of supply and/or upon arrival on the site by the Landscape Architect. Notify Landscape Architect of delivery date and notify prior to shipment.

.2 Approval of plant material at source will not impair the right of the Owner or Landscape Architect to inspect plants upon arrival on the site or during the course of construction and to reject plants which have been damaged, or which, in any way, do not conform to the specifications.

.3 If partial acceptance is desired, give timely notice to the Landscape Architect in writing.

.4 Partial acceptance will be given when planting work has been delayed due to circumstances beyond the control of the contractor or where planting would be in conflict with good horticultural practices and would jeopardize the performance.

.5 Planting of materials, prior to inspection by the Landscape Architect will be the Contractor's responsibility.

.6 Remove all rejected materials from the site immediately.

.7 Furnish all inspection certificates as may be required by federal, provincial and other applicable regulations.

.8 Labels shall indicate variety, grade and size of each plant specimen or bundle. Do not remove any labels from plants until final or partial approval by the Landscape Architect, or as directed.

.9 Final inspection of all plant material will be made at the end of the specified guarantee period. All plants must be in a healthy growing condition at the time of this inspection.

.10 The contractor is to provide the Landscape Architect with a full scale marked plan showing any substitutions or changes in colour.

1.8. Maintenance

.1 Prepare and present to the Landscape Architect, two copies of a maintenance schedule prior to the beginning of the guarantee period.

.2 All plant materials shall be maintained by the Contractor immediately after any planting has been installed and shall continue until the date of final acceptance.

.3 Maintenance shall include all measures necessary to establish and maintain all plants in a vigorous and healthy growing condition, including but not limited to:

a. Weeding of planting beds and tree pits. Use herbicides in accordance with the manufacturer's directions. Make good any damage, resulting from herbicide use at no extra cost.

b. Watering when required and in sufficient quantities to saturate the root system.

c. Pruning, including the removal of dead or broken branches, and treatment of pruning wounds with approved dressing.

d. Disease and insect control when required. Use chemical methods in accordance with the manufacturer's directions. Make good any damage at no extra cost.

e. Keep all accessories in good condition and properly adjusted. Repair or replace accessories when required at no extra cost.

.4 The Contractor shall be responsible for making monthly inspections of all plantings during the guarantee period and submit a written report of each inspection to the Landscape Architect.

.5 The Contractor shall instruct the Landscape Architect in writing of any corrective or preventative measures necessary to ensure healthy plant growth. Any damage to plants shall be reported in writing to the Landscape Architect.

.6 At the time of acceptance, all material must be in a healthy vigorous growing condition. Beds and tree pits must be free of weeds, rubbish or debris.

1.8. Guarantee

.1 Submit written guarantee that all caliper plant materials shall be guaranteed for a period of twelve (12) months (or as specified in the warranties section, whichever is greater), commencing on the date of acceptance of substantial performance or client acceptance, whichever is later.

.2 The guarantee period for approved "collected plants" shall extend for a period of one (1) year beyond the period stated above.

.3 During the guarantee period, the Contractor shall make monthly inspections and replace all plants which are dead, missing or which are not in a healthy vigorous growing condition.

.4 Supply and plant all replacements in strict accordance with Contract Documents and guarantee replacement as specified.

.5 Tag or mark, in a permanently visible manner, all replacement plant material and notify the Landscape Architect, in writing of the date on which replacements were planted. Include a sketch showing location of replaced plants.

.6 Plant replacements at a time which is in accordance with good horticultural practice.

.7 Remove all accessories and cut at grade, those trees which are to be replaced at a later date. Remove plants, which are to be replaced, when found, or when notified by the Landscape Architect.

PART II – PRODUCTS

2.1. Plant Material

.1 All plant material must be nursery grown and meet the specifications set out in the latest Guide Specifications for Nursery Stock prepared by the Canadian Nursery Trade Association (CNTA) for quality and method of cultivation.

.2 Nomenclature of specified plants shall conform to the International Code of Nomenclature for Cultivated Plants and the latest edition of Standardized Plant Names.

.3 Any plant material not conforming to 2.1.1 above will be designated as collected plants.

.4 Collected plants may only be used when approved in writing, by the Landscape Architect.

.5 Plant Material: true to name and type, structurally sound, well branched; healthy and vigorous and free from disease, insect infestations, rodent damage, sun scald, frost cracks, and other abrasions to the bark and densely foliated with a healthy, well developed root system. Pruning wounds must show vigorous bark on all edges and all parts must show live and green cambium tissue when cut.

.6 All material must conform to the sizes shown on the plant list, except that larger material may be used when approved by the Landscape Architect. Use of larger plants will not increase the contract price.

.7 Plant material sizes must conform to the following standards:

a. caliper – diameter of the trunk measured 150 mm above the normal grade around the plant.

b. height – measured from the normal grade around the plant to the top of the main foliage mass.

c. spread – the diameter of the main foliage mass, at its widest point.

2.2. Other Material

.1 Topsoil: a fertile, friable, natural loam; mechanically screened, containing not less than 4% organic matter for clay loams and not less than 4% organic matter for sandy loams to a maximum of 15% and capable of sustaining vigorous plant growth, free of subsoil contamination, roots and stones over 25mm diameter, reasonably free of weeds (as determined by the Landscape Architect) and having a pH ranging from 6.0 to 7.5.

.2 Peat moss: partially decomposed fibrous form of cellular stems and leaves of sphagnum moss, free of woody substance and harmful mineral matter, having a pH range of 4.5 to 6.0 and furnished in air dry state packed in standard bags of bales showing the name of the manufacturer.

.3 Tree Wrap: 225 g burlap supplied in strips 150 mm minimum to 250 mm maximum width or heavy, waterproof crepe paper 100 mm to 150 mm wide.

.4 Anchor stakes: metal ‘T’ bars: 51 x 51 x 5mm – 2500mm long, or
Wood stakes: 50 x 50mm - 2130mm long (as specified)

.6 Wire: #10 galvanized wire for trees 75mm caliper or larger and #11 gauge galvanized wire for smaller trees. Alternative: Use 19mm (3/4”) Hemp Rope if specified.

.7 Hose: two ply, reinforced, 20mm diameter, new, black rubber garden hose.

.8 Mulch: as specified on details.

.9 Rodent Guards: 300mm Big 'O' pipe, 200mm MIN Height.

.10 Rodent Wrap Tree Protectors : spiral, plastic tree wrap.

.11 Watering Bags: Treegator or approved equivalent, sized to suit tree caliper specified on the drawings.

.12 Fertilizer Tablets: as per details.

.13 Anti-Desiccant: Wax-like emulsion

2.3. Mixes

.1 Provide standard planting soil mix as follows: When planted in turf field, backfill with T5 5.10.05.05 – Type 1 – Standard mix as per City of Toronto Construction Specifications for Growing Medium – T5.10 (Most recent addition)
When planted adjacent to asphalt or concrete, backfill with T5 5.10.05.07 – Type 3 – Boulevard mix as per City of Toronto Construction Specifications for Growing Medium – T5.10 (Most recent addition) (Mix thoroughly and provide sample prior to planting.)

.2 Add bone meal at the rate of .58 kg per cubic metre and mix thoroughly for each tree or planting bed.

.3 Be prepared to adjust the above rate in response to the soil analysis report.

2.4 Planter Soil Mixes

.1 Provide soil mix equal as per drawings, or approved.

PART III – EXECUTION

3.1. Preparation

.1 Obtain the approval of the Landscape Architect of all planting excavations

.2 Apply topsoil to a depth of 450 mm for shrub and ground cover beds.

3.2. Installation of Plant Material

.1 Planting shall be done during periods suitable with respect to weather conditions and locally accepted practice and to the Landscape Architect's approval.

.2 Ensure width of all planting excavations is 3 times the diameter of the root ball.

. 3 Place plant plumb in the centre of the planting pit with a minimum of 150mm of compacted planting soil mixture under the root ball. Face the plant to give the best appearance or relationship to adjacent structures. Cut away any ropes which might girdle the tree. Remove all rope, wire, and burlap from top 1/3 of the root ball.

.4 Place bare root plants so that the roots lie in a natural position.

.5 Backfill with planting soil in 150mm layers and firmly tamp each layer to ensure the plant remains plumb. Ensure no air pockets remain around the roots.

.6 Water thoroughly when hole is 1/2 full of tamped soil mixture and again when the operation is complete.

.7 Except for plants in planting beds, construct an earth saucer around each plant equal to the diameter of the rootball and 100mm minimum depth to retain water around the roots.

.8 Apply anti-desiccant to deciduous trees in leaf at the time of planting and in accordance with the manufacturer's recommendations.

3.3. Installation of Planting Accessories

.1 Wrap all trees over 50mm caliper. Apply wrapping in a spiral manner from grade to above the second branch. Secure wrapping with suitable cord.

.2 Stake or guy all trees as outlined in the drawings and detail.

.3 Install watering bags on all newly planted trees in accordance with manufacturer's instructions.

3.4. Pruning

.1 Prune plants after planting to compensate for root loss and in such a manner that the natural shape and character are retained. Do not cut a leader. Use only clean and sharp tools, conforming to proper horticultural practice.

3.5. Mulching

.1 Where a mulch is called for in shrub areas, place 100 mm deep saucer filled with 150 mm deep approved mulch over the planting area. For tree planting areas, place 150mm settled depth tub-ground mulch. Use only specified mulch per the drawing details. No other type of mulch is acceptable unless approved in writing by the Landscape Architect.

3.6. Clean-up

.1 At the completion of planting operations, remove all surplus material from the site at no extra cost.

.2 Make good all damage resulting from planting operations at no extra cost.

.3 Maintain all areas neat and tidy at all times until final acceptance.

End of Section

PART I – GENERAL

1.1. Scope of Work

.1 This section specifies requirements for sub-drains including perforated and non-perforated flexible P.V.C., and manhole/catch basin connections.

1.2. Materials

.1 Granular Backfill as required except under sand play areas, concrete curbing and pavement:

Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting the following gradation limits:

ASTM Designation		% Passing
50.0	mm	100
31.5	mm	60 - 100
16.0	mm	40 - 100
4.75	mm	25 - 60
2.0	mm	20 - 45
0.425	mm	10 - 25
0.075	mm	0 - 10

.2 Common Backfill

Approved material selected from trench excavation or other source, unfrozen and free from cinders, ashes, sod, refuse or other deleterious materials, and with the natural water content within 90% of the optimum value for the Proctor compaction specified, based on the native soil which is being used for backfill.

.3 PVC Pipe

Drainage pipe shall be 100 mm to 150 mm diameter flexible, Poly Vinyl Chloride (PVC), C.S.A. approved as per drawings. All fittings, and connections shall be PVC. Material density shall be minimum accordance to ASTM method D1505 / D1928. When the above PVC is to be perforated, it shall be installed with holes facing down, with Filter Cloth tubing as manufactured by National Sewer Pipe or approved equal.

.4 Filter Bedding Material under sand play areas and in trench with perforated PVC to be hard, durable particles of clear, natural, aggregate limestone of 10 mm diameter size and no fines.

.5 Filter Sock:

.1 Synthetic filter: rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents. Terrafix Type 370R or approved equal.

.2 Fabric: woven construction supplied as continuous tube of 100 mm diameter.

.3 Seams: sewn in accordance with manufacturer's recommendations.

1.3. Trenching

.1 Select shortest distance for sub-drains to existing sewer systems as shown on the drawings, avoiding all existing features such as trees, fences and other structures.

.2 Do not place bedding filter material prior to approval of excavation by the Landscape Architect.

.3 Excavate to achieve minimum percent slope of pipe as shown on the drawings.

.4 Notify Landscape Architect if soil at proposed elevation of trench bottom appears unsuitable for foundation of installation. Remove unsuitable material from trench bottom as directed by Landscape Architect.

.5 Unless otherwise authorized by Landscape Architect in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation. Fence off any open excavations to protect public.

.6 Stockpile suitable excavated materials required for trench backfill in approved location within site limits.

.7 Dispose of unsuitable or surplus material off site.

1.4. Backfilling

.1 Do not proceed with trench backfilling operations until Landscape Architect has inspected and approved installations.

.2 Use approved common or granular backfill material as indicated on the drawings.

.3 Backfilling around installations:

a) Place bedding and surround material as noted on drawings;

b) Place layers simultaneously on both sides of installed work to equalize loading;

c) Place material by hand under, around and over installations until required cover is provided. Dumping material directly on installations will not be permitted.

.4 Do not place backfill in freezing weather without prior approval of Landscape Architect.

.5 Place backfill material in uniform layers not exceeding 300 mm in thickness up to sub-grade elevation or top of trench. Compact each layer before placing succeeding layer.

.6 Compact trench bottom and backfill materials:

a) In pavement areas, to a density at least equal to density of adjacent, undisturbed soil;

b) Under sand in play areas to 85% Standard Proctor Density;

c) In pavement areas, compact to a minimum of 98% Standard Proctor Density.

.7 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

1.5. Pipe Installation

.1 Excavations require inspection and approval prior to commencement of installation operations.

.2 Lay drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel or each pipe is in contact with bed throughout full length.

.3 Commence laying at outlet and proceed in upstream direction.

.4 Lay perforated pipes with perforations downwards.

.5 Lay bell and spigot pipe with bell ends facing upstream.

.6 Weld joints of PVC pipe according to manufacturer's instructions.

.7 Make joints tight in accordance with manufacturer's instructions.

.8 Do not allow water to flow through pipes during construction.

.9 Make watertight connections to existing drains or catch basins where indicated and arrange for inspection by the Landscape Architect prior to backfilling.

.10 Plug open upstream ends of pipes with watertight concrete, steel or P.V.C. bulkheads.

.11 Surround pipe with filter sock and granular / filter material and compact as specified.

.12 Protect sub-drain against flotation during installation.

1.6. Connections to Municipal Facilities

.1 Connect sub-drains and catch basins to Municipal storm sewer system where indicated on the drawings. Arrange for inspection by Municipal Public Works Department and receive approval prior to backfilling.

1.7. Restoration

.1 Reinstate pavements and sodded areas to condition and elevation which existed before trenching to satisfaction of the Landscape Architect.

End of Section

SIGNAGE & WAYFINDING PROGRAM

TDSB

Construction Documents
Entro Project Number 0172

3	**Drawing Update**	**Nov 16, 2026**
2	Logo Update	Nov 02, 2026
1	Issued for Tender	Nov 20, 2024

entro 33 Harbour Square, Suite 202, Toronto, Canada M5J 2G2 T: 416-368-6988 entro.com

General

GN-01	Drawing list
GN-02	General Notes
GN-03	Typography
GN-04	Colours

Drawings

A1.1-01	Wall Mounted School ID
A2.1-01	Freestanding School ID with EMC
A2.2-01	Freestanding School ID with Readograph

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
Drawing List

Sign Type	Drawn By	Checked By
	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
GN-01

1. General Notes

A. Sign components presented in this document are for design intent purposes only. Shop drawings shall be provided by the Sign Contractor (SC) to be used as the final construction documents, and shall include complete construction, engineering and installation details required for implementing the designs described herein.

B. The designs are the property of **TDSB**, and Entro Communications (EC).

C. Upon award of the contract, typical design templates, custom artwork, and graphic layouts shall be provided via electronic format for the production of sign layouts and lettering as directed by the Designer.

2. Fabrication

A. Sign Contractor (SC) shall furnish all labor, materials, equipment, tools, supplies and services necessary and incidental to complete engineering fabrication, of sign(s) as specified. SC shall provide all engineering materials, equipment, services, labor tools, and supplies to fulfill completion of this contract. SC shall be responsible for a complete and thorough job. Materials not specifically described but required for a complete and proper installation shall be identified and provided for by the SC. SC shall be responsible for the quality of all materials and workmanship of any firms or individuals who act as their subcontractors. SC shall be responsible for providing subcontractors with complete and up-to-date drawings, specifications, sign schedules and other information issued for this project. SC shall be responsible for coordinating final review and approval of all copy wording with Designer prior to submittal of shop drawings.

The Owner reserves the right to add and otherwise modify sign text and lettering layout during the shop drawing review at no additional cost to the Owner.

B. Provide complete and comprehensive fabrication liaison with all other trades. Where the SC is providing graphics only, it shall be the SC's responsibility to schedule their work to coincide with other trades' fabrication, finishing and installation schedules.

C. The SC shall provide dimensioned shop drawings for all signs clearly showing materials, typographic layouts, fabrication methods, external finishes, anchorage, electrical connections and other details of construction as well as details related to engineering and other construction responsibilities. SC shall provide location detail drawings for signs supported or anchored to other construction.
SC is responsible for providing stamped engineering drawings where required.

D. The SC shall provide manufacturer's technical data and installation instruction for each type of sign required.

E. Prior to any sign fabrication, SC shall provide samples of each sign product and material samples showing finishes, typography, letter spacing, colors and surface texture as requested by Designer as indicated on sign type drawings.

F. The SC shall be responsible for all construction of internal supports for a safe and permanent installation of all signs.

G. By initiating its installation in an area, SC is certifying that the substrate is suitable for its installation and SC accepts all responsibility for any further preparation of substrate required.

3. Site Preparation

A. The SC shall be responsible for field measurements as required to verify or supplement dimensions indicated herein and shall be responsible for accurate fit of signs upon installation.

B. The SC is responsible for visiting the site and familiarizing themselves with its conditions prior to submitting a bid.

C. The SC must familiarize themselves with sub-soil conditions which may affect engineering of footings/sign supports.

4. Permiting

A. All necessary sign permits and variances are to be obtained and paid for by the SC.

5. Installation

A. The SC shall provide delivery to site along with coordination and assistance with other trades for complete installation.

B. The SC is responsible for coordinating with the TDSB to ensure 'locates' (i.e. gas, phone, power lines, etc.) which may affect sign supports/footings and locations.

6. Quality Assurance

A. The intent of the drawings and contract documents package is to provide all information necessary for a complete contract. In the event of a discrepancy, or an error, neither one rules over the other. Notify the Owner if any discrepancies arise for direction on how to proceed.

B. The Owner must be notified of any variations of conditions as shown on these drawings. It shall be the SC's responsibility to obtain and utilize the most current and up-to-date plans and specifications for all construction and installation work.

C. The SC shall use only personnel thoroughly experienced and skilled with the products and methods for fabrication and installation of sign specified. SC must be able to demonstrate five years or more fabrication experience in the architectural graphics industry.

D. Work done and material furnished shall be of superior quality in every respect. Signs and sign panels shall be flat, plumb, and without oil-canning. All edges, and surfaces to be smooth and free from burrs.

E. The Owner shall reserve the right to reject any shop drawings, samples, or other submittals, as well as any finished product or installation that does not meet or exactly equal the standard of quality established. Any such decision will be considered final and not subject to recourse.

F. All electrical components shall display required manufacturer's safety and/or electrical labels (UL/Hydro) or approved equal standards as acceptable by Designer. Such labels and equipment shall not be displayed or positioned so as to detract from the aesthetic quality of each sign.

G. The SC must guarantee that only new materials are being used for this work.

H. Products must be made accessible for quality control inspection at any time.

I. Any claims for work carried out on instructions by others will not be accepted or honored.

J. All materials to be painted with Matthews Paint (or approved equivalent) acrylic polyurethane, according to the paint supplier directions and standards.

K. All VHB tape to be mounted at least 12mm away from sign edges to ensure it is not visible from sides. Special attention to be paid for signs mounted on glazing.

L.SC shall coordinate location of mockups with TDSB Design and Installation team for approval. SC shall complete a mockup of each sign type and receive approval of mockup before completing remaining installations. With the approval, accepted mockup may be completed in-situ and remain as a completed part of the work.

7. Typography

A. All typographic layouts shall utilize typeface specified in each sign type drawing. A digital version of the typeface shall be provided by the Designer.

B. Letterforms and symbols shall be photographically or digitally rendered in precise, crisp, clean forms. All letterforms shall be free of ticks, discontinuous curves, line waves, cut or ragged edges, edge build-up, bleeding, surface pinholes, and other imperfections. Letterforms shall conform to the prescribed proportions of the typographic font(s) specified by the Designer.

8. Substitutions

A. Bidders shall submit bids based on the tender documents. No substitutions shall be allowed as part of the base bid. Should Bidders wish, they may submit alternate prices with their bid submissions that documents Bidder's all proposed substitutions from specifications. Substitutions of any kind shall be approved prior to any sign fabrication or installation. No substitutions will be considered without samples.

9. General Conditions

A. The SC is responsible for coordinating with the TDSB to ensure all electrical and communications hookup, internal wiring, and supply of appropriate components (e.g. outdoor ballasts, etc.) for all signs. For this project assume that 120V primary power will be made available by the TDSB, to the location of any illuminated signs. Final hookup, including any software installation will be the responsibility of the TDSB.
The SC will be responsible for continued support as per warrantee.

B. The SC is to protect goods supplied by them from damage during installation with appropriate insurance against fire, theft, or other damage. They shall also protect from injury the property of the Owner, which may be adjacent, or with which they may come in contact, and they shall make good any such damage occurring through their fault.

C. Care must be taken with the handling of sign materials, to prevent staining caused by oils and other agents. They must be protected by appropriate covering during fabrication, delivery and onsite storage.

D. The SC shall not use any hazardous substances in the manufacture of the signs, nor bring on site any hazardous substances, regulated under any environmental laws.

E. Upon completion of the project the SC shall provide the TDSB with a manual and/or instructions on the care and maintenance of the signs and replacement of component parts. The SC will provide general software training for the digital signs and provide access to ECM manufacture's support for more detailed setup.

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
General Notes

Sign Type	Drawn By	Checked By
	CB	EP/WM

Scale	Dimensions
	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
GN-02

Page	of	Rev No.
3	17	3

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

HELVETICA, BOLD

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro

33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
Typography

Sign Type	Drawn By	Checked By
	CB	EP/WM

Scale	Dimensions
	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
GN-03

GREEN
HEX: #44A745
RGB: 68, 167, 69
CMYK: 75, 9, 100, 0

BLUE
HEX: #4079BA
RGB: 64, 1217, 186
CMYK: 78, 489, 2, 0

ORANGE
HEX: #E5723
RGB: 229, 117, 35
CMYK: 7, 66, 100, 0

PURPLE
HEX: #A758AD
RGB: 167, 88, 173
CMYK: 38, 77, 0, 0

WHITE
CMYK: 0,0,0,0
PMS Bright White

GREY
PMS 877 C

DARK GREY
CMYK: 72,66,645,72
PMS Black C

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
Colours

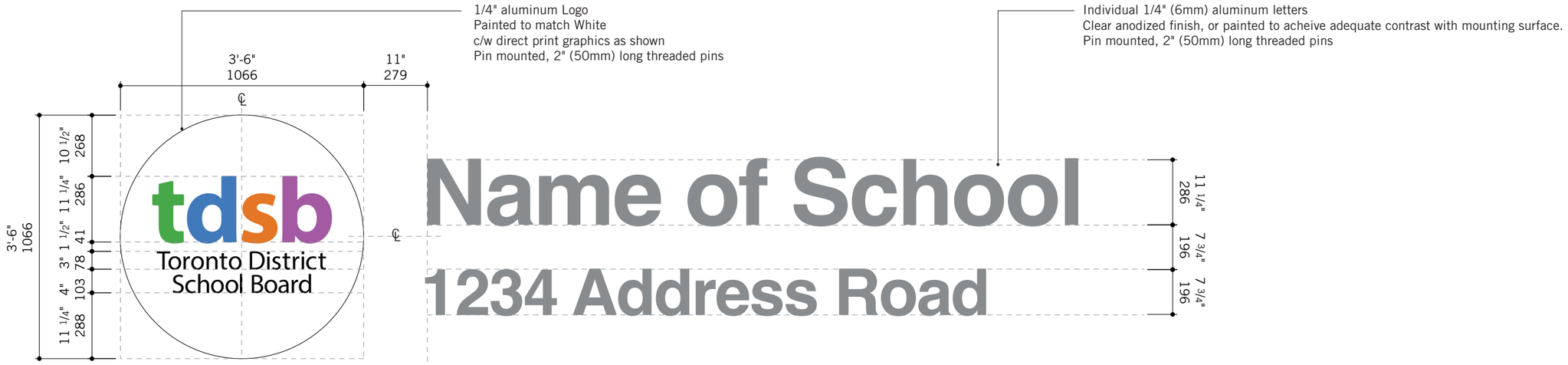
Sign Type	Drawn By	Checked By
	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
GN-04

Page	of	Rev No.
5	17	3



FRONT VIEW - 2 LINES (PREFERRED)
SCALE 1:20



FRONT VIEW - 3 LINES (WHERE REQUIRED)
SCALE 1:20

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

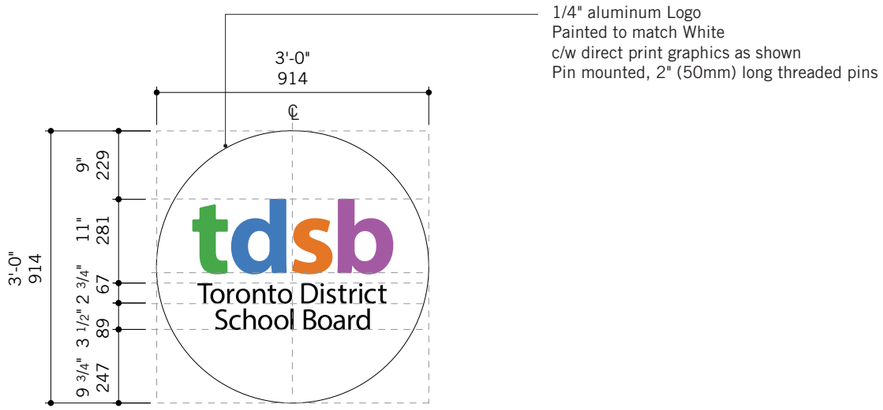
Drawing
A1.1 Wall Mounted School ID Details

Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A1.1-01



FRONT VIEW (APPROVED ALTERNATIVE LOGO - SMALLER)
SCALE 1:20

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A1.1 Wall Mounted School ID Details

Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A1.1-02

Page	of	Rev No.
7	17	3

Jarvis Collegiate institute

495 Jarvis Street

Annette Street Junior and Senior Public School

265 Annette Street

EXAMPLES - FOR PRICING PURPOSES
SCALE 1:20

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A1.1 Wall Mounted School ID Example

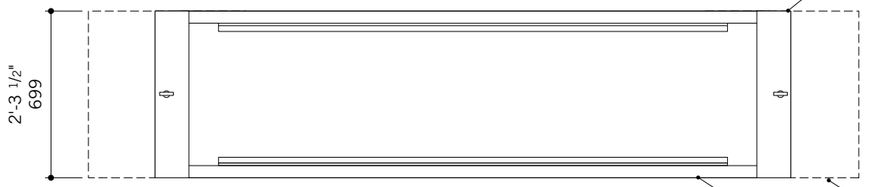
Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A1.1-03

Page	of	Rev No.
8	17	3



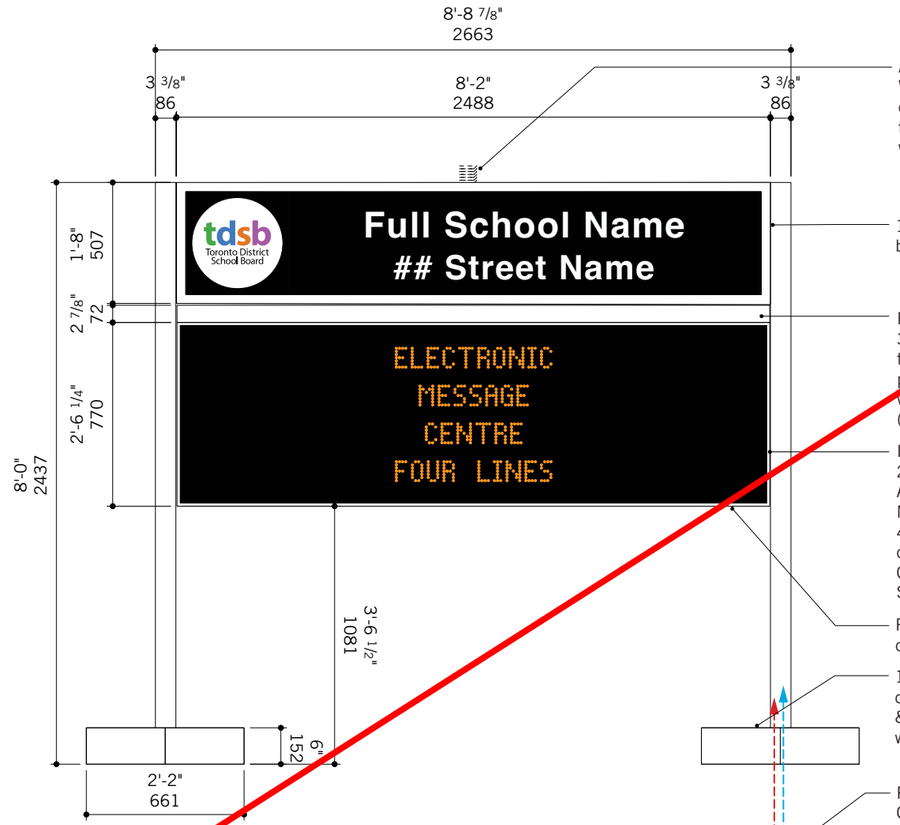
1/8" (3mm) aluminum sheet brakeformed
cabinet reinforced w/ aluminum angles
& tubing, painted to match PMS877
with 2 part polyurethane paint (satin finish)

Provide aluminum reinforcement plate on
interior face of sign box side panel
(At all bolt hole locations & both sides)
Steel posts must be tapped to receive
stainless steel bolts used to secure sign
Box to supporting post.

Dashed outline of baseplate cover beyond

Double-Sided Header Panel
Fixed 1/4" (6mm) Sign White acrylic panel
with applied vinyl graphics on first surface
3/16" (5mm) clear polycarbonate cover
(non-glare matte finish)
1 1/2" 38mm EX-7 Aluminum retainer cover
c/w continuous piano hinge and
Qty 2 rust resistant hold open arms, 1 per side.
Paint retainer cover and hardware to match
PMS877 with 2 part polyurethane paint
(Satin finish)

PLAN VIEW
SCALE 1:25



ALTERNATE, WHEN +300ft FROM OFFICE:
Wireless ethernet antenna and modem
c/w 2nd wireless ethernet antenna and modem
to be installed on school building
with

1/8" (3mm) thick neoprene sheet gasket
between cabinets and posts

Perforated metal panel
3/8" (9mm) dia. holes @ 1/2" (12mm) OC
to provide 51% open area.
primed & painted to match Black
with 2 part polyurethane paint
(Satin finish)

Infinity Series EMC
20mm pixel pitch,
Amber led,
Matrix: 36 x 120,
4 lines of 140mm high characters.
c/w Black retainer & fillers.
Clear polycarbonate cover (non-glare).
Sign is double sided.

Provide opening for ventilation
on bottom panel

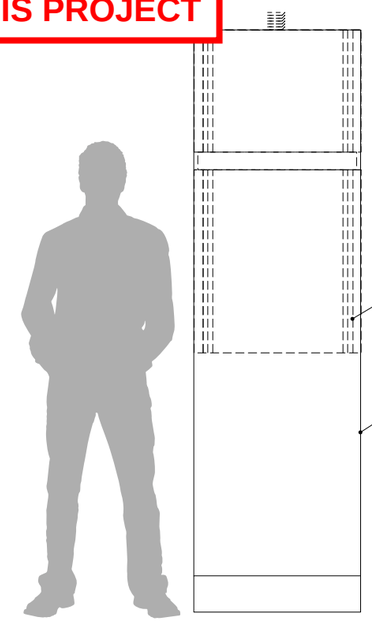
1/8" (3mm) aluminum sheet brakeformed
cover reinforced w/ aluminum angles
& tubing, painted to match PMS877
with 2 part polyurethane paint (satin finish)

PREFFERED, WHEN -300ft FROM OFFICE:
Cat5 Data Connection

Coordinate as required on power servicing and activation

FRONT VIEW
SCALE 1:25

NOT REQUIRED FOR THIS PROJECT



Dashed outline of cabinets beyond

1/8" (3mm) aluminum sheet brakeformed
cover reinforced w/ aluminum angles
& tubing, painted to match PMS877
with 2 part polyurethane paint (satin finish)

SIDE VIEW
SCALE 1:25

GENERAL NOTES:

1. All screws being used must be zinc coated stainless steel.
2. Font for 'school name' & 'address' is to be 'Helvatica Bold'.
3. TDSB logo colours: 'stem & pit' black, 'apple & letters' pantone 355 green.
4. New ground sign to be double-sided, incl. 2 Electronic Message Centres & School name graphics on both sides of header box.
5. Lexan covers are to be prepped with rust resistant hasps that will accommodate lockable cam locks.
6. Post - HSS 6"x3"x1/4" (152x76x6mm), Base plate - 3/4"x24" (19x610mm) Dia.
   Anchor bolts - 1"x23 1/2" (25x600mm)
7. All steel hot dip galvanized to CAN/CSA-G164, min. Coating 600 g/m2
   Weld 1/4" top cap to both posts.
8. All structural steel to conform to CSA standard g40.20/g40.21;
   grade 350w for hollow structural sections & grade 300w for angles, channels, rods & plates. It should also conform to CSA standard w59 for welded steel construction & metal arc welding.
9. Surface preparation to remove all scale, oxidation & foreign material from surface by grit blasting to a minimum condition of SSPC-SP-10 with a blast profile of 2.5 to 4 mils, in accordance w/ SSPC-VISI-89 "visual standard for abrasive blast cleaned steel". Prepare steel in zinc phosphate, TT-C-490, method 1, type 1 or 11. Apply 3 to 5 mils of an epoxy powder primer. Apply 3 to 5mils of a silver polyester or super durable polyester to match clear anodized aluminum in colour. Cure as per powder manufacturers' data sheets & recommendations for the substrate being coated.
10. All fabricated steel posts & base plates shall have no sharp protrusions, all edges to be radiussed & weld spatter ground smooth, all welds to be a continuous porosity free seem weld & to be free of grease & dust prior to powder coating.
11. Sign supplier to provide anchor bolt templates.
12. Footings are to be designed by sign manufacturer to local soil conditions. Design is to be included in permit drawing submittal (c/w engineering stamp, licensed to practice in the province of Ontario).

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.1 Freestanding School ID with EMC

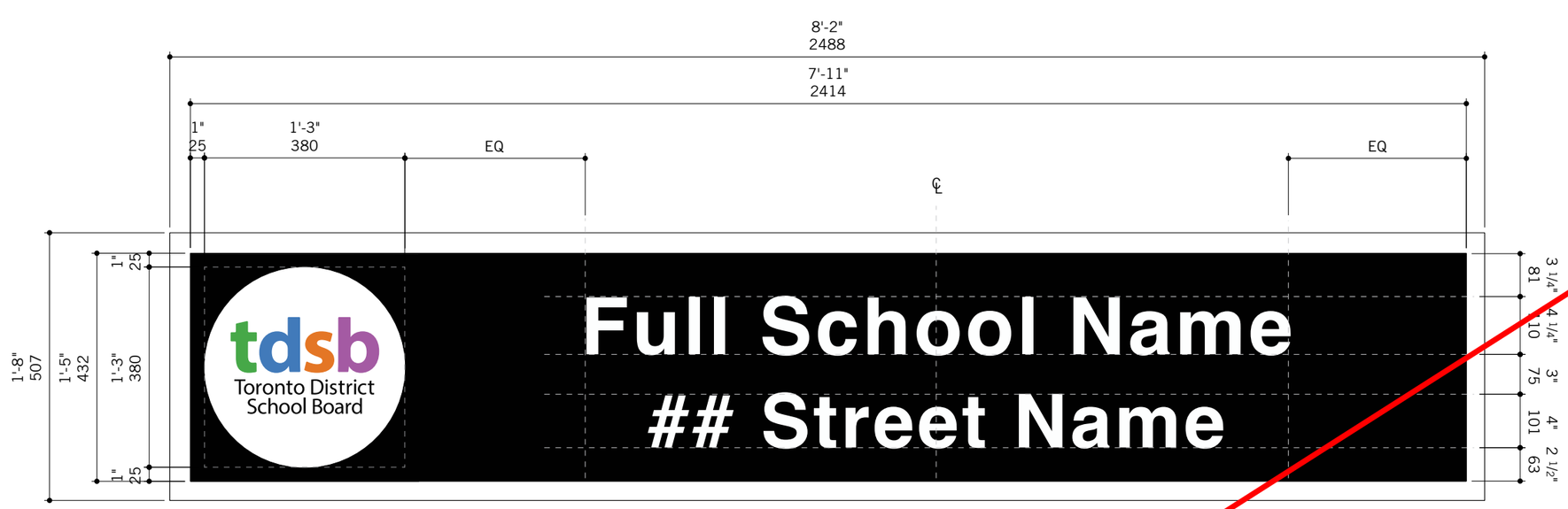
Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

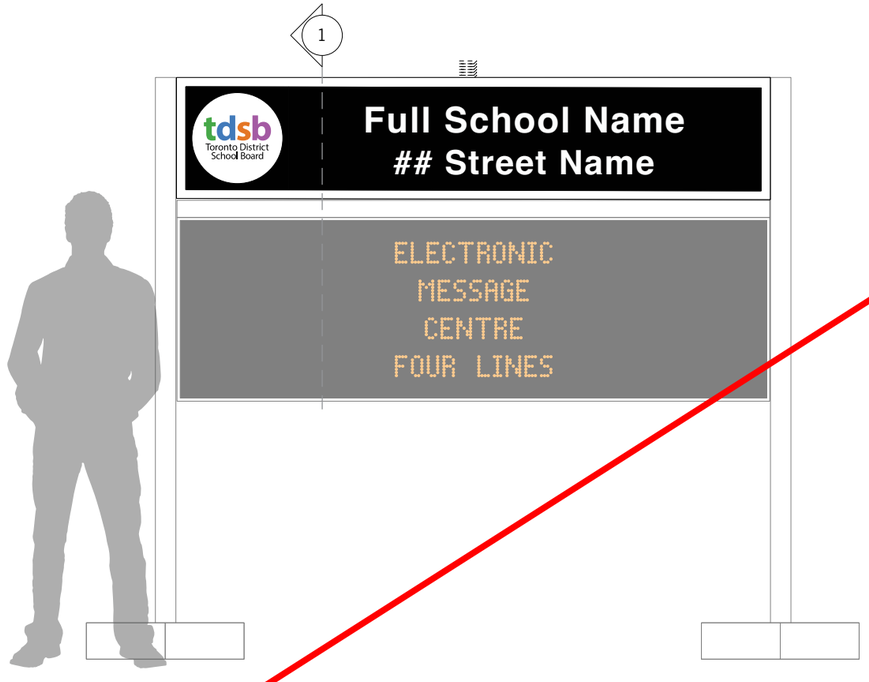
Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.1-01

Page	of	Rev No.
9	17	3



DETAIL
SCALE 1:10



FRONT VIEW
SCALE 1:25

ALTERNATE, WHEN +300ft FROM OFFICE:
Wireless ethernet antenna
Modem to be installed inside

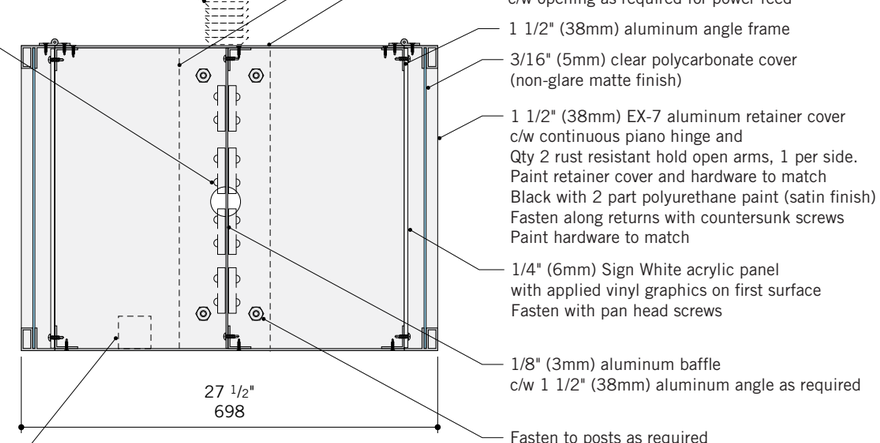
NOT REQUIRED FOR THIS PROJECT

Electrical Specification: LED Lights to include:
- 6500K colour temperature
- >70 CRI
- L70/50000
- LM-79 & LM-80
- 5 year warranty
- CUL listed &/or CSA approved
- 110 lumen/watt
- IP67- illumination of the sign in compliance w/ the City of Toronto's sign bylaws.
- Power supply: 120V input, 12 VDC output, class 2, -40 degrees Celsius to 40 degrees Celsius, CUL listed &/or CSA approved, >5 year warranty

Sloan Signbox 2 LED modules
or approved equivalent

Approved Manufacturers:
- Agilight LED
- Allanson LED
- GE

Transformer Allanson CVL2125-120-277
or approved equivalent



Dashed outline of post beyond

1/8" (3mm) brakeformed aluminum sheet metal
Painted to match PMS877 with
2 part polyurethane paint (satin finish)
Fasten to angles with countersunk screws
c/w opening as required for power feed

1 1/2" (38mm) aluminum angle frame

3/16" (5mm) clear polycarbonate cover
(non-glare matte finish)

1 1/2" (38mm) EX-7 aluminum retainer cover
c/w continuous piano hinge and
Qty 2 rust resistant hold open arms, 1 per side.
Paint retainer cover and hardware to match
Black with 2 part polyurethane paint (satin finish)
Fasten along returns with countersunk screws
Paint hardware to match

1/4" (6mm) Sign White acrylic panel
with applied vinyl graphics on first surface
Fasten with pan head screws

1/8" (3mm) aluminum baffle
c/w 1 1/2" (38mm) aluminum angle as required

Fasten to posts as required
Fabricator to spec hardware

SECTION 1
SCALE 1:10

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.1 Freestanding School ID with EMC

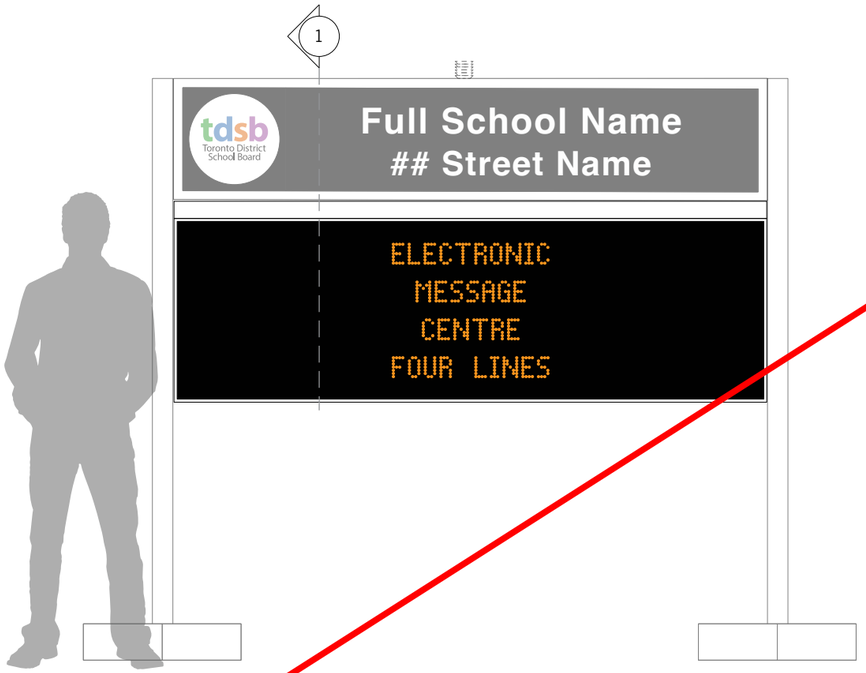
Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.1-02

Page	of	Rev No.
10	17	3



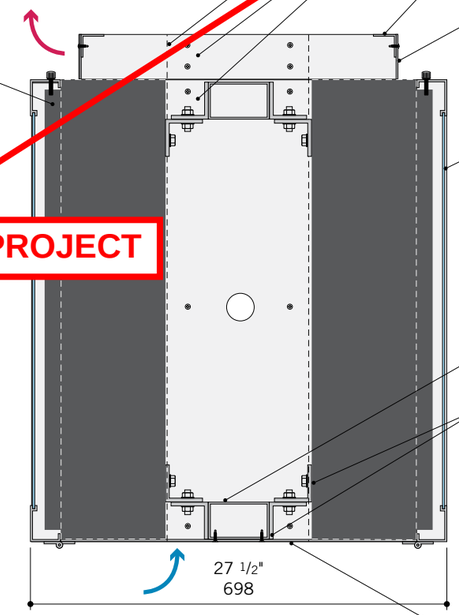
FRONT VIEW
SCALE 1:25

NOT REQUIRED FOR THIS PROJECT

Optec Model: INF-20-Y-V-P-D-QR
(or approved equivalent)

Warranty: 7 Yrs Parts and Service
Display Specifications
LED Pixel Pitch: 20.0mm
Matrix Size: 36 x 120
Viewing Area: 2' 4 3/8" x 7' 10 1/2"
Character Size: 5.5 Inches
Number of Lines: 5 lines
Number Characters per Lines: 20 characters
Brightness: 5000 NIT's (+-5%)
Viewing Angle: 140 Degrees Horizontal
Display Configuration: Double Face
(2 Cabinets - Primary/Secondary)
Maintenance Door: Front
Ventilation: Rear Vent
Dimming Levels: 100 - Auto & Manual
Dimming/Temp. Sensor: Auto
Software: ViViD
Software Upgrade: 7 Years
Software Upgrades Warranty: 7 Yrs Software Upgrades
Delivery Lead Time: 10 - 12 Weeks
Vandal Cover: Included
Electrical & Venting Requirements
AC Power Required: Single Phase 120V or 240V 50/60Hz
Total Boot Up Amps* (120V):6.7
Regular Operating Amps* (120V):1.94
Example Electrical Cost* (120V):US$0.30/Day
Venting Requirement*:128.16 CFM

Alternate suppliers:
(must demonstrate ability to match spec listed above)
Daktronics
Nanolumens
Media Resources Inc
Nu-media
Sunitron



SECTION 1
SCALE 1:10

Dashed outline of post beyond

1/8" (3mm) aluminum sheet metal
Paint to match PMS877 with
2 part polyurethane paint (satin finish)
Mechanically fasten to post

1 1/2" (38mm) aluminum angles
& tubing, painted to match Black
with 2 part polyurethane paint (satin finish)
Weld to 3mm aluminum sheet metal

Perforated metal panel
3/8" (9mm) dia. holes @ 1/2" (12mm) OC
to provide 51% open area.
primed & painted to match Black
with 2 part polyurethane paint
(Satin finish)

3/16" (5mm)clear polycarbonate
(non-glare matte finish)
Aluminum retainer cover
c/w continuous piano hinge and
Qty 2 rust resistant hold open arms, 1 per side.
Paint retainer cover and hardware to match
Black with 2 part polyurethane paint (satin finish)
Fasten with knurled machine screws
or equivalent, as required

4"x2 1/12" (102x62mm) steel tube
Weld to posts

2 1/12" (62mm) aluminum angle tabs
as required to mount EMC display
Fabricator to spec hardware

Perforated metal panel
3/8" (9mm) dia. holes @ 1/2" (12mm) OC
to provide 51% open area.
Painted to match PMS877 with
2 part polyurethane paint (satin finish)
Fasten to angles with countersunk screws

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.0 Freestanding School ID with EMC

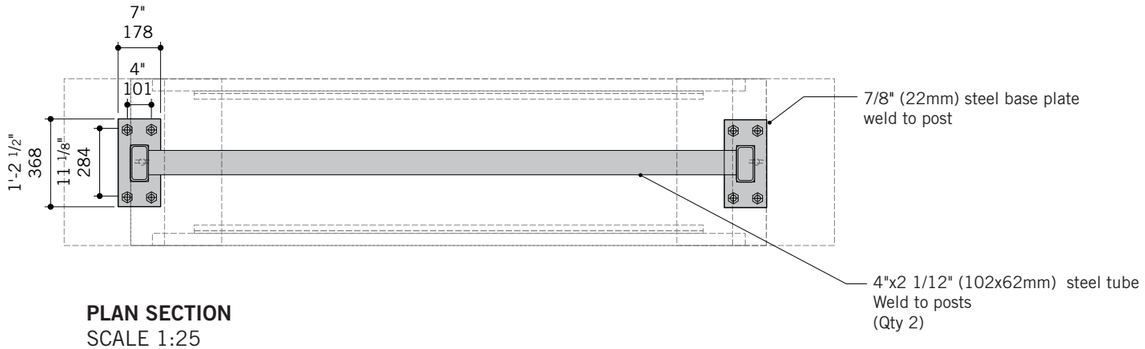
Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

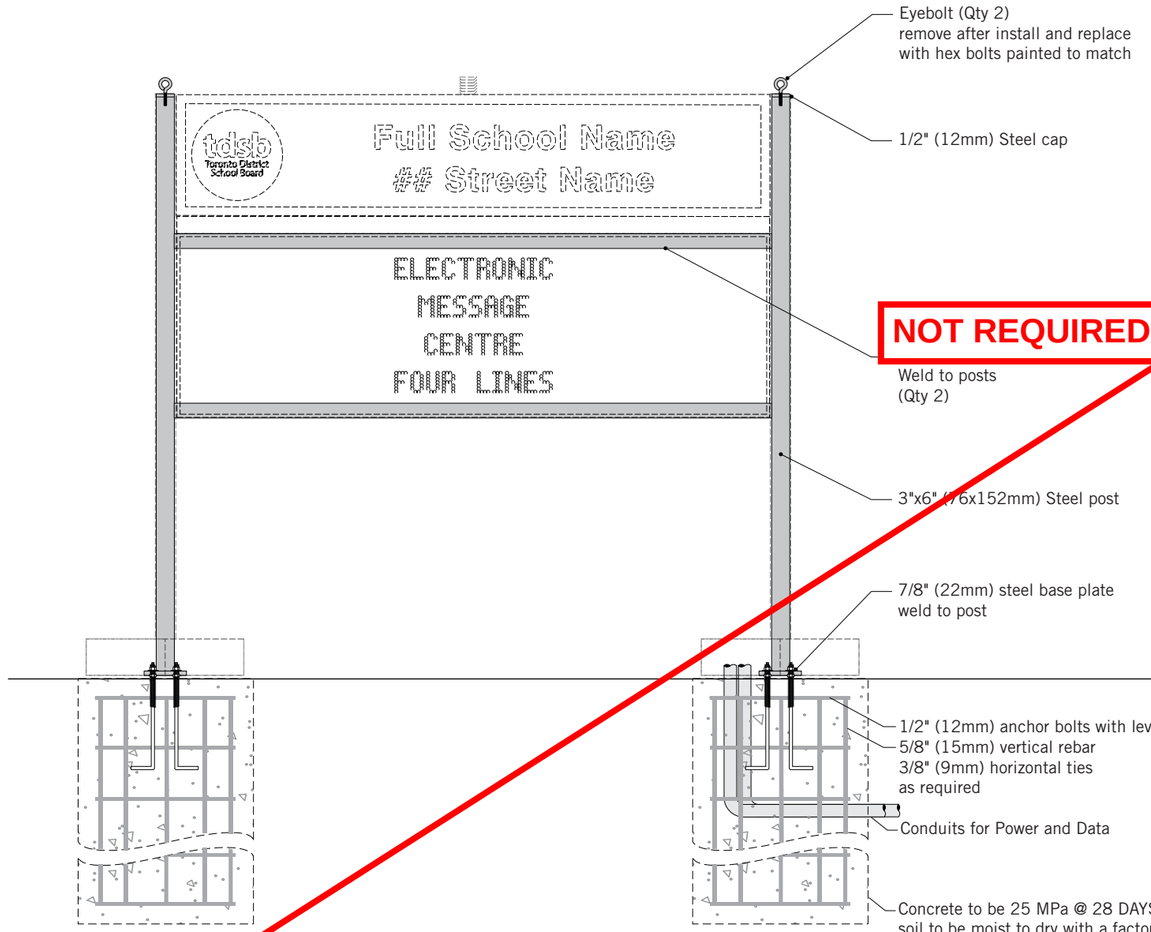
Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.1-03

Page	of	Rev No.
11	17	3



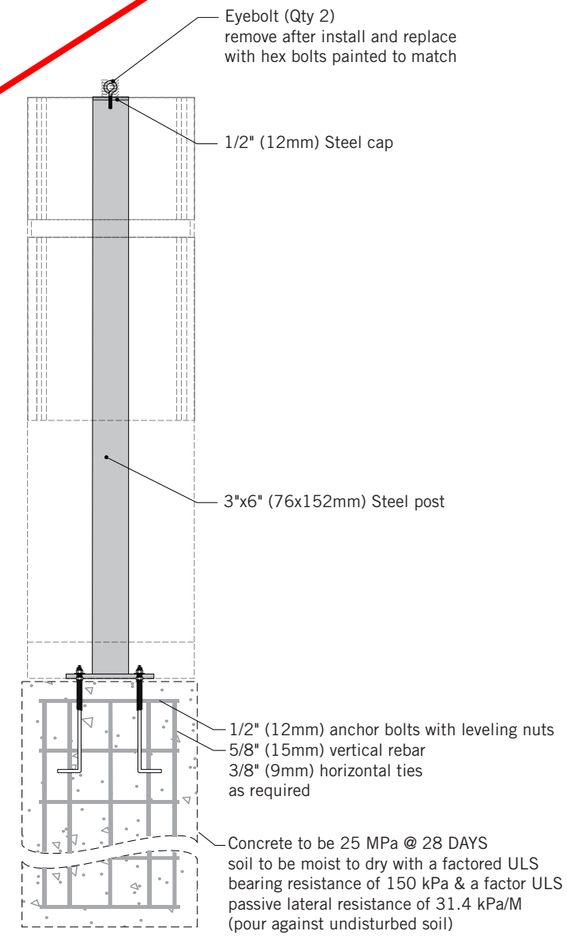
PLAN SECTION
SCALE 1:25



FRONT SECTION
SCALE 1:25

Note:
All foundation designs to reviewed
and approved by engineer

NOT REQUIRED FOR THIS PROJECT



SIDE SECTION
SCALE 1:25

Note:
All foundation designs to reviewed
and approved by engineer

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.0 Freestanding School ID with EMC

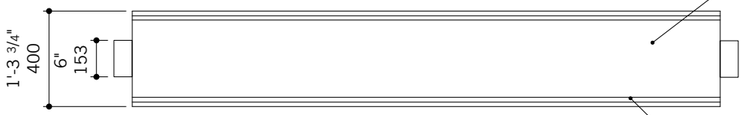
Sign Type	Drawn By	Checked By
A2.1	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.1-04

Page	of	Rev No.
12	17	3

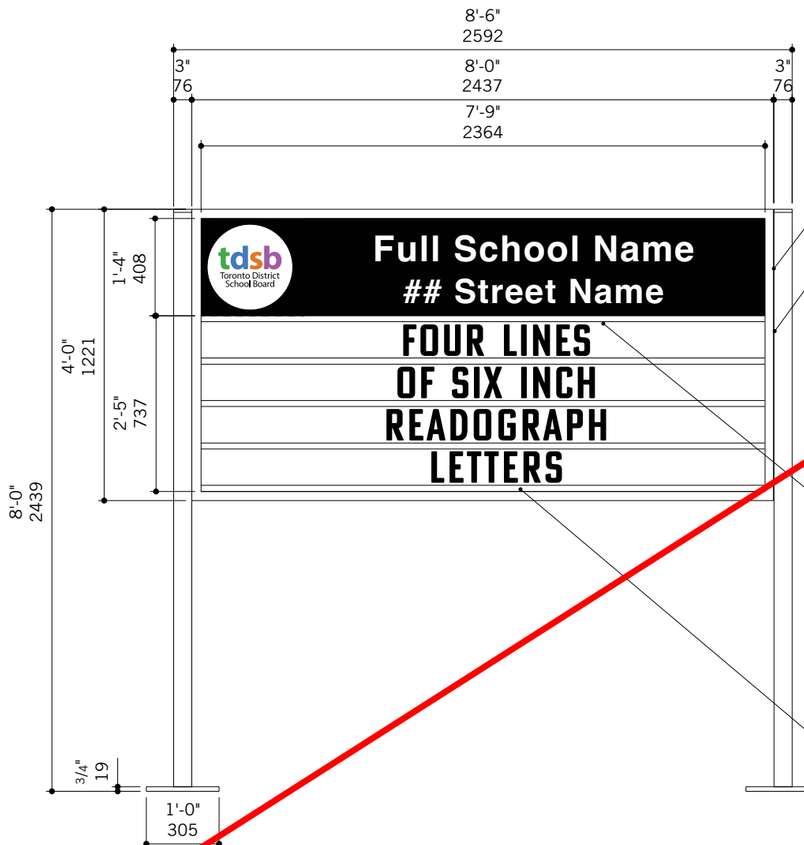


1/8" (3mm) aluminum sheet break formed
cabinet reinforced w/ aluminum angles
& tubing, painted to match PMS877
with 2 part polyurethane paint (satin finish)

Provide aluminum reinforcement plate on
interior face of sign box side panel
(At all bolt hole locations & both sides)
Steel posts must be tapped to receive
stainless steel bolts used to secure sign
Box to supporting post.

Double-Sided Header Panel
Fixed 1/4" (6mm) Sign White acrylic panel
with applied vinyl graphics on first surface
3/16" (5mm) clear polycarbonate cover
(non-glare matte finish)
1 1/2" 38mm EX-7 Aluminum retainer cover
c/w continuous piano hinge and
Qty 2 rust resistant hold open arms, 1 per side.
Paint retainer cover and hardware to match
PMS877 with 2 part polyurethane paint
(Satin finish)

PLAN VIEW
SCALE 1:25



1/8" (3mm) aluminum sheet break formed
between cabinets and posts

1/8" (3mm) aluminum sheet break formed
cabinet reinforced w/ aluminum angles
& tubing, painted to match PMS877
with 2 part polyurethane paint (satin finish)

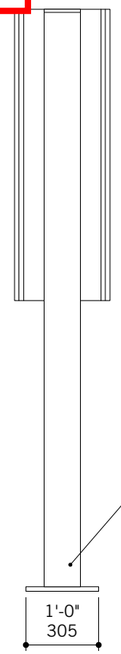
Provide aluminum reinforcement plate on
interior face of sign box side panel
(At all bolt hole locations & both sides)
Steel posts must be tapped to receive
stainless steel bolts used to secure sign
Box to supporting post.

Double-Sided Header Panel
Fixed 1/4" (6mm) Sign White acrylic panel
with applied vinyl graphics on first surface
3/16" (5mm) clear polycarbonate cover
(non-glare matte finish)
1 1/2" 38mm EX-7 Aluminum retainer cover
c/w continuous piano hinge and
Qty 2 rust resistant hold open arms, 1 per side.
Paint retainer cover and hardware to match
PMS877 with 2 part polyurethane paint
(Satin finish)

Double-Sided Readograph Panel
Clear acrylic tracks adhered to White acrylic sign
face to accommodate 4 rows of 6" (152mm) High letters
Sign manufacturer to provide two sets of
interchangeable six inch rigid letters,
"Pronto" series, by Gemini Canada.

FRONT VIEW
SCALE 1:25





1/8" (3mm) aluminum sheet break formed
cover reinforced w/ aluminum angles
& tubing, painted to match PMS877
with 2 part polyurethane paint (satin finish)

SIDE VIEW
SCALE 1:25

NOT REQUIRED FOR THIS PROJECT

GENERAL NOTES:

1. All screws being used must be zinc coated stainless steel.
2. Font for 'school name' & 'address' is to be 'Helvatica Bold'.
3. TDSB logo colours: 'stem & pit' black, 'apple & letters' pantone 355 green.
4. New ground sign to be double-sided, incl. 2 Readographs &
   school name graphics on both sides of header box.
5. Lexan covers are to be prepped with rust resistant hasps that will accommodate lockable cam locks.
6. Anchor bolts - 1"x23 1/2" (25x600mm)
7. All steel hot dip galvanized to CAN/CSA-G164, min. Coating 600 g/m2
   Weld 1/4" (6mm) top cap to both posts.
8. All structural steel to conform to CSA standard g40.20/g40.21;
   grade 350w for hollow structural sections & grade 300w for angles,
   channels, rods & plates. It should also conform to CSA standard w59
   for welded steel construction & metal arc welding.
9. Surface preparation to remove all scale, oxidation & foreign material
   from surface by grit blasting to a minimum condition of SSPC-SP-10 with
   a blast profile of 2.5 to 4 mils, in accordance w/ SSPC-VISI-89 "visual
   standard for abrasive blast cleaned steel". Prepare steel in zinc phosphate,
   TT-C-490, method 1, type 1 or 11. Apply 3 to 5 mils of an epoxy powder primer.
   Apply 3 to 5mils of a silver polyester or super durable polyester to match
   clear anodized aluminum in colour. Cure as per powder manufacturers'
   data sheets & recommendations for the substrate being coated.
10. All fabricated steel posts & base plates shall have no sharp protrusions,
    all edges to be radiussed & weld spatter ground smooth, all welds to be
    a continuous porosity free seem weld & to be free of grease & dust prior
    to powder coating.
11. Sign supplier to provide anchor bolt templates.
12. Footings are to be designed by sign manufacturer to local soil conditions.
    Design is to be included in permit drawing submittal
    (c/w engineering stamp, licensed to practice in the province of Ontario).

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.2 Freestanding School ID with Readograph

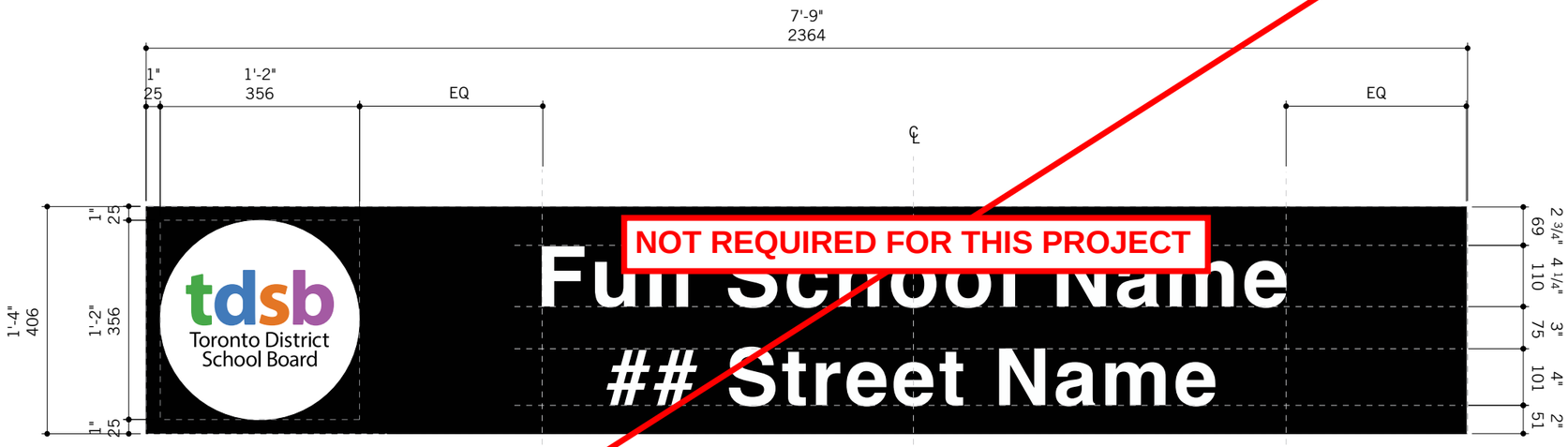
Sign Type	Drawn By	Checked By
A2.2	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.2-01

Page	of	Rev No.
13	17	3



DETAIL
SCALE 1:10

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.2 Freestanding School ID with Readograph

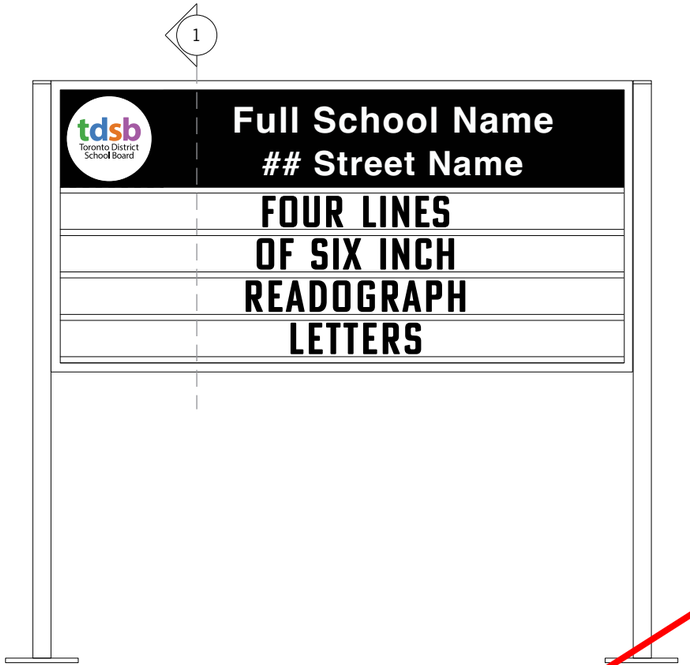
Sign Type	Drawn By	Checked By
A2.2	CB	EP/WM

Scale	Dimensions
As Noted	Metric

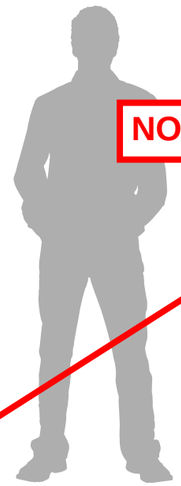
Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.2-02

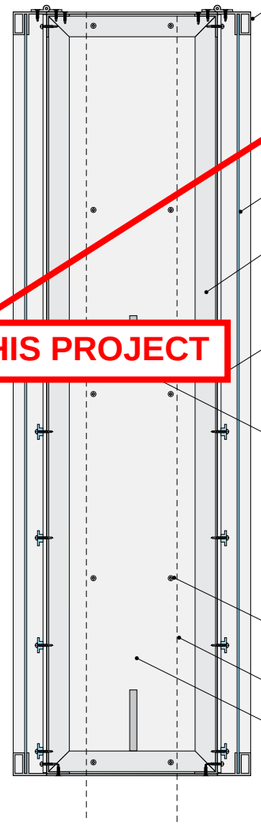
Page	of	Rev No.
14	17	3



FRONT VIEW
SCALE 1:25



NOT REQUIRED FOR THIS PROJECT



SECTION 1
SCALE 1:10

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.2 Freestanding School ID with Readograph

Sign Type	Drawn By	Checked By
A2.2	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

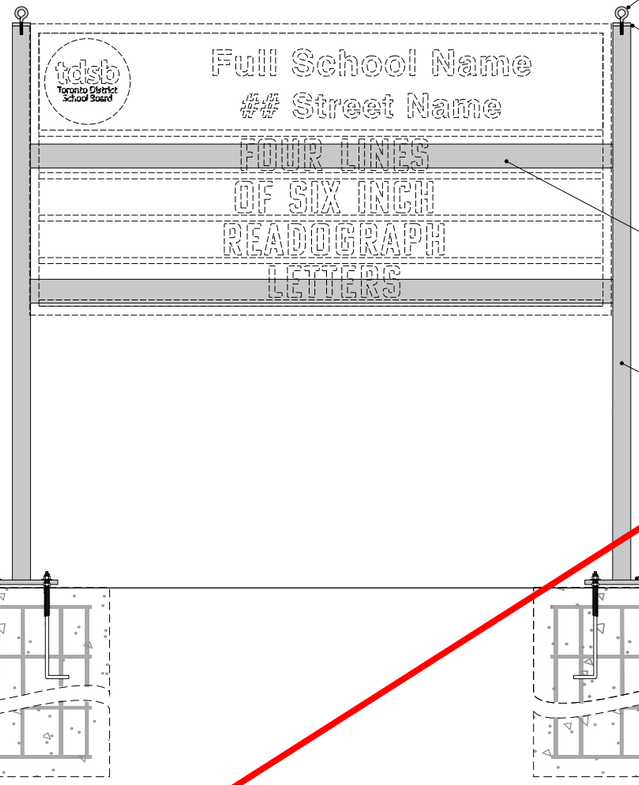
Drawing No.
A2.2-03

Page	of	Rev No.
15	17	3



3/4" (19mm) steel base plate
weld to post, painted to match
PMS877 with 2 part polyurethane
paint (satin finish)

PLAN VIEW
SCALE 1:25



Eyebolt (Qty 2)
remove after install and replace
with hex bolts painted to match

1/2" (12mm) Steel cap
Paint to match PMS877
with 2 part polyurethane paint
(Satin finish)

1/
Paint to match PMS877
with 2 part polyurethane paint
(Satin finish)

3"x6" (76x152mm) Steel post
Paint to match PMS877
with 2 part polyurethane paint
(Satin finish)

3/4" (19mm) steel baseplate
Paint to match PMS877
with 2 part polyurethane paint
(Satin finish)

1/2" (12mm) anchor bolts with leveling nuts
5/8" (15mm) vertical rebar
3/8" (9mm) horizontal ties
as required

Concrete to be 25 MPa @ 28 DAYS
soil to be moist to dry with a factored ULS
bearing resistance of 150 kPa & a factor ULS
passive lateral resistance of 31.4 kPa/M
(pour against undisturbed soil)

Note:
All foundation designs to reviewed
and approved by engineer

FRONT VIEW
SCALE 1:25

NOT REQUIRED FOR THIS PROJECT

SIGNAGE & WAYFINDING PROGRAM
TDSB

These designs, plans, and specifications, and the copyright herein, are the property of Entro Communications, wholly, and must not be used, reproduced, or copied wholly or in part without the express written consent of Entro Communications.

No.	Description	Date
3	Drawing Update	Nov 16, 26
2	Logo Update	Nov 02, 26
1	Issued for Tender	Nov 20, 24

Consultant

entro
33 Harbour Square, Suite 202,
Toronto, Canada M5J 2G2

Drawing
A2.2 Freestanding School ID with Readograph

Sign Type	Drawn By	Checked By
A2.2	CB	EP/WM

Scale	Dimensions
As Noted	Metric

Job No.	Project Start Date
0172	July, 2024

Drawing No.
A2.2-04

Page	of	Rev No.
16	17	3

entro 33 Harbour Square, Suite 202, Toronto, Canada M5J 2G2 T: 416-368-6988 entro.com



Heydon Park Secondary School - TDSB
Arborist's Report

Client:
BORTOLOTTO
November 17th, 2026
HKLA Job# 2026-082



PREPARED BY:

Henry Kortekaas & Associates Inc.

230 Westney Road S, Unit 308 - Ajax, ON, L1S 7J5 (905) 839-5599 info@hkla.ca

November 17th, 2026

Tania Bortolotto
Founder and President
Bortolotto Design Achitect Inc.
174 Spadina Aven, Toronto, ON, M5T 2C3
Tel: 416.324.9951 Ext. 1
Email: tania@bortolotto.com

HENRY KORTEKAAS + ASSOCIATES INC.
HKLA
Landscape Architects and Consulting Arborists
230 Westney Rd S, Unit 308 - Ajax, ON - L1S 7J5
Office: (905) 839-5599 // Email: info@hkla.ca
Direct: (905) 706-1229 // Web: www.hkla.ca

Re: Heydon Park Secondary School - TDSB - Arborist Report

HKA Ref No: 2026-082

Henry Kortekaas and Associates was retained to provide the Aboricultural related consulting services and documentation for trees affected by a development project scheduled for Heydon Park Secondary School at 70 D'Arcy St in Toronto, ON.

The purpose of this report is to provide the Tree Inventory Assessment and Preservation Plan (TAPP) (see Appendix C L-TP), Arborist Report, and the Tree Value Assessment.

We trust this documentation meets your needs. If you have any questions, please do not hesitate to contact us at (905) 839-5599.

Sincerely,

HENRY KORTEKAAS & ASSOCIATES INC.

Carter Tullis, BLA, ISA
Junior Landscape Designer
ISA Certified Arborist ON-381985A

HENRY KORTEKAAS & ASSOCIATES INC.

Kyle Foch, BLA, OALA, CSLA, SLA
Principal Landscape Architect

TABLE OF CONTENTS

1. INTRODUCTION 1
2. MUNICIPAL TREE BYLAWS 1
3. STUDY PURPOSE 1
4. STUDY PROCESS 2
5. SITE LOCATION 2
6. INVENTORY 2
7. PRESERVATION ANALYSIS 3
8. TREE IDENTIFICATION & LOCATION CRITERIA 5
9. TREE OBSERVATION AND RECOMMENDATIONS 6
APPENDIX A - DISCLAMER / LIMITATIONS 8
APPENDIX B - CITY OF TORONTO TREE PROTECTION FENCE DETAIL 10
APPENDIX C - 2026-082 TIPP & LANDSCAPE DRAWING PACKAGE 12
APPENDIX D - REFERENCES 20

1. INTRODUCTION

Henry Kortekaas & Associates, was contacted by Bortolotto Design Architect Inc. advising that Heydon Park Secondary School at 70 D'Arcy Street, Toronto, ON, is scheduled for development.

HKLA used a provided tree survey to underlay the Tree Inventory drawing to accurately locate the trees.

Existing trees that conflict with proposed grading or development were recommended for injury. All trees recommended for retention on the property will be protected by the City of Toronto Standard Tree Protection Fencing, (see Appendix C, Drawing L-TP).



Tree tag #1084 (Sitka Spruce / Picea sitchensis)

2. MUNICIPAL TREE BYLAWS

The trees on this lot are regulated under Toronto Municipal Code, (Appendix D), which states:

No person shall injure or destroy any tree, including a multi-stem tree having at least one stem, that has a diameter measurement of 30 centimetres or more measured at 1.4 metres above ground level in accordance with this article, unless authorized by permit to do so.

3. STUDY PURPOSE

This project was undertaken to comply with the City of Toronto policies regarding tree identification and protection of trees. The study objectives are:

1. To inventory the species and location of all significant trees on the subject site, and within 3 m of, the property. Each inventoried tree on site is given a number.
2. To record the size and condition of each tree.
3. To recommend which existing trees can be preserved within the proposed development.
4. To provide guidelines for the preservation and long-term health of these trees.

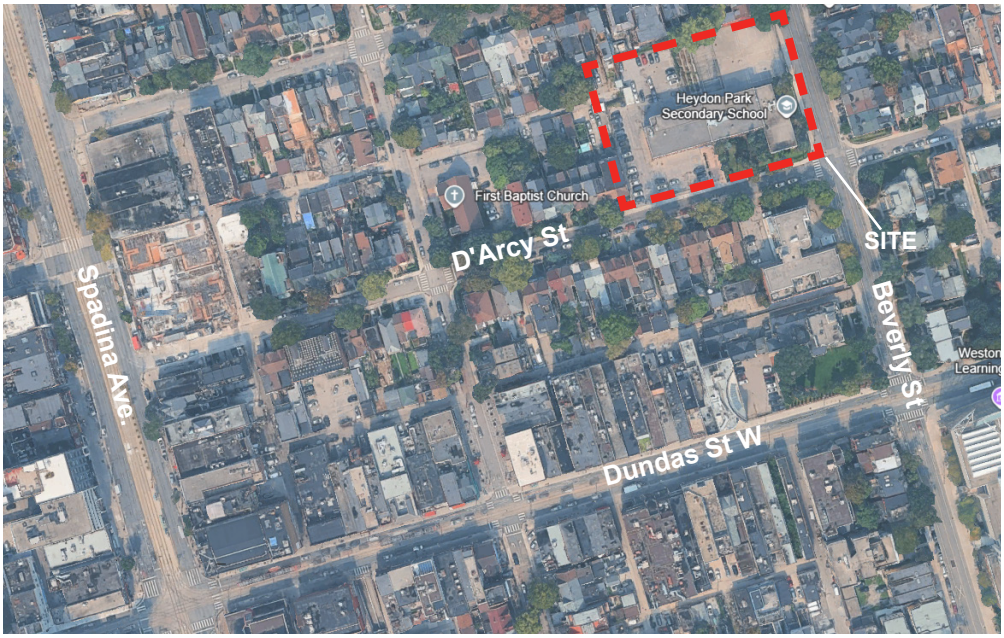
4. STUDY PROCESS

All specimens or tree groupings with the potential for preservation, have been located.

These trees were evaluated on their condition, rated as to the species adaptability to environmental change, their potential value within the completed future development and their potential for preservation considering the requirement for fill, site-servicing, asphalt, foundations and space for excavations, etc.

5. SITE LOCATION

The site is located at 70 D'Arcy Street, Toronto, ON - northeast of the main intersection comprised of Dundas Street West & Spadina Avenue, just a short walk from the Art Gallery of Ontario.



6. INVENTORY

An inventory of the site vegetation was carried out on October 14th, 2026. From this inventory, specimen trees and tree groupings were tagged and identified. This data appears on the drawings 2026-026 L-TP (See Appendix C).

7. PRESERVATION ANALYSIS

In order to develop the property in accordance with the current project site plan, 21 trees were inventoried. Of the 21 trees, there are 5 trees to be retained with injury. The remaining 16 trees are to be retained and protected without injury.



Tree tag #1072 (Elm / Ulmus spp.)

1.Size

Mature specimens add to the aesthetics of the site and maintain the mature vegetation character of the neighbourhood. Mature trees screen unwanted views, provide shade, block winds and improve the visual landscape of the area. Large trees, however, are less tolerant of change. Alteration of soil conditions will reduce the levels of air, water, and nutrients reaching the wide spread roots of mature specimens. Foundations and excavations for foundations will change water flow and cut root systems. The potential life span of a species in a 'fill or cut' situation or proposed new foundations must also be considered. There is less value in preserving a tree that is already at, or past its normal life expectancy and conflicts with the approved plan.

1.1. Condition

The health of a tree specimen is factored into that specimen's potential for preservation. A mature, desirable specimen will have a low preservation potential if it is in poor health. A tree's condition is determined visually based on branch structure and growth, trunk irregularities - such as cankers, broken limbs, wounds, heart rot and fungal growth, twig and foliage growth, and root restrictions, limb entanglement with utilities, etc.

1.2. Landscape Function/Location

The relative "landscape" importance of a specimen on this or any site is also dependent on its function. Trees that perform a desirable function - wind break, shade, visual screen, or spatial divides between sites are rated as having medium to high value. Site boundary trees are particularly important to the surrounding landscape and have the highest potential for preservation.

1.3. Relative Species Value

The value of site vegetation was based on the rating system developed by The I.S.A. and includes: species hardiness; species tolerance to pollution, disease and environmental change; maintenance requirements; aesthetic form, and; life expectancy. All species that are considered to have value as future urban trees are rated as high in the Species Potential (SPP) category. All species which are considered to have little value as future urban trees, and all those which are generally regarded as 'weed' or nuisance trees or foreign invasive trees have been rated as low in the SPP category.

1.3.1. Size

The size of a landscape plant is expressed by the dimensions of its above ground parts. It is typically expressed by trunk diameter, in this case taken at 1.37 meters (rounded to 1.40 meters) known as Diameter at Breast Height (DBH).

1.3.2. Contributing Rating

Functional and aesthetic contributions influence its value in most settings. Benefits may be affected by; plant size, shape, branch structure, foliage density and distribution. Plants contribute to the site by screening, privacy control, creating wildlife habitat opportunities, or energy saving qualities, among others.

High densities of trees lowers individual contribution. For example, if one (1) tree was removed from a windbreak (i.e., Picea abies, Norway Spruce), the benefit of the windbreak would remain.

1.3.3. Placement

The placement rating of the plant being evaluated determines how effective it is in providing functional and aesthetic attributes. For example: the placement of a deciduous tree to provide summer shade and winter sun for a patio is critical. Placement is especially important for wind breaks, snow deposition, erosion control and dust reduction. Placement is also important for an aesthetic view point when a plant can provide a landscape focus, frame a view or accent a building.

1.3.4. Location Factor

Location factor is determined as follows:

(Site + Contribution + placement)/3 = location rating



Tree tag #1085 (White Pine / Pinus strobus)



Tree tag #1066 (Freeman Maple / Acer freemanii)

8. TREE IDENTIFICATION & LOCATION CRITERIA

See Tree Inventory and Preservation Plan (L-TP1) for tree location and species identification, condition and recommendations.

The following chart is reflected on the tree preservation drawing. It demonstrates the identification and classification practices, and is separated by 9 criteria:

DBH (cm) Diameter at breast height. Nominally 1.4m and measured in centimetres.

SP (m) Spread. The average diameter of canopy coverage, measured in metres.

HT (m) Height. The nominal height of the tree, measured in metres.

TI Trunk Integrity. An indication of the structural integrity and general health of the tree. Measured as (G)ood, (F)air or (P)oor.

CS Crown Structure. Correlated with tree condition/health. Measured as (G)ood, (F)air or (P)oor.

CV Crown Vigour. General correlation with tree condition/health. Measured as (G)ood, (F)air or (P)oor.

CDB (%) Crown Die Back. Measured as the percent of branch tips in the crown that are dead, as a percentage.

SPP Species Potential. An experiential estimation of the suitability of the tree species compared to the existing/proposed site conditions. Measures as (H)igh (M)edium or (L)ow.

SIP Site Potential. An experiential estimation of the tree's suitability compared to the existing/proposed site conditions. Measured as (H)igh, (M)edium or (L)ow.

Ownership Tree ownership was determined based on the location of the tree trunk relative to the subject property boundaries, as established by the available property survey information and site observations, in accordance with the applicable definitions under Chapter 813 of the City of Toronto Municipal Code.

Recommendation and Notes: A recommendation based on the noted criteria and design information to the site suitability of the tree.

9. TREE OBSERVATION AND RECOMMENDATIONS

9.1 A total of 24 trees have been inventoried. 21 trees are to be retained, 5 of which with injury. No trees are to be removed.

Note that the following five (5) trees will be retained with injury:

Tree tag #1073, #1074, #1075, #1076, #1083

All of these meet the DBH requirement to apply for tree permit.

The proposed injuries are not expected to significantly contribute to the loss of structural stability or declining health provided injury mitigation measures are followed.

9.2 We recommend that all trees scheduled to be retained are protected by City of Toronto approved tree protection fencing placed at the distances specified or as otherwise shown on the plans and as per regulations outlines in the City of Toronto Municpal Code, Chapter 813 followed. 4x8 plywood hoarding is to be used, in accordance to the City of Toronto tree protection fence standards.

9.3 If grading works do occur within the tree protection zone, precaution and best practices are to be followed to limit damage done to the tree and its root systems.

If excavation is to occur in the root area of the tree, it is recommended that all exposed roots are to be cut cleanly with disinfected blades by hand or pruning saw by the contractor. Any roots found to be 5cm in diameter will need permissions from Urban Forestry to be pruned. Once trimmed, exposed root ends are to be back filled to grade with clean fill to prevent desiccation.

No soil compaction or storage of construction materials is to take place within the TPZ. If machinery needs to be used within the TPZ, it is required that plywood be placed over a layer of mulch (100mm thick minimum), to limit compaction. These mitigations are to be removed, by hand, upon completion of work within the TPZ.

Any damage that occurs to the tree including broken limbs, roots or wounds inflicted to the trunk are to be reported to the consulting Arborist immediately.

9.4 Tree Permit and Replacement

Urban Forestry requires the submission of a complete ‘Application to Injure or Destroy Trees’ and any associated fees adjusted regularly. Estimated fee per tree, subject to annual adjustment are,
Private Tree: $425.75 per tree
City Tree: $425.75 per tree
Boundary/Neighbour Tree: $891.30 per tree

• Five (5) Private tree over 30cm DBH is to be be injured. Anticipated application cost is 5 x $425.75 to total $2,128.75

The total anticipated application fee is $2,128.75. All fees will be confirmed by Urban Forestry. An Application Permit fee to Injure or Remove Trees will be required.

Urban Forestry will/may require large growing native shade trees to be planted at a replacement ratio of 3:1. Where tree planting to replace trees to be removed is not possible on the site, the municipality may accept cash in lieu payment. Urban Forestry will advise of the cost based on tree compensation value estimate $583.00/tree adjusted annually.

Based on the current site plan, there are 19 trees with a DBH larger than the 30cm DBH requirement.

An application for injury shall be submitted for a total of 5 trees (#1073, #1074, #1075, #1076, #1083), which are bylaw protected.

The current proposed site plan has four (4) proposed trees to offer as replacement planting. Since there are no trees to be removed, there will be no offer of cash-in-lieu.

The General Manager of Parks, Forestry and Recreation may request a Tree Planting Deposit to guarantee the planting or protection of trees. Urban Forestry will advise of the cost.

9.5 Mitigations Measures

All proposed excavation works within the existing tree protection zone to be done by hand under supervision of an ISA certified arborist. All tree protection barriers (horizontal and vertical) will be installed, prior to construction, in accordance with the City of Toronto document.

Roots located outside of the TPZ that have received approval from Urban Forestry to be pruned must first be exposed by hand digging or use of the low pressure hydro vac method. Any root pruning beyond the TPZ must be performed by a qualified Arborist or other tree professional approved by Urban Forestry. All pruning of roots and branches must be in accordance with best hortiricultural practices.

APPENDIX A - DISCLAMER / LIMITATIONS

Appendix A: Disclaimer/Limitations

1. Data has been verified insofar as possible; however Henry Kortekaas & Associates Inc. can neither guarantee nor be responsible for the accuracy of information provided by others.

2. Unless otherwise required by law, possession of this report or a copy thereof does not imply right of publication or use for any purpose in whole or in part by any other than the person to whom it is addressed, without the prior expressly written or verbal consent of Henry Kortekaas & Associates Inc.

3. Excerpts or alterations to this report, without the authorization of Henry Kortekaas & Associates Inc. invalidates its intent and/or implied conclusions. This report may not be used for any expressed purpose other than its intended purpose and alteration of any part of this report invalidates the report.

4. Unless expressed otherwise: 1) information contained in the report covers only those items that were examined and reflect the condition of those items at the time of inspection; and 2) the inspection was made using accepted arboricultural techniques and is limited to visual examination of accessible items without climbing, dissection, probing or coring, and detailed root examination involving excavation. Weather conditions such as thick snow cover will limit the potential for basal examination and further site visits may be required. While reasonable efforts have been made to asses trees outlined in this report, there is no warranty or guarantee, expressed or implied, that problems or deficiencies with the tree(s) or any part(s) of them may not arise in future. All trees should be inspected and reassessed periodically.

5. The determination of ownership of any subject tree(s) is the responsibility of the owner and any civil or common-law issues, which may exist between property owners with respects to trees, must be resolved by the owner. A recommendation to remove or maintain tree(s) does not grant authority to encroach in any manner onto adjacent private properties.

6. The scope of work undertaken in this report, with the noted site observations and resultant conclusion, was based on existing site conditions and the proposed schematic site development layout.

APPENDIX B - CITY OF TORONTO TREE PROTECTION FENCE

7. Tree Protection Plan Details

The following diagrams provide details for tree protection barriers and sediment protection barriers:

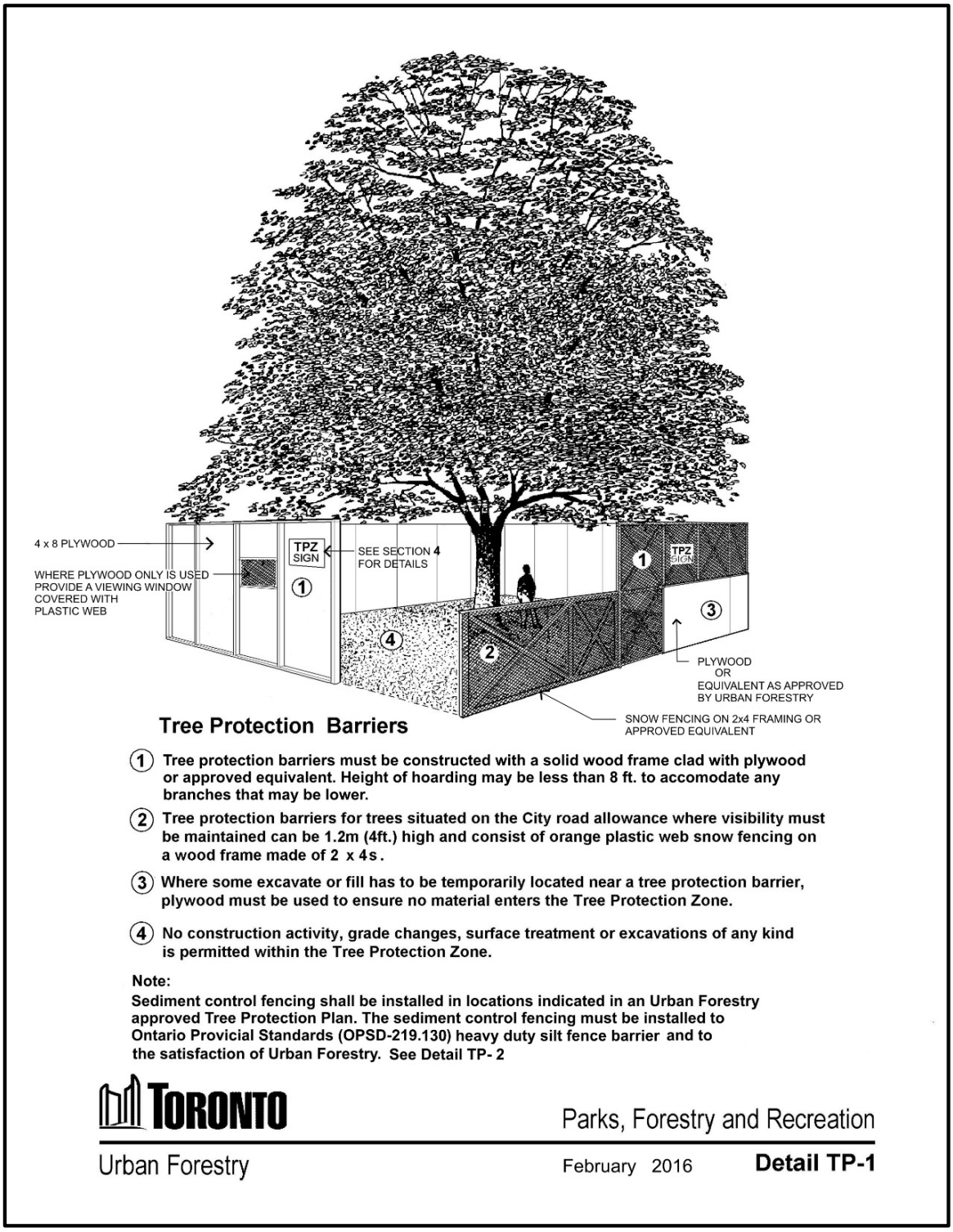
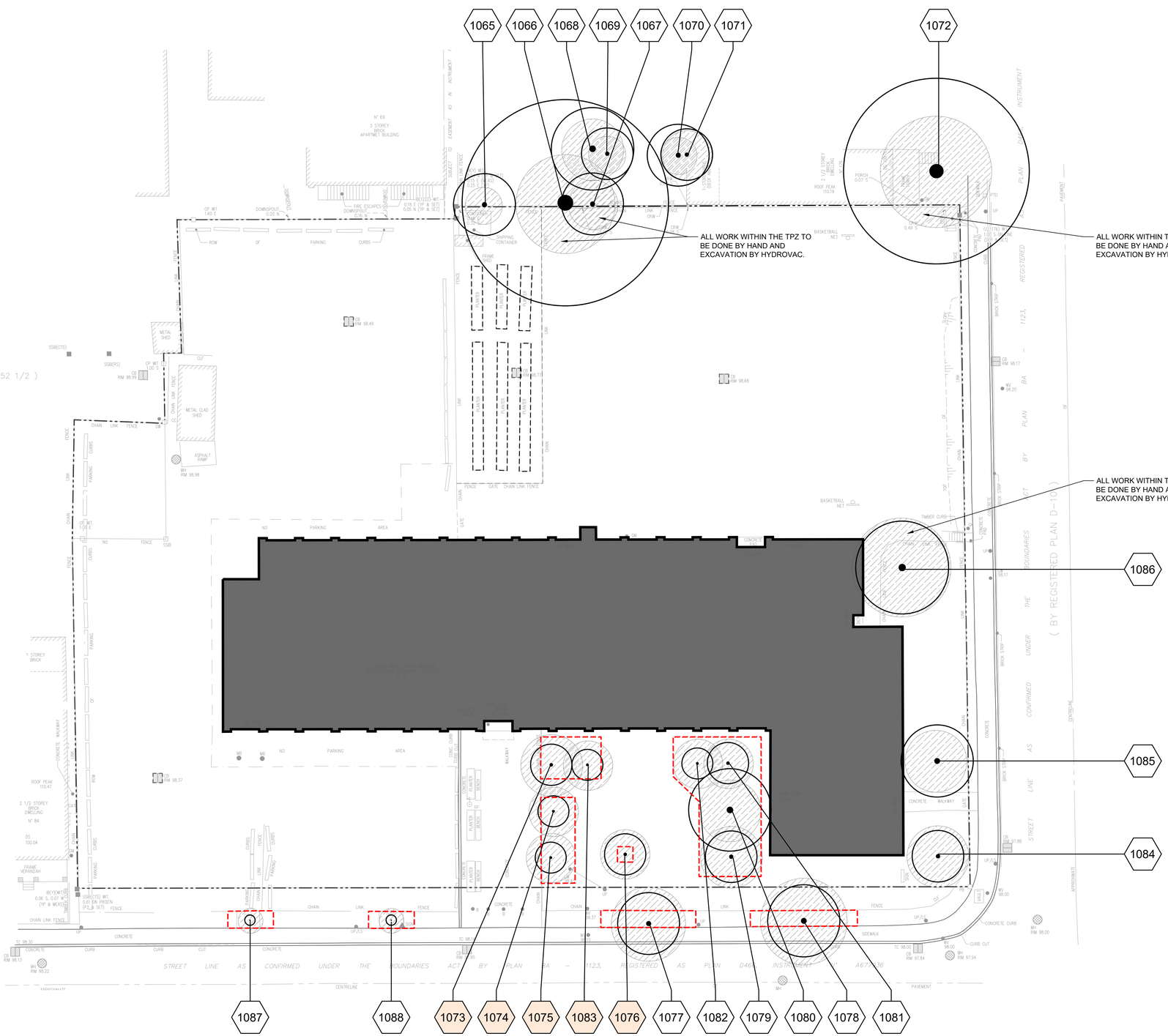


Figure 4: Urban Forestry Detail TP-1

APPENDIX C - 2026-082 TIPP & LANDSCAPE DRAWING PACKAGE



LEGEND - TIPP

- 123 — TREES TO BE REMOVED
- 123 — TREES TO BE RETAINED W/ INJURY
- 123 — TREES TO BE RETAINED
- TREE PROTECTION ZONE (TPZ)

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- [ ] CONCEPTUAL
- [ ] PRELIMINARY
- [ ] SITE PLAN
- [ ] PERMIT
- [x] TENDER
- [ ] CONTRACT
- [ ] CONSTRUCTION
- [ ] AS-BUILT

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
KYLE FOCHT
OALA
MEMBER

HKLA
HENRY KENTAKAA + ASSOCIATES INC.
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 639-5599 I: Email: info@hkla.ca I: Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

SPA FILE #

PROJECT:
HEYDON PARK RENOVATION
TDSB

DRAWING:
TREE PRESERVATION PLAN

DRAWN BY: CT	SCALE: 1:200	L-TP1
CHECKED BY: KF	DATE: 2026-09-15	DRAWING 1 of 8
JOB NO.: 2026-082		

File #2026-082

Tree Inventory
Project: Heydon Park SS, Toronto, ON

HKA Job #: 2026-082

Date: 2026-10-14

Conditions: 15 Degrees C.

Inventory Done By: C.T.

CODES		
DBH	Diameter at breast height	(cm)
SPR	Spread	(m)
HT	Height	(m)
TI	Trunk Integrity	(G,F,P)
CS	Crown Structure	(G,F,P)
CV	Crown Vigor	(G,F,P)
CDB	Crown Die Black	(%)
SPP	Species Potential	(L,M,H)
TPZ	Tree Protection Zone	(m)
PHY	Physical Condition	(text)
~ = Estimate (L)=low (M)=moderate (H)=high (G) = Good, (F) = Fair, (P) = Poor		

Tree Tag #	*Common Name*	*Scientific Name*	*DBH*	*SP*	*HT*	*TI*	*CS*	*CV*	*CDB*	*SPP*	*TPZ*	*PHY*	*Ownership*	*Recommendation (REMOVE/RETAIN)*
1065	Manitoba Maple	Acer negundo	23	6	7	F	F	F	20%	L	1.8		NEIGHBOUR	RETAIN & PROTECT
1066	Freeman Maple	Acer freemanii	70,76	20	16	F	G	G	10%	0	4.8	2 Leader	NEIGHBOUR	RETAIN & PROTECT
1067	Green Ash	Fraxinus pennsylvanica	30	6	7	G	F	F	10%	L	2.4		NEIGHBOUR	RETAIN & PROTECT
1068	Manitoba Maple	Acer negundo	41	8	9	G	P-F	P-F	20%	L	3.0	One main branch clean cut	NEIGHBOUR	RETAIN & PROTECT
1069	Elm	Ulmus spp.	5,10,12	5	7	G	F	F	15%	0	1.8	3 Leader	NEIGHBOUR	RETAIN & PROTECT
1070	Green Ash	Fraxinus pennsylvanica	20,25	6	8	F	P	P	45%	L	1.8	2 Leader, Dieback	NEIGHBOUR	RETAIN & PROTECT
1071	Green Ash	Fraxinus pennsylvanica	34	5	8	F	P	P	80%	L	2.4	Significant Dieback, Near Dead	NEIGHBOUR	RETAIN & PROTECT
1072	Elm	Ulmus spp.	90	18	15	G	F-G	G	10%	0	5.4		NEIGHBOUR	RETAIN & PROTECT
1073	Sitka Spruce	Picea sitchensis	49	4	14	G	F	F	15%	0	3.0		PRIVATE	RETAIN WITH INJURY DUE TO CONSTRUCTION
1074	Sitka Spruce	Picea sitchensis	33	3	12	G	F	F	15%	0	2.4		PRIVATE	RETAIN WITH INJURY DUE TO CONSTRUCTION
1075	Sitka Spruce	Picea sitchensis	32	3	9	G	F	F	15%	0	2.4		PRIVATE	RETAIN WITH INJURY DUE TO CONSTRUCTION
1076	Sitka Spruce	Picea sitchensis	33	4	9	G	F	F	15%	0	2.4		PRIVATE	RETAIN WITH INJURY DUE TO CONSTRUCTION
1077	Horsechestnut	Aesculus hippocastanum	54	6	10	G	P	P	40%	M	3.6		CITY	RETAIN & PROTECT
1078	Horsechestnut	Aesculus hippocastanum	65	7	10	G	P-F	P-F	20%	M	4.2		CITY	RETAIN & PROTECT
1079	Sitka Spruce	Picea sitchensis	42	5	10	G	F	F	15%	0	3.0		PRIVATE	RETAIN & PROTECT
1080	White Pine	Pinus strobus	46	8	10	G	P-F	P	20%	H	3.0		PRIVATE	RETAIN & PROTECT
1081	White Pine	Pinus strobus	33	4	8	G	P	P	55%	H	2.4	Poor Condition	PRIVATE	RETAIN & PROTECT
1082	White Spruce	Picea glauca	37	3	11	G	F	F	10%	H	2.4		PRIVATE	RETAIN & PROTECT
1083	Blue Spruce	Picea pungens	32	3	11	G	G	G	5%	H	2.4		PRIVATE	RETAIN WITH INJURY DUE TO CONSTRUCTION
1084	Sitka Spruce	Picea sitchensis	47	5	11	G	G	G	10%	0	3.0		PRIVATE	RETAIN & PROTECT
1085	White Pine	Pinus strobus	44	7	7	G	P-F	P-F	20%	H	3.0		PRIVATE	RETAIN & PROTECT
1086	Horsechestnut	Aesculus hippocastanum	80	9	12	G	G	F-G	10%	M	4.8		PRIVATE	RETAIN & PROTECT
1087	Kentucky Coffeetree	Gymnocladus dioicus	5	1	3	G	G	G	0%	H	1.2		CITY	RETAIN & PROTECT
1088	Ginkgo	Ginkgo biloba	4	1	3	G	G	G	0%	H	1.2		CITY	RETAIN & PROTECT

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- [ ] CONCEPTUAL
- [ ] PRELIMINARY
- [ ] SITE PLAN
- [ ] PERMIT
- [x] TENDER
- [ ] CONTRACT
- [ ] CONSTRUCTION
- [ ] AS-BUILT

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
KYLE FOCH
MEMBER

HKLA
HENRY KIM LANDSCAPE ARCHITECTS INC.
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-5599 \\ Email: info@hkla.ca \\ Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

PROJECT: SPA FILE #
HEYDON PARK RENOVATION
TDSB

DRAWING:
TREE PRESERVATION PLAN

DRAWN BY:	SCALE:	
CT	AS SHOWN	L-TP2
CHECKED BY:	DATE:	DRAWING
KF	2026-09-15	2 of 8
JOB NO.:		
2026-082		

File #2026-082

REFERENCE NOTES SCHEDULE SITE

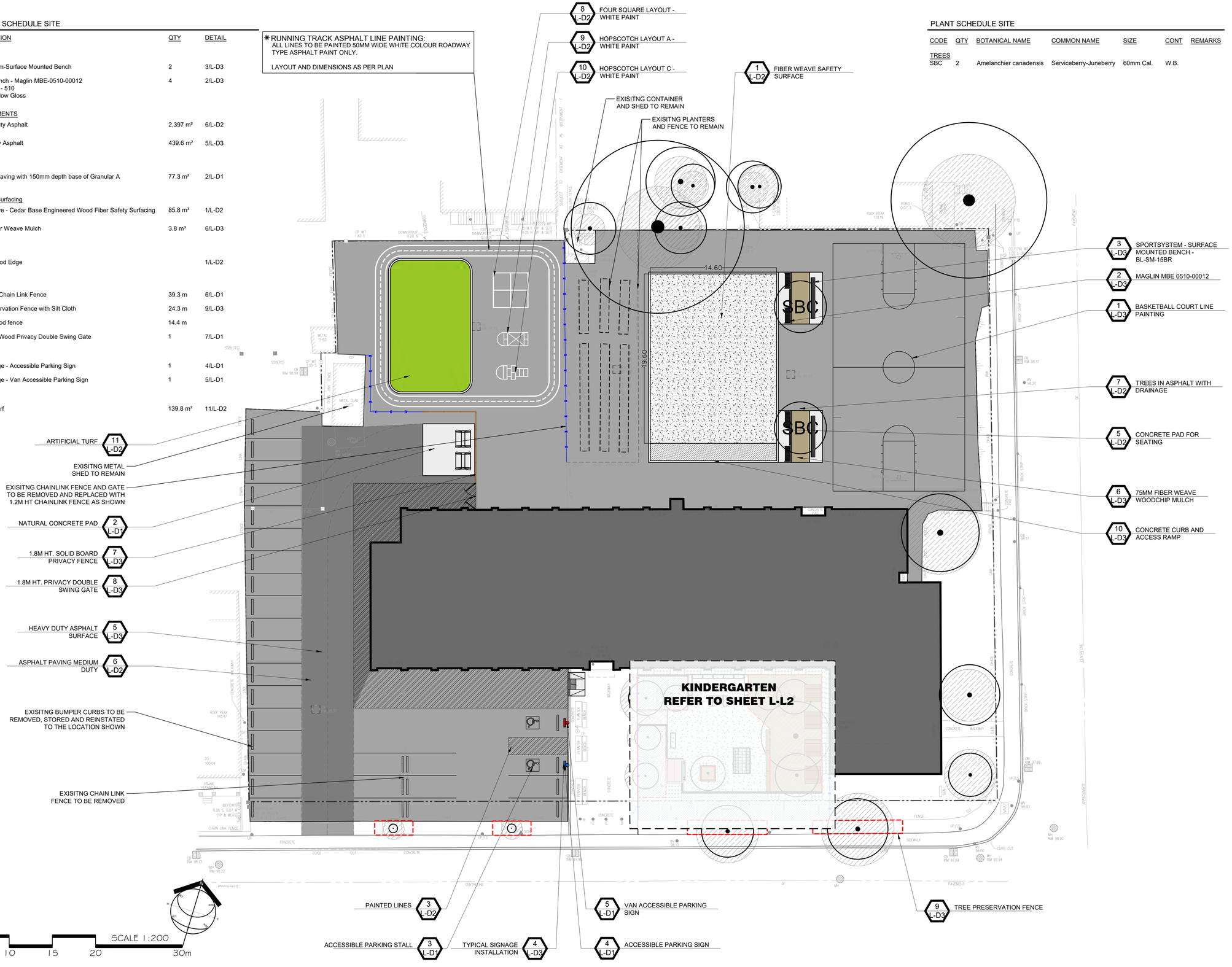
SYMBOL	DESCRIPTION	QTY	DETAIL
Site Furnishings			
	Sportsystem-Surface Mounted Bench	2	3/L-D3
	Backed Bench - Maglin MBE-0510-00012 500 Series - 510 Frame: Yellow Gloss	4	2/L-D3
32 EXTERIOR IMPROVEMENTS			
	Medium Duty Asphalt	2,397 m²	6/L-D2
	Heavy Duty Asphalt	439.6 m²	5/L-D3
Concrete Paving			
	Concrete Paving with 150mm depth base of Granular A	77.3 m²	2/L-D1
Athletic and Recreational Surfacing			
	Fiber Weave - Cedar Base Engineered Wood Fiber Safety Surfacing	85.8 m³	1/L-D2
	75mm Fiber Weave Mulch	3.8 m³	6/L-D3
Walls and Steps			
	Timber Wood Edge		1/L-D2
Fences and Gates			
	1.2m High Chain Link Fence	39.3 m	6/L-D1
	Tree Preservation Fence with Silt Cloth	24.3 m	9/L-D3
	1.8m ht wood fence	14.4 m	
	1.8m High Wood Privacy Double Swing Gate	1	7/L-D1
Identification Devices			
	Site Signage - Accessible Parking Sign	1	4/L-D1
	Site Signage - Van Accessible Parking Sign	1	5/L-D1
Turf & Grasses			
	Artificial Turf	139.8 m²	11/L-D2

✳RUNNING TRACK ASPHALT LINE PAINTING:
ALL LINES TO BE PAINTED 50MM WIDE WHITE COLOUR ROADWAY TYPE ASPHALT PAINT ONLY.

LAYOUT AND DIMENSIONS AS PER PLAN

PLANT SCHEDULE SITE

CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONT	REMARKS
TREES						
SBC	2	Amelanchier canadensis	Serviceberry-Juneberry	60mm Cal.	W.B.	



LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISITING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- ☐ CONCEPTUAL
- ☐ PRELIMINARY
- ☐ SITE PLAN
- ☐ PERMIT
- ☒ TENDER
- ☐ CONTRACT
- ☐ CONSTRUCTION
- ☐ AS-BUILT

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
KYLE FOCH
OALA
MEMBER

HKLA
HENRY KORTEKAAS ASSOCIATES INC.
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-5069 | Email: info@hkla.ca | Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

PROJECT: SPA FILE #

HEYDON PARK RENOVATION

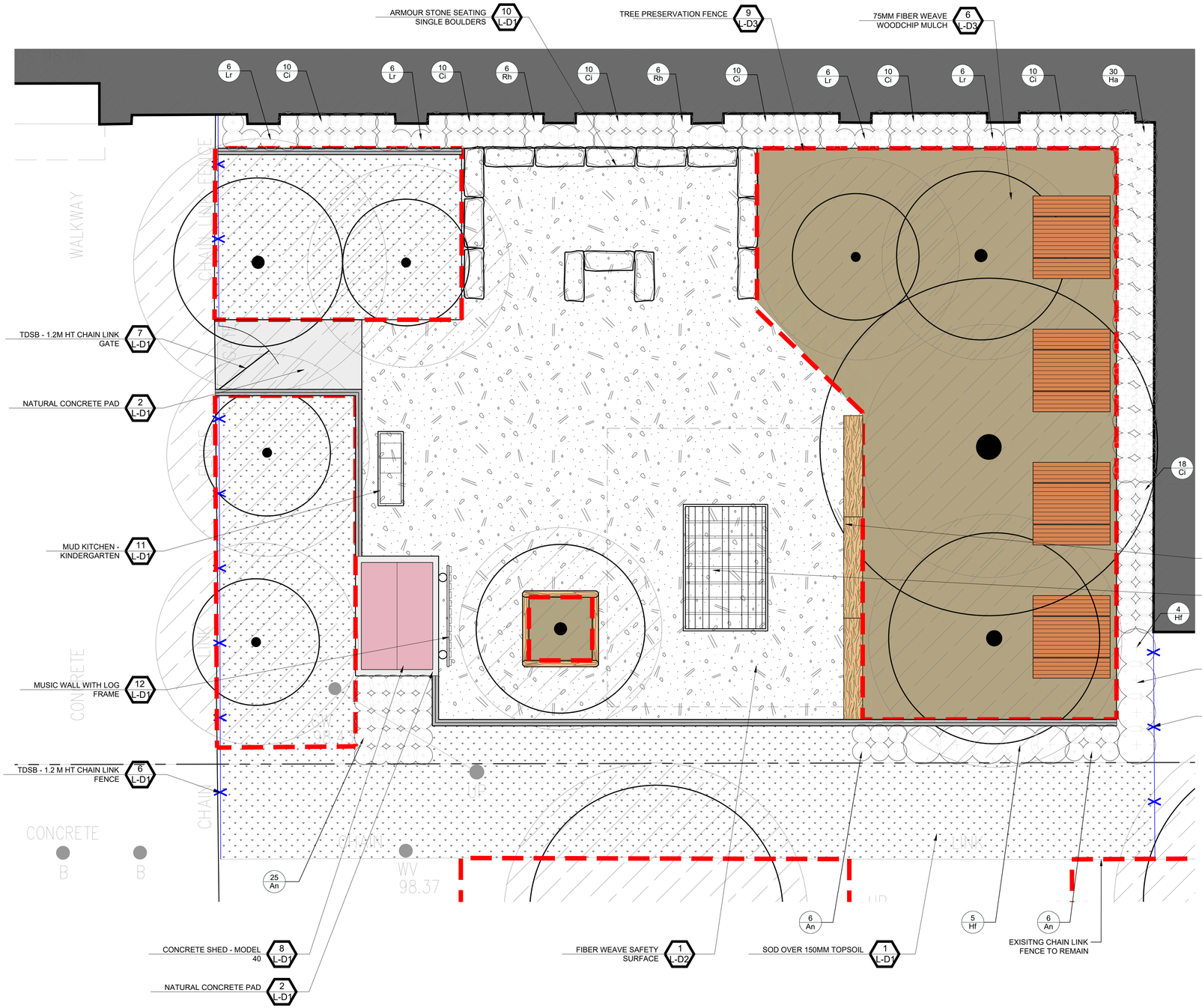
TDSB

DRAWING: LANDSCAPE PLAN BACK YARD

DRAWN BY: CT	SCALE: SCALE
CHECKED BY: KF	DATE: 2026-09-15
JOB NO.: 2026-082	

L-L1
DRAWING 3 of 8

File #2026-082



REFERENCE NOTES SCHEDULE FRONTYARD

SYMBOL	DESCRIPTION	QTY	DETAIL
Site Furnishings			
	Seating Log	3	4/L-D2
32 EXTERIOR IMPROVEMENTS			
	Concrete Paving with 150mm depth base of Granular A	11.3 m²	2/L-D1
Athletic and Recreational Surfacing			
	Fiber Weave - Cedar Base Engineered Wood Fiber Safety Surfacing	38.8 m³	1/L-D2
	75mm Fiber Weave Mulch	14.4 m³	6/L-D3
Walls and Steps			
	Timber Wood Edge	30.3 m	1/L-D2
Rocks/Boulders - Large			
	Armour Stone Seating	14	10/L-D1
Fences and Gates			
	1.2m High Chain Link Fence	21.5 m	6/L-D1
	Tree Preservation Fence with Silt Cloth	137.3 m	9/L-D3
	1.2m High Chain Link Single Swing Gate	1	7/L-D1
Turf & Grasses			
	Sod over 150mm Topsoil	110.1 m²	1/L-D1

PLANT SCHEDULE FRONTYARD

CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONT	REMARKS
SHRUBS						
An	37	Aster novae-angliae	New England Aster	1gal	Potted	
Ci	78	Carex morrowii 'Ice Dance'	Ice Dance Japanese Sedge	1gal	Potted	
Lr	24	Diervilla x Kodiak	Kodiak® Orange Diervilla	50cm Ht.	Potted	
Hf	9	Heliopsis helianthoides	False Sunflower	1gal	Potted	
Ha	30	Hosta x 'Autumn Frost'	Autumn Frost Hosta	1gal	Potted	
Rh	12	Rudbeckia hirta	Black-eyed Susan	1gal	Potted	N/DT

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISITING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- ☐ CONCEPTUAL
- ☐ PRELIMINARY
- ☐ SITE PLAN
- ☐ PERMIT
- ☒ TENDER
- ☐ CONTRACT
- ☐ CONSTRUCTION
- ☐ AS-BUILT

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — KYLE FOCHT — OALA MEMBER

HKLA
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-3599 | Email: info@hkla.ca | Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

PROJECT: SPA FILE #

HEYDON PARK RENOVATION

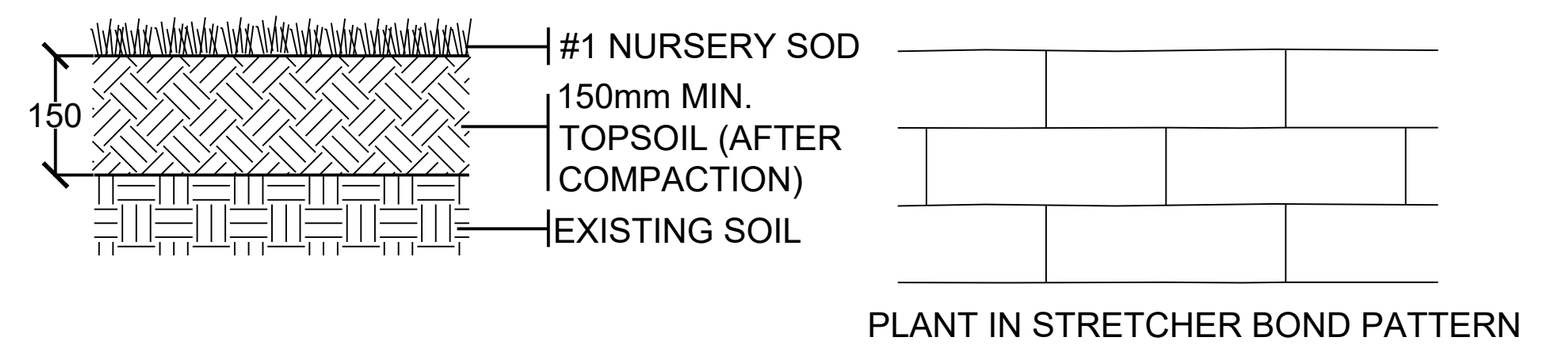
TDSB

DRAWING:

LANDSCAPE PLAN FRONT YARD

DRAWN BY: CT	SCALE: SCALE	L-L2	
CHECKED BY: KF	DATE: 2026-09-15	DRAWING 4 of 8	
JOB NO.: 2026-082			

File #2026-082



SOD: SOD SHALL BE CERTIFIED No.1 CULTIVATED SOD AS SCHEDULED, GROWN AND SOLD IN ACCORDANCE WITH CLASSIFICATION OF THE NURSERY SOD GROWERS' ASSOCIATION OF ONTARIO. IT MUST BE FIBROUS AND WELL ROOTED; FREE FROM STONES, MATTED OR DEAD GRASS AND PERENNIAL WEEDS AND SHALL HAVE BEEN SUBJECT TO REGULAR MOWING AND TREATMENT WITH SELECTIVE WEED KILLER AND INSECTICIDES DURING THE PREVIOUS GROWING SEASON. THE SOD MUST BE ROLLED IN SUCH A MANNER AS TO PREVENT TEARING DURING HANDLING. THE SOD MUST BE TRANSPORTED AND LAID WITHIN FOUR (4) DAYS OF LIFTING AND SHALL BE PROTECTED DURING TRANSPORTATION TO PREVENT DRYING OUT. DRIED OUT UNHEALTHY SOD WILL NOT BE ACCEPTED ON SITE. SHOULD THERE BE AN UNAVOIDABLE DELAY IN INSTALLATION THE SOD MUST BE KEPT COOL AND MOIST UNTIL IT IS LAID.

FERTILIZER: SPREAD PRE-SODDING FERTILIZER (10:10:10) AT THE RATE OF 75 GRAMS PER SQ.M. AT LEAST ONE (1) WEEK BEFORE THE SOD IS LAID USING AN APPROVED BROAD CAST DISTRIBUTOR; WORKING IT INTO THE TOP 75mm OF SOIL BY CROSS-HARROWING OR RAKING.

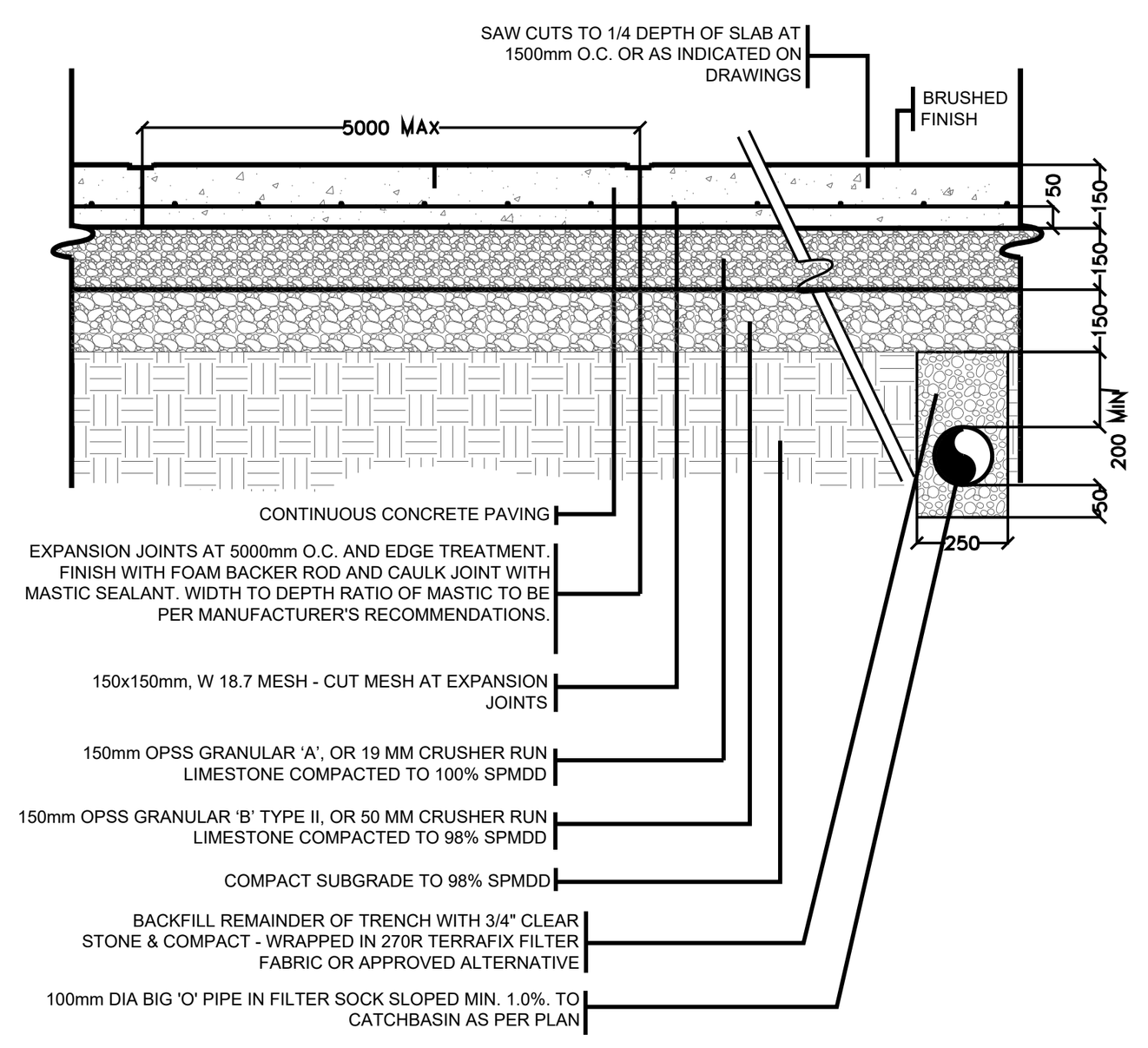
LAYING SOD: THE SURFACE OF THE SOIL MUST BE RAKED LEVEL OR TO FORM EVEN-FLOWING CONTOURS, AND WELL FIRMED BUT LEAVING A FINE LOOSE TEXTURE BEFORE THE SOD IS LAID. THE SOD SHALL BE LAID IN ROWS COMMENCING AT A POINT CLOSE SOIL ACCESS SO THAT WORK PROCEEDS OVER THE SOD ALREADY LAID USING ADEQUATE TIMBER PLANKS TO SUPPORT WORKMEN AND WHEELBARROWS. SOD SHALL BE LAID IN STRETCHER BOND PATTERN (AS IN BRICK WALLS) WITH BROKEN CROSS JOINTS. THEY SHALL BE CLOSELY BUTTED TOGETHER LEAVING NO GAP AFTER THE SOD IS PROPERLY PLACED THE SOD IS TO BE ROLLED TO INSURE GOOD CONTACT BETWEEN SOD AND UNDERLYING SOIL. ROLLING IS TO BE PERPENDICULAR TO THE DIRECTION IN WHICH THE SOD WAS LAID. ANY IRREGULARITIES SHALL BE ADJUSTED BY LIFTING AND RAKING OUT OR INFILLING WITH FINE SOIL. EDGES WILL ALWAYS BE LAID WITH WHOLE TURFS. THE FINISHED LEVEL OF THE TURF SHALL CONFORM TO THE LEVELS SHOWN ON THE DRAWINGS AND SHALL BE 25mm ABOVE PREVIOUS SOIL LEVEL ADJOINING EXISTING TREES OR SHRUBS. SOD MUST NOT BE LAID DURING SNOW OR FROSTY WEATHER OR ON EXCEPTIONALLY DRY OR WATERLOGGED GROUND. IMMEDIATELY AFTER INSTALLATION, THE CONTRACTOR MUST WATER THE SOD AND UPPER 150mm OF SOIL.

MOWING AND TRIMMING: DURING THE GROWING SEASON THE GRASS WILL BE CUT WITH AN APPROVED MACHINE AT REGULAR INTERVALS TO ENSURE THAT THE GRASS DOES NOT EXCEED 50mm HIGH. THE EDGES OF THE SODDED AREAS SHALL BE NEATLY TRIMMED BY HAND CLIPPING AT THE TIME OF EACH MOWING. HEAVY GRASS MOWINGS MUST BE REMOVED OR SPREAD ABOUT EVENLY IMMEDIATELY AFTER TRIMMING AND MOWING.

HANDOVER: AREAS WILL NOT BE ACCEPTED FOR HANDOVER ON THE SPECIFIED DATES IF FOR ANY OF THE FOLLOWING REASONS THE WORK IS NOT UP TO STANDARD: (A) IF THE SWARD HAS FAILED TO ESTABLISH ITSELF TO THE SATISFACTION OF THE OWNER; (B) IF THE GRASS IS DAMAGED BY FAILURE TO CARRY OUT MAINTENANCE OPTIONS; (C) IF PARTS OF GRASS ARE ONLY HALF-COMPLETED; (D) IF SINKAGE BELOW FINISHED LEVEL HAS OCCURRED; (E) THE GRASS AREAS AND SITE HAVE NOT BEEN CLEARED OF STONE, WEEDS AND OTHER RUBBISH; (F) IF RESODDED PATCHES HAVE NOT BECOME ESTABLISHED. THE CONTRACTOR IS TO CONTINUE TO MAINTENANCE OF THE GRASS UNTIL ACCEPTANCE AND IS RESPONSIBLE FOR A MINIMUM OF THREE (3) CUTS.

1 SOD OVER 150MM TOPSOIL

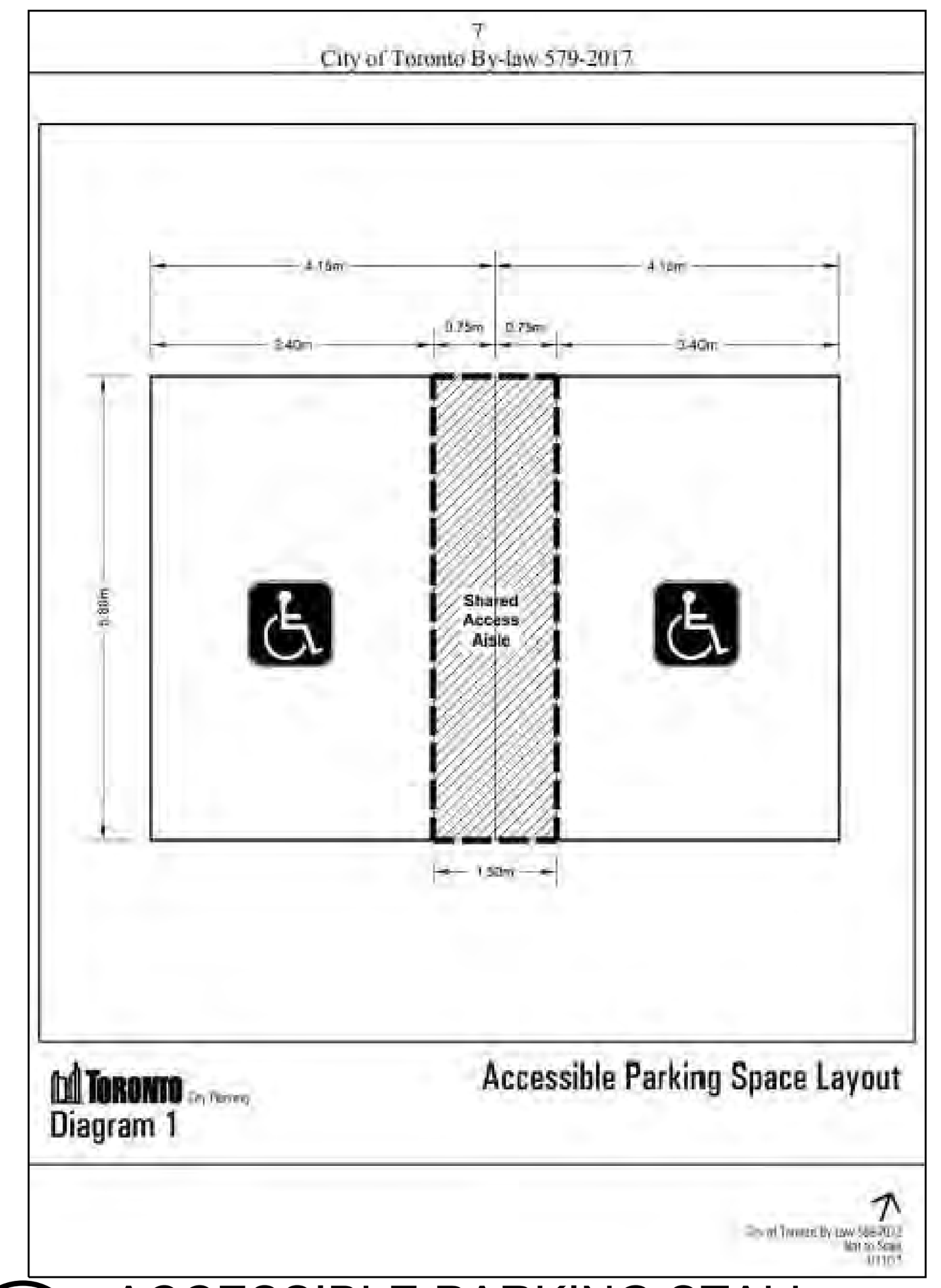
N.T.S. 329223-01



NOTES:
1. CONCRETE SHOULD BE PROPORTIONED, MIXED PLACED AND CURED IN ACCORDANCE WITH THE REQUIREMENTS OF CSA STANDARD CAN/CSA-A23.1-94 FOR CLASS C-2 EXPOSURE, WITH THE FOLLOWING KEY REQUIREMENTS:
MINIMUM 28 DAY COMPRESSIVE STRENGTH: 32MPa
AIR ENTRAINMENT: 5 TO 8%
MAXIMUM WATER/CEMENTING MATERIAL RATIO: 0.45
2. CONCRETE SHOULD BE PLACED AND SPREAD IN A MANNER WHICH AVOIDS SEGREGATION. IT SHOULD BE CONSOLIDATED WITH A VIBRATORY SCREED OR INTERNAL VIBRATORS. CONSOLIDATION CLOSE TO FORM EDGES MUST BE GIVEN SPECIAL CONSIDERATION.
3. CONCRETE SHOULD BE FINISHED TO A THICKNESS TOLERANCE OF 0 TO +10mm. CONCRETE MUST BE CURED ADEQUATELY TO PROVIDE DURABILITY AND STRENGTH. CURING CAN BE ACCOMPLISHED BY WET BLANKET, SPRINKLING, PLASTIC SHEETS AND CURING COMPOUNDS. CURING SHOULD BEGIN IMMEDIATELY AFTER LOSS OF BLEED WATER.
4. THE PAVEMENT SHOULD BE CLOSED TO TRAFFIC UNTIL A MINIMUM FLEXURAL STRENGTH OF 2MPa IS ATTAINED OR AN APPROXIMATE COMPRESSIVE STRENGTH IF 20MPa. THIS MINIMUM STRENGTH IS GENERALLY REACHED WHEN THE CONCRETE CAN BE SAW CUT WITHOUT RAVELING.
5. CONTROL JOINTS TO BE EVERY 2500 mm MAXIMUM OR AS SHOWN. EXPANSION JOINT TO BE EVERY 5000 mm MAXIMUM OR AS SHOWN AND WHERE CONCRETE MEETS ADJACENT HARDSCAPED SURFACES OR STRUCTURES.

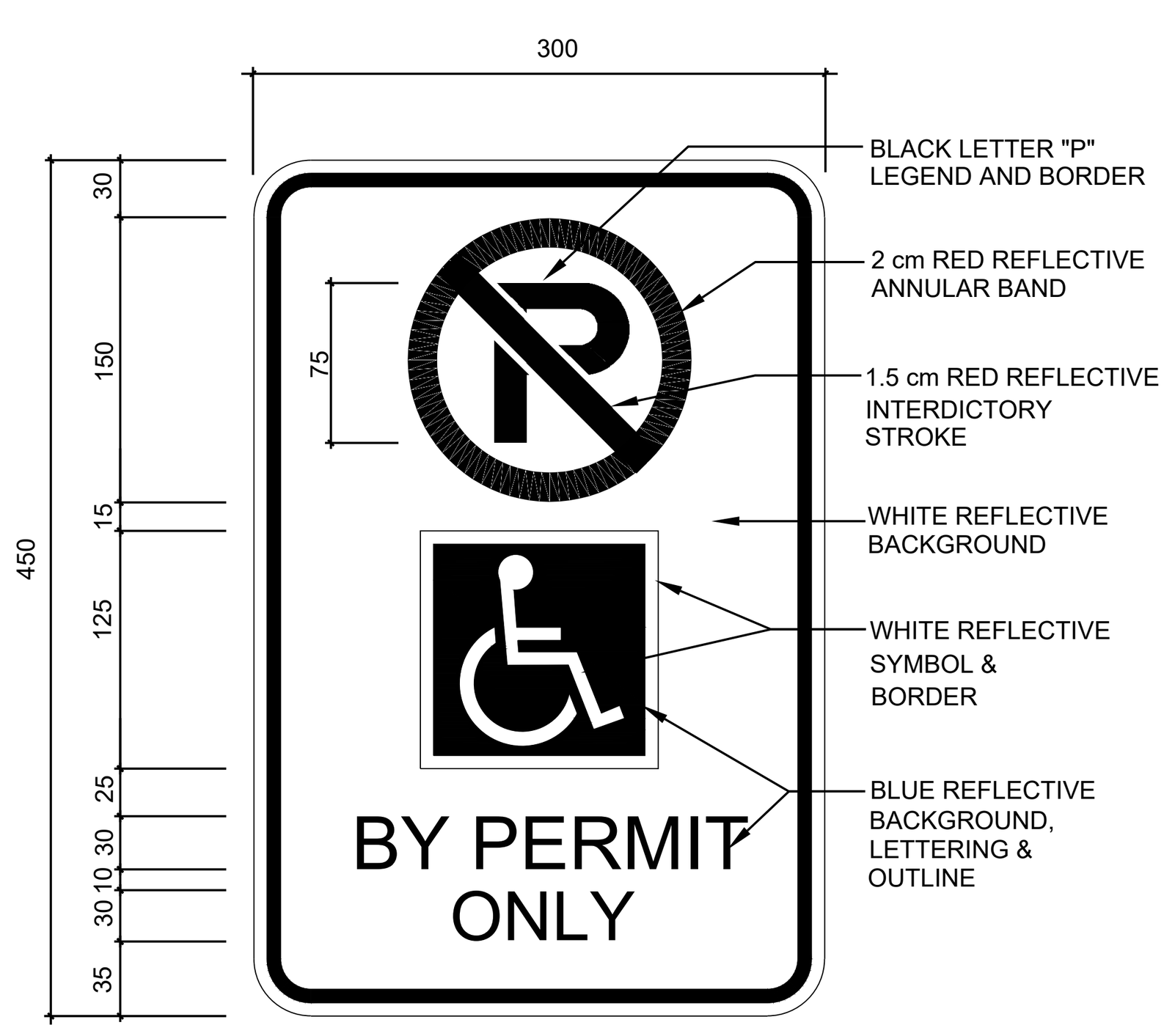
2 NATURAL CONCRETE PAD

1:25 WITH MESH AND DRAIN 321313.13-110



3 ACCESSIBLE PARKING STALL

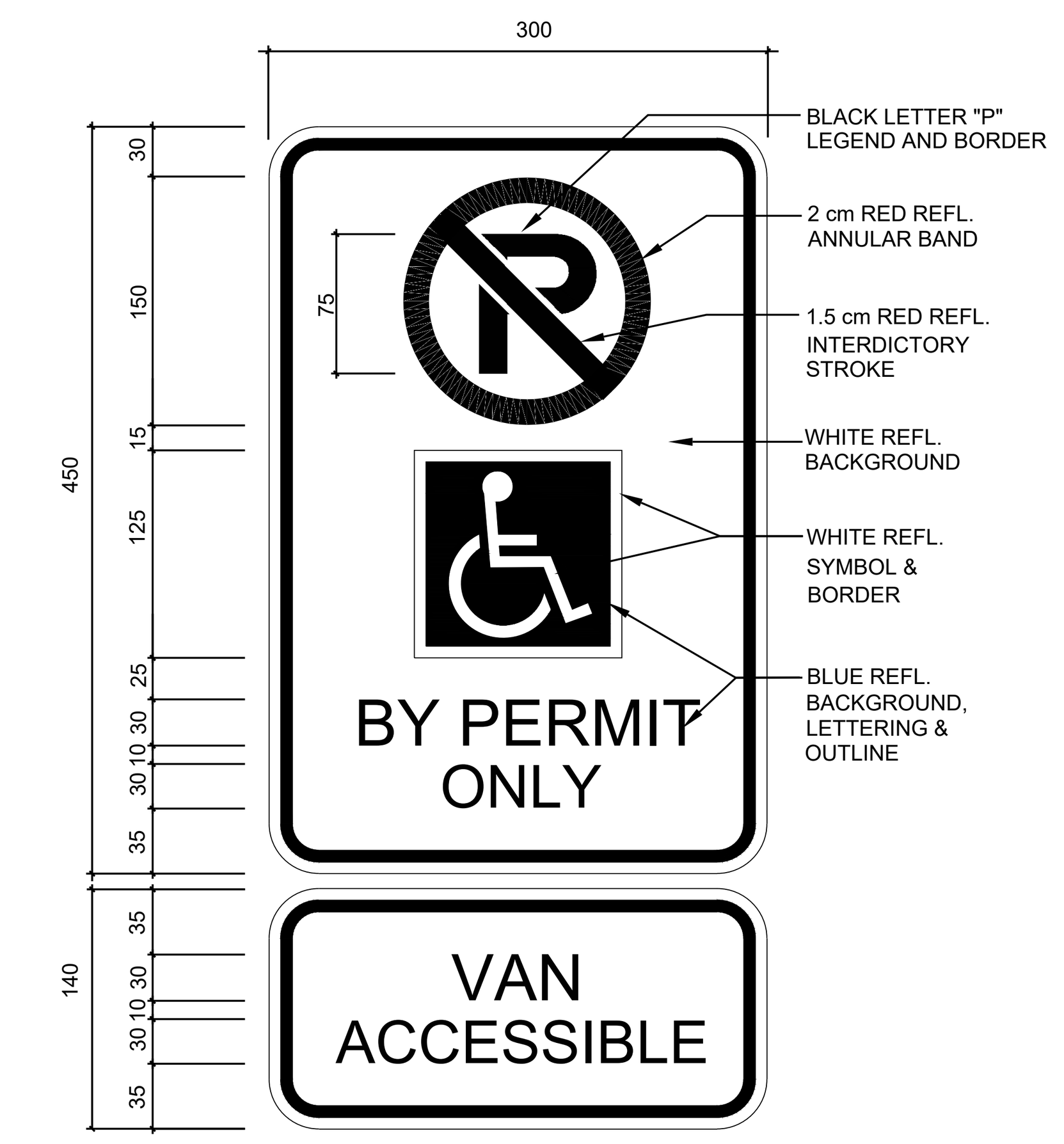
N.T.S. CITY OF TORONTO 324102-17



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. FONT HELVETICA BOLD CONDENSED.

4 ACCESSIBLE PARKING SIGN

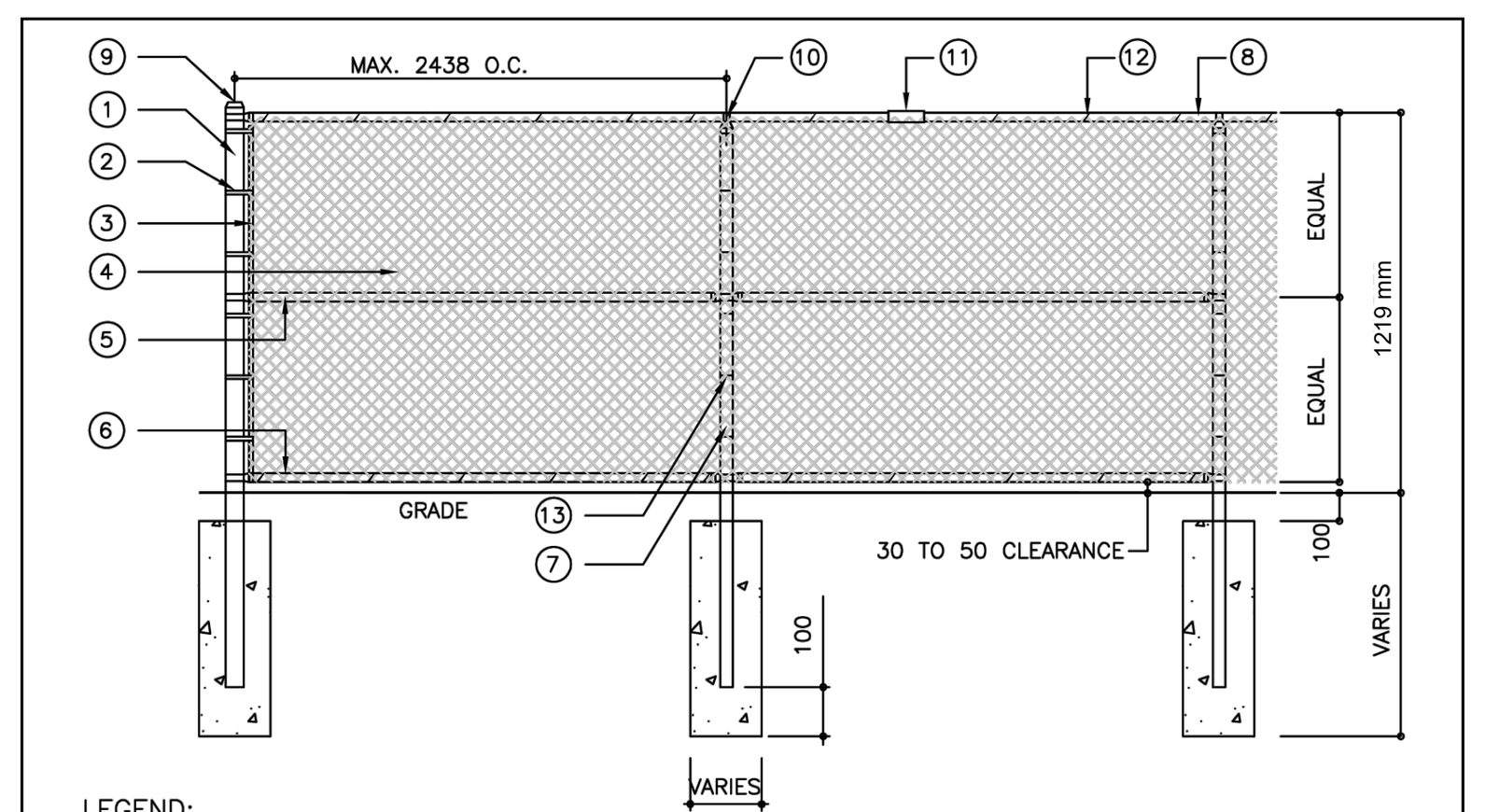
N.T.S. 324123.03-22



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

5 VAN ACCESSIBLE PARKING SIGN

N.T.S. 324123.03-72



LEGEND:
1. TERMINAL POST
2. ALUMINUM TENSION BAR BANDS AT 305mm O.C.
3. 5mm x 19mm GALVANIZED FLAT METAL TENSION BARS
4. 50 x 50mm, 6 GAUGE STEEL MESH
5. MID RAIL (NOT REQUIRED ON 1220mm HIGH FENCES)
6. BOTTOM RAIL
7. LINE POST
8. TOP RAIL
9. DOME CAP
10. LOOP CAP
11. 178mm LONG GALVANIZED SLEEVE OVER RAIL JOINTS
12. 4.2mm GALVANIZED STEEL TOP AND BOTTOM RAIL FASTENERS AT 450mm O.C.
13. 4.2mm GALVANIZED STEEL LINE POST FASTENERS AT 305mm O.C.

POST AND RAIL SIZE TABLE

TYPE	2438, 1829 AND 1525 HT.	1219 HT.
TERMINAL POSTS:	88.9mm O.D.	60.3mm O.D.
LINE POSTS:	60.3mm O.D.	48.3mm O.D.
TOP/BOTTOM RAILS:	42.2mm O.D.	42.2mm O.D.
MID RAILS:	42.2mm O.D.	NOT REQUIRED

ALL PIPES SHALL BE HOT DIP GALVANIZED SCHEDULE 40

FOOTING SIZE TABLE

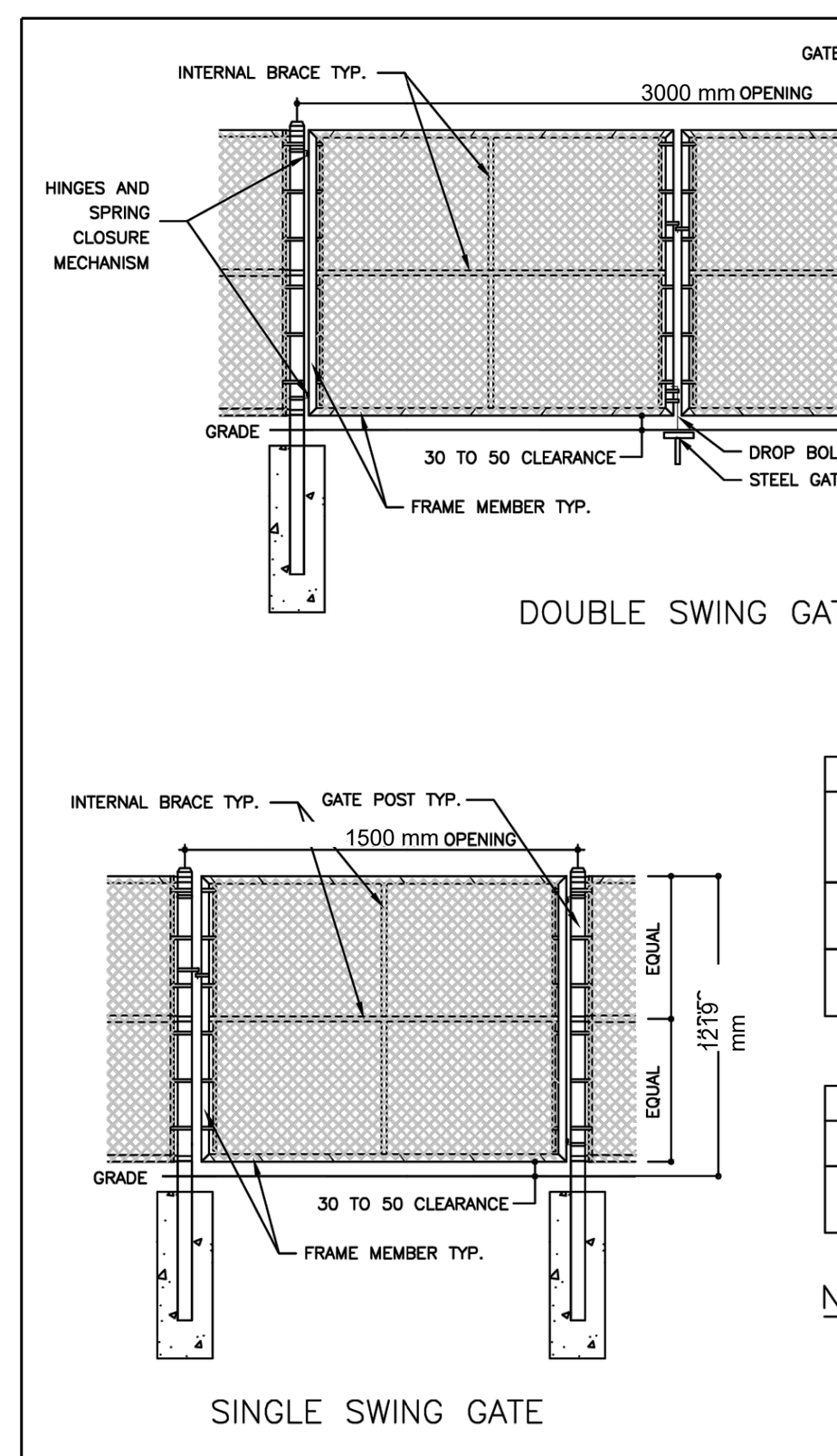
POST O.D.	WIDTH OF FOOTING	DEPTH OF FOOTING
88.9mm	350mm	1370mm
60.3mm	300mm	1200mm
48.3mm	250mm	1200mm

ALL FOOTINGS TO BE 30 MPa CAST-IN-PLACE CONCRETE. USE SONO-TUBES FOR ENTIRE DEPTH OF FOOTING. TOP OF FOOTINGS TO BE 100mm BELOW FINISHED GRADE.

Toronto District School Board Facility Services Department Design & Construction Division 15 Oakburn Cres. Toronto, Ontario M2N 2T5 t. 416-395-4588 / f. 416-395-9734	Facility: SCHOOL NAME ANY STREET NAME	Drawn By: M.OZKAN	Approved By: STANDARDS COMM.
	Project: TDSB STANDARD DETAILS FOR CHAIN LINK FENCES	Checked By: M.OZKAN	TDSB Project No: XXXX-XXXX-XXX
		Date: 17/01/2012	Sheet No: S-1
	Sheet Title: XXXX XXXX XXXX	Scale: NTS	

6 TDSB - 1.2 M HT CHAIN LINK FENCE

1:100 32 3101.95-05



GATE AND GATEPOST DETAILS TABLE

GATE TYPE AND MAX OPENING (m)	FRAME MEMBER MIN O.D.	INTERNAL BRACE MIN. O.D.	POST DIA MIN. O.D.
SINGLE SWING 1.5 DOUBLE SWING 3.0	42.9	33.4	88.9
SINGLE SWING 4.5 DOUBLE SWING 9.0	48.3	33.4	114.3

FOOTING SIZE TABLE

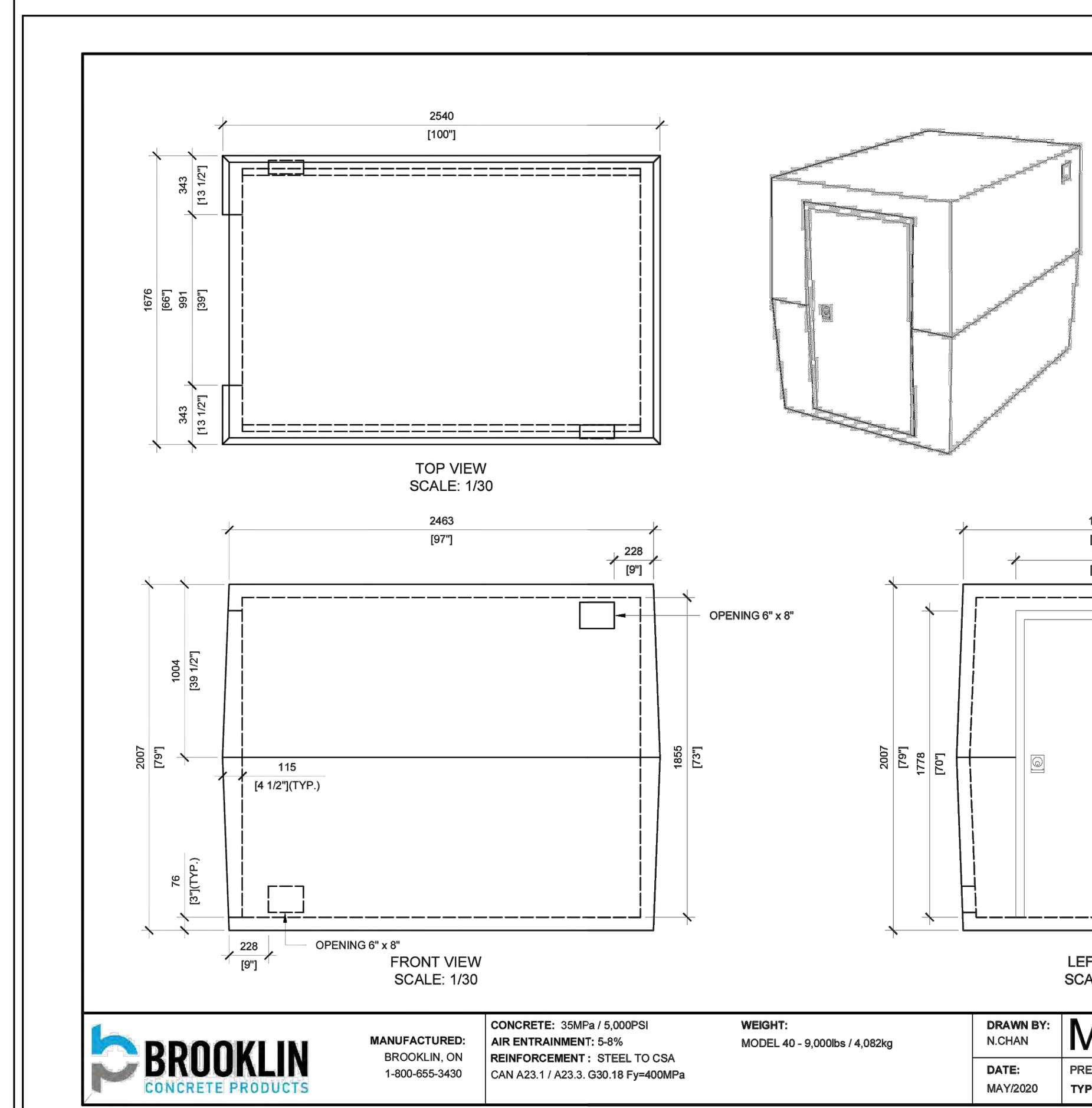
POST O.D.	WIDTH OF FOOTING	DEPTH OF FOOTING
88.9 mm	350 mm	1370 mm
114.3 mm	450 mm	1520 mm

NOTES:
1- FOR CHAIN LINK FABRIC, CONCRETE TYPE AND OTHER CONNECTION DETAILS REFER TO "TDSB STANDARD DETAILS FOR CHAIN LINK FENCE S-1" AND SPECS

Toronto District School Board Facility Services Department Design & Construction Division 15 Oakburn Cres. Toronto, Ontario M2N 2T5 t. 416-395-4588 / f. 416-395-9734	Facility: SCHOOL NAME ANY STREET NAME	Drawn By: M.OZKAN	Approved By: STANDARDS COMM.
	Project: TDSB STANDARD DETAILS FOR CHAIN LINK GATES	Checked By: M.OZKAN	TDSB Project No: XXXX-XXXX-XXX
		Date: 17/01/2012	Sheet No: S-2
	Sheet Title: XXXX XXXX XXXX	Scale: NTS	

7 TDSB - 1.2M HT CHAIN LINK GATE

1:100 32 3101.95-06

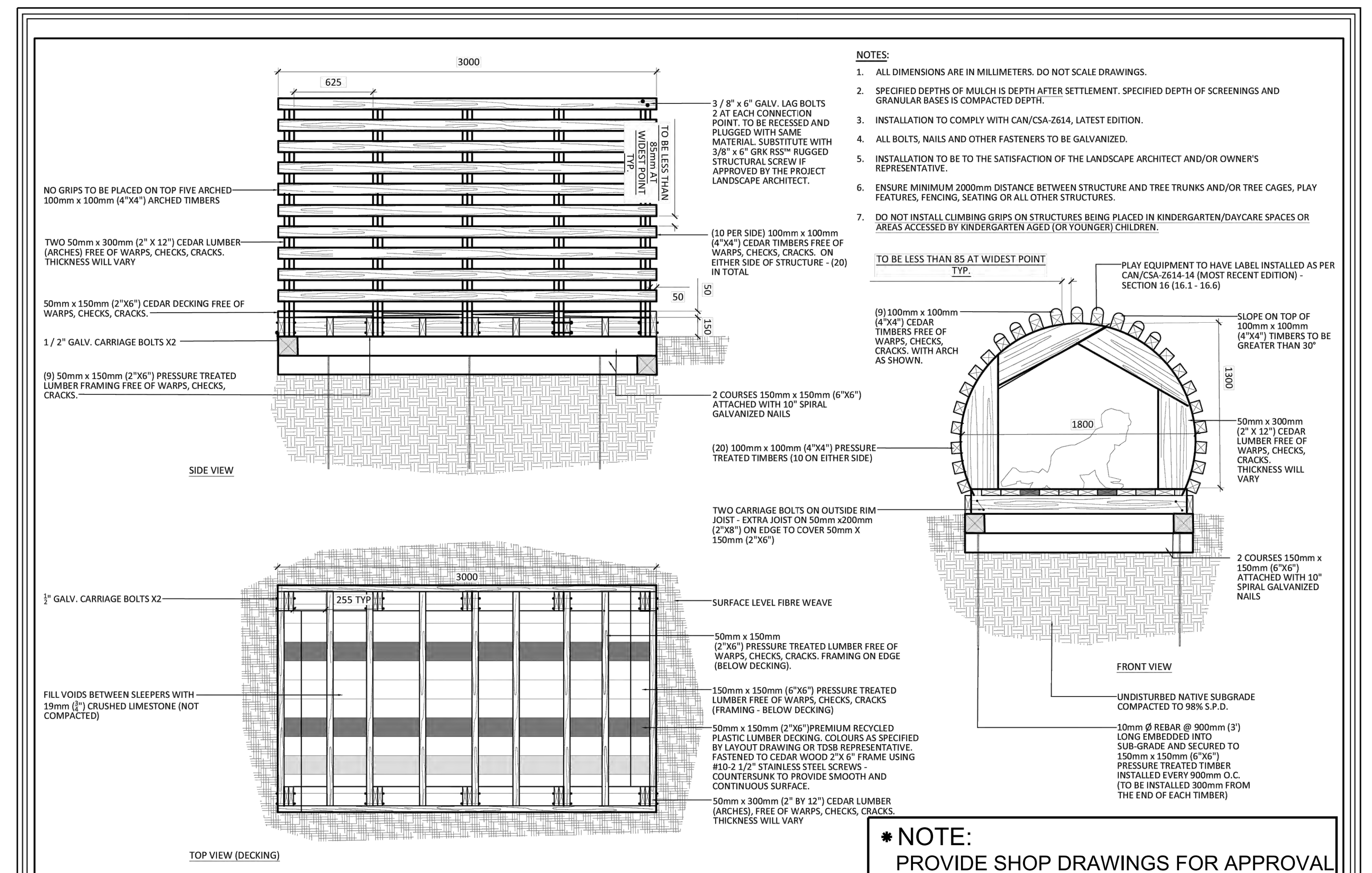


GENERAL NOTES:
1. DELIVERY IS MADE BY CRANE-EQUIPPED TRUCKS
2. SITE MUST BE READY, SAFE AND ACCESSIBLE FOR UNLOADING FROM THE REAR OF THE TRUCK
3. MIN OVERHEAD CLEARANCE OF 18FT (5.5 METRES) IS REQUIRED
4. ALL UNITS MUST BE HANDLED WITH PROPER LIFTING EQUIPMENT (I.E. SPREADER BAR)
5. SHED TO BE SURFACE MOUNTED TO THE CONCRETE PAD
6. CONTRACTOR TO PROVIDE SHOP DRAWING FOR APPROVAL

BROOKLIN CONCRETE PRODUCTS	MANUFACTURED: BROOKLIN, ON 1-800-655-3430	CONCRETE: 35MPa / 5,000PSI AIR ENTRAINMENT: 5-8% REINFORCEMENT: STEEL TO CSA CAN A23.1 / A23.3. G30.18 Fy=400MPa	WEIGHT: MODEL 40 - 9,000lbs / 4,082kg	DRAWN BY: N.CHAN DATE: MAY/2020	MODEL 40 PRECAST CONCRETE UTILITY BUILDING WITH DOOR TYPICAL USE: STORAGE / ELECTRICAL BUILDING

8 CONCRETE SHED - MODEL 40

NTS BROOKLIN CONCRETE PRODUCTS 325060-05

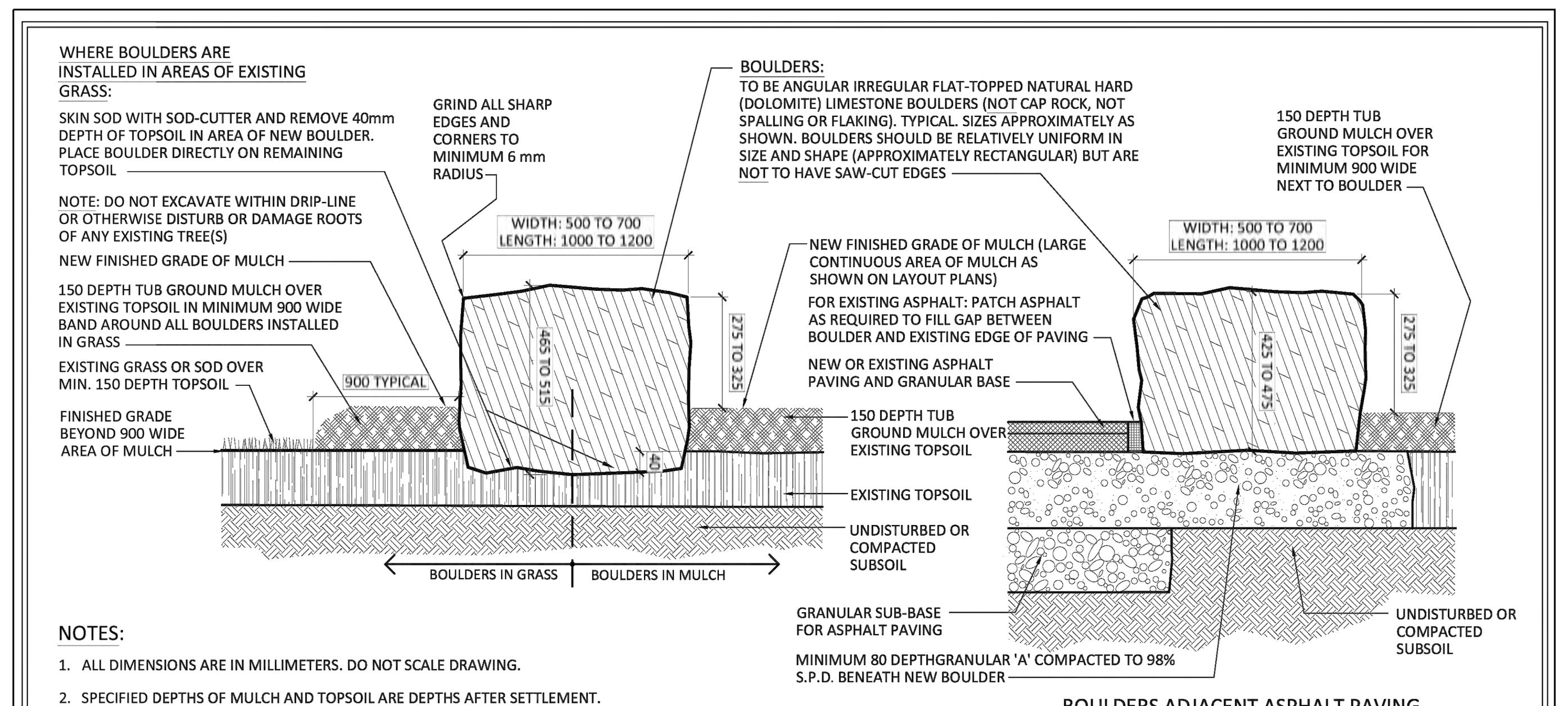


NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWINGS.
2. SPECIFIED DEPTHS OF MULCH IS DEPTH AFTER SETTLEMENT. SPECIFIED DEPTH OF SCREENINGS AND GRANULAR BASES IS COMPACTED DEPTH.
3. INSTALLATION TO COMPLY WITH CAN/CSA-Z614, LATEST EDITION.
4. ALL BOLTS, NAILS AND OTHER FASTENERS TO BE GALVANIZED.
5. INSTALLATION TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.
6. ENSURE MINIMUM 2000mm DISTANCE BETWEEN STRUCTURE AND TREE TRUNKS AND/OR TREE CAGES, PLAY FEATURES, FENCING, SEATING OR ALL OTHER STRUCTURES.
7. DO NOT INSTALL CLIMBING GRIPS ON STRUCTURES BEING PLACED IN KINDERGARTEN/DAYCARE SPACES OR AREAS ACCESSED BY KINDERGARTEN AGED (OR YOUNGER) CHILDREN.

✱ NOTE:
PROVIDE SHOP DRAWINGS FOR APPROVAL

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES
LOBSTER TRAP SHELTER
18 MONTHS - 5 YEARS SPECIFICATION (DAYCARE AND FDK)
1104-33 (9)
SCALE: NTS | ISSUE/REVISION: FINAL | DATE: JULY 2025 | DWG NO.: 24.35



WHERE BOULDERS ARE INSTALLED IN AREAS OF EXISTING GRASS:
SKIN SOD WITH SOD-CUTTER AND REMOVE 40mm DEPTH OF TOPSOIL IN AREA OF NEW BOULDER. PLACE BOULDER DIRECTLY ON REMAINING TOPSOIL

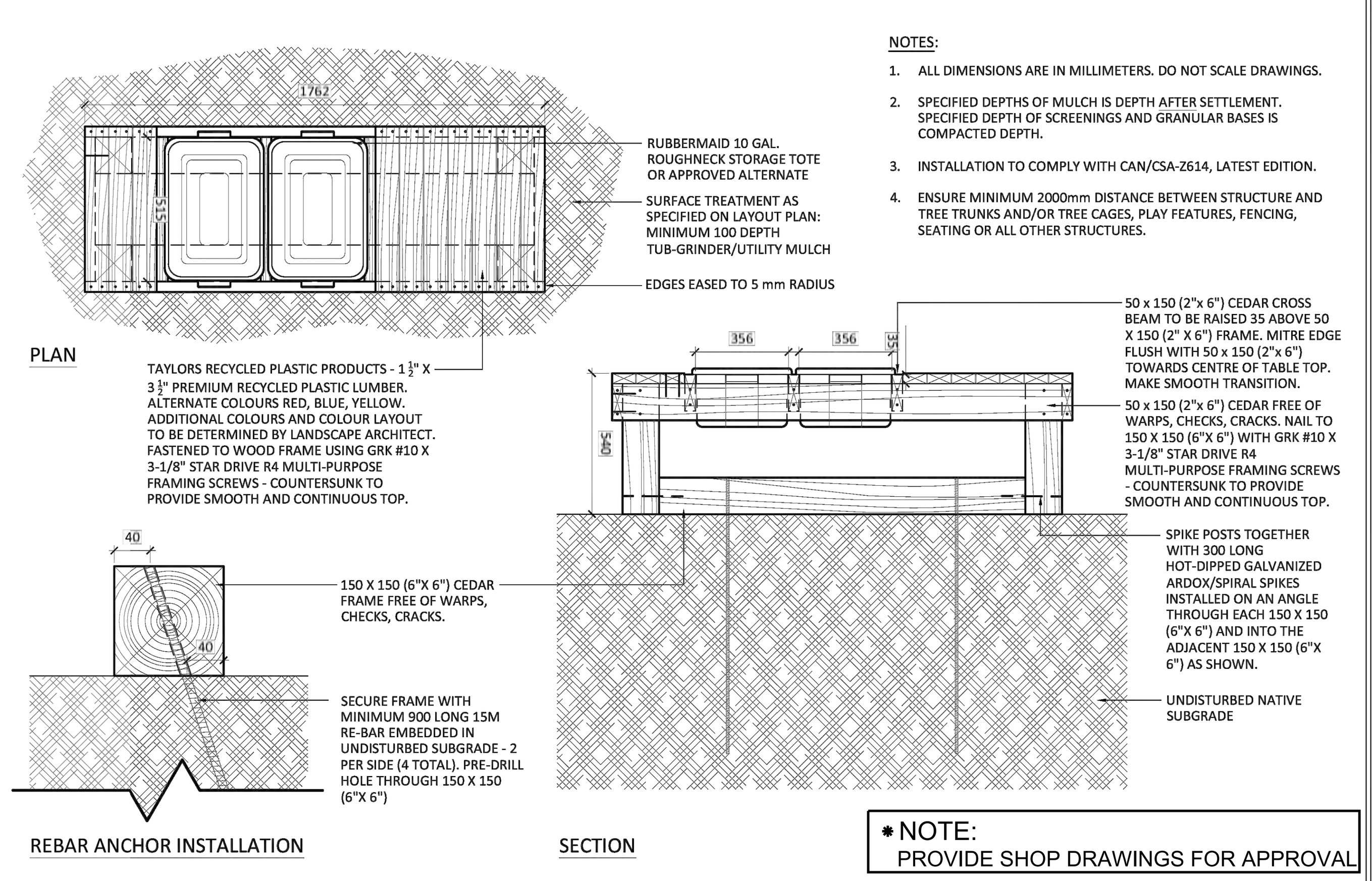
BOULDERS:
TO BE ANGULAR IRREGULAR FLAT-TOPPED NATURAL HARD (DOLOMITE) LIMESTONE BOULDERS (NOT CAP ROCK, NOT SPALLING OR FLAKING). TYPICAL. SIZES APPROXIMATELY AS SHOWN. BOULDERS SHOULD BE RELATIVELY UNIFORM IN SIZE AND SHAPE (APPROXIMATELY RECTANGULAR) BUT ARE NOT TO HAVE SAW-CUT EDGES

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWING.
2. SPECIFIED DEPTHS OF MULCH AND TOPSOIL ARE DEPTHS AFTER SETTLEMENT. SPECIFIED DEPTH OF GRANULAR BASES IS COMPACTED DEPTH.
3. ALL BOULDERS TO BE SIZES AS INDICATED ABOVE.
4. INSTALL ALL BOULDERS WITH MINIMUM ONE-FIFTH BELOW FINISHED GRADE OF SURROUNDING MULCH AS SHOWN.
5. ENSURE THAT ALL BOULDERS ARE STABLE AND FREE FROM ALL MOVEMENT AFTER INSTALLATION IS COMPLETE.
6. PRIOR TO PROJECT COMPLETION ENSURE THAT ALL SHARP CORNERS AND EDGES ON EXPOSED SIDES OF STONES ARE ELIMINATED (ROUNDED) TO MINIMUM 6 mm RADIUS BY GRINDING OR OTHER SIMILAR MEANS TO SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.
7. GAPS BETWEEN BOULDERS ARE TO BE MINIMIZED TO REDUCE DANGER OF ENTANGLEMENT AND ENTRAPMENT, TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE. GAPS ARE EITHER TO BE LESS THAN 50mm OR GREATER THAN 2000 mm.
8. ENSURE MINIMUM 2000 DISTANCE BETWEEN ALL BOULDERS AND TREE TRUNKS AND/OR TREE CAGES.
9. ENSURE THAT ALL BOULDERS ARE INSTALLED WITH SEATING SURFACE LEVEL.
10. INSTALLATION OF BOULDERS TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.

✱ NOTE:
PROVIDE SHOP DRAWINGS FOR APPROVAL

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES
ARMOUR STONE SEATING
SINGLE BOULDERS
1104-11 (10)
SCALE: NTS | ISSUE/REVISION: FINAL | DATE: JULY 2025 | DWG NO.: 24.11



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWINGS.
2. SPECIFIED DEPTHS OF MULCH IS DEPTH AFTER SETTLEMENT. SPECIFIED DEPTH OF SCREENINGS AND GRANULAR BASES IS COMPACTED DEPTH.
3. INSTALLATION TO COMPLY WITH CAN/CSA-Z614, LATEST EDITION.
4. ENSURE MINIMUM 2000mm DISTANCE BETWEEN STRUCTURE AND TREE TRUNKS AND/OR TREE CAGES, PLAY FEATURES, FENCING, SEATING OR ALL OTHER STRUCTURES.

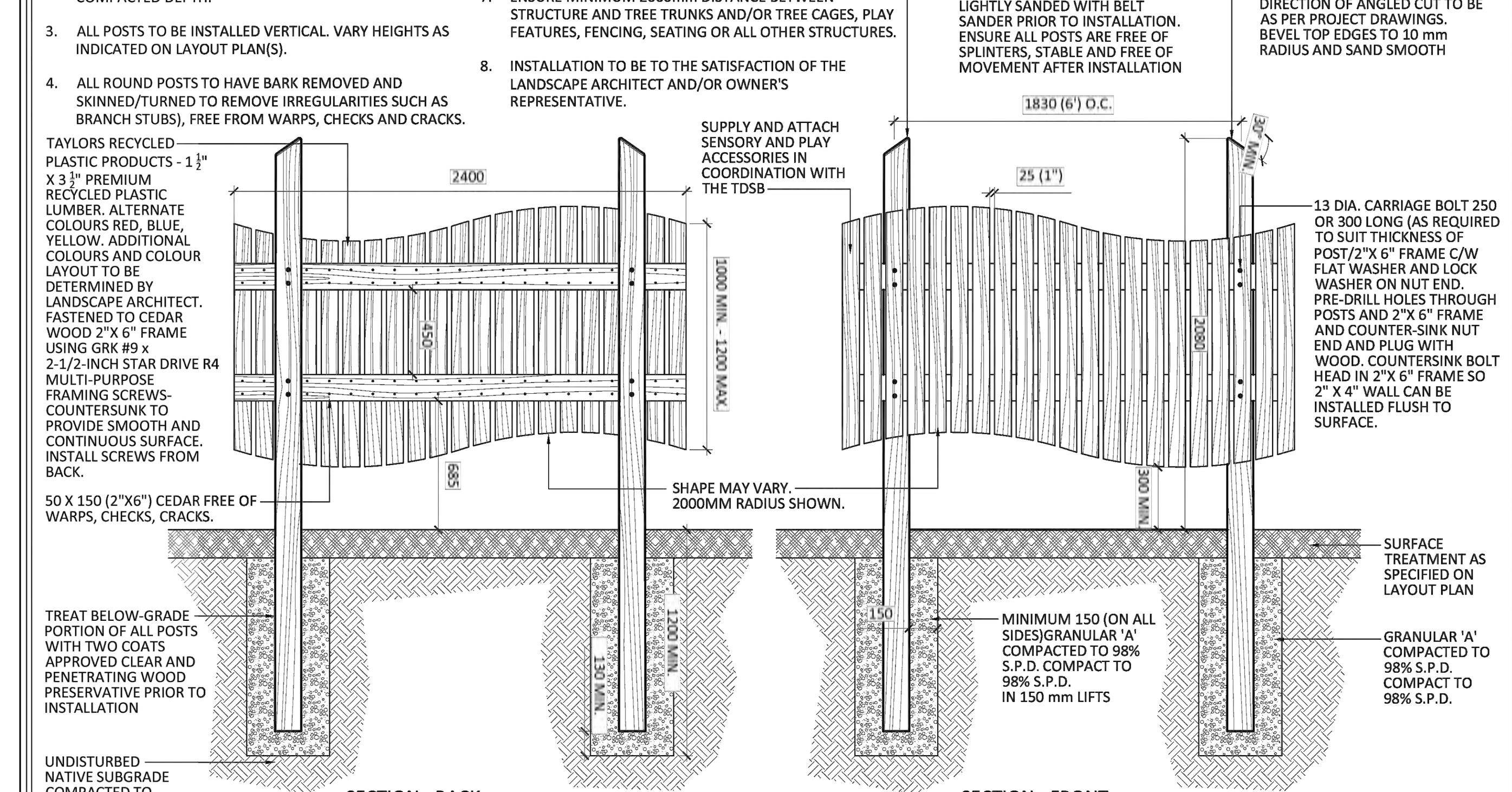
✱ NOTE:
PROVIDE SHOP DRAWINGS FOR APPROVAL

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES
MUD KITCHEN
KINDERGARTEN
1104-17 (11)
SCALE: NTS | ISSUE/REVISION: FINAL | DATE: JULY 2025 | DWG NO.: 24.17

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWINGS.
2. SPECIFIED DEPTHS OF MULCH IS DEPTH AFTER SETTLEMENT. SPECIFIED DEPTH OF SCREENINGS AND GRANULAR BASES IS COMPACTED DEPTH.
3. ALL POSTS TO BE INSTALLED VERTICAL. VARY HEIGHTS AS INDICATED ON LAYOUT PLAN(S).
4. ALL ROUND POSTS TO HAVE BARK REMOVED AND SKINNED/TURNED TO REMOVE IRREGULARITIES SUCH AS BRANCH STUBS), FREE FROM WARPS, CHECKS AND CRACKS.
5. INSTALLATION TO COMPLY WITH CAN/CSA-Z614, LATEST EDITION.
6. ALL BOLTS, NAILS AND OTHER FASTENERS TO BE GALVANIZED.
7. ENSURE MINIMUM 2000mm DISTANCE BETWEEN STRUCTURE AND TREE TRUNKS AND/OR TREE CAGES, PLAY FEATURES, FENCING, SEATING OR ALL OTHER STRUCTURES.
8. INSTALLATION TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.

✱ NOTE:
PROVIDE SHOP DRAWINGS FOR APPROVAL



THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES
MUSIC WALL
WITH LOG FRAME
1104-27 (12)
SCALE: NTS | ISSUE/REVISION: FINAL | DATE: JULY 2025 | DWG NO.: 24.27

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- [ ] CONCEPTUAL
- [x] TENDER
- [ ] PRELIMINARY
- [ ] CONTRACT
- [ ] SITE PLAN
- [ ] CONSTRUCTION
- [ ] PERMIT
- [ ] AS-BUILT

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — KYLE FOCH — MEMBER

HKLA — HENRY KORTEKAAS + ASSOCIATES INC.
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-5599 \\ Email: info@hkla.ca \\ Web: www.hkla.ca

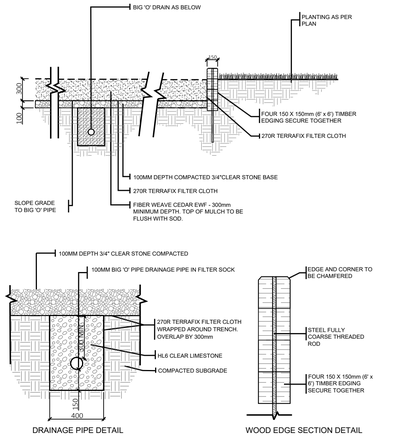
THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

PROJECT: SPA FILE #
HEYDON PARK RENOVATION
TDSB

DRAWING:
DETAILS

DRAWN BY: CT	SCALE: AS SHOWN	L-D1
CHECKED BY: KF	DATE: 2026-09-15	DRAWING 5 of 8
JOB NO.: 2026-082		

File #2026-082



DRAINAGE PIPE DETAIL

WOOD EDGE SECTION DETAIL

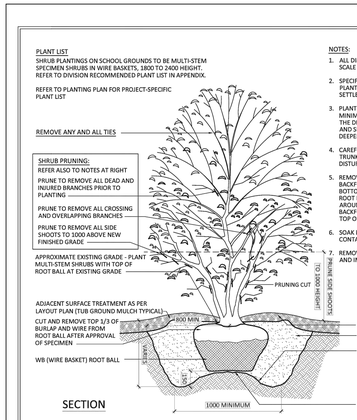
1 FIBER WEAVE SAFETY SURFACE

N.T.S. 321819.13-53

PLANT LIST

SHRUB PLANTINGS ON SCHOOL GROUNDS TO BE MULTI-STEM SPECIMEN SHRUBS IN WIRE BASKETS, 1800 TO 2400 HEIGHT. REFER TO DIVISION RECOMMENDED PLANT LIST IN APPENDIX.

REFER TO PLANTING PLAN FOR PROJECT-SPECIFIC PLANT LIST



SECTION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWING.
2. SPECIFIED DEPTHS OF MULCH, TOPSOIL AND PLANTING SOIL MIX ARE DEPTHS AFTER SETTLEMENT.
3. PLANTING PIT EXCAVATION WIDTH SHOULD BE A MINIMUM OF THREE (3) TIMES THE WIDTH OF THE DIAMETER OF THE ROOT BALL FOR TREES AND SHRUBS. EXCAVATION DEPTH SHOULD BE NO DEEPER THAN THE DEPTH OF THE ROOT BALL.
4. CAREFULLY REMOVE ANY LOOSE SOIL AROUND TRUNK. TOP OF ROOT BALL SHOULD NOT BE DISTURBED OR COVERED WITH SOIL.
5. REMOVE BURLAP AND WIRE AS NOTED BELOW. BACKFILL WITH PLANTING MIX AROUND THE BOTTOM HALF OF THE ROOT BALL. STABILIZE ROOT BALL BY TAMPING THE SOIL BY FOOT AROUND THE BOTTOM HALF OF THE ROOT BALL. BACKFILL THE REMAINING PLANTING PIT TO THE TOP OF THE ROOT BALL.
6. SOAK BACKFILLED AREA TO ENSURE FULL CONTACT BETWEEN ROOT BALL AND BACKFILL.
7. REMOVE ANY WRAP AND TIES FROM TRUNKS AND INSPECT FOR DAMAGE.
8. TIES AND GUYS ARE NOT REQUIRED FOR WB OR BALL AND BURLAPPED SHRUBS.
9. MAINTAIN ORIGINAL GRADE AFTER TRANSPLANTING. DEPTH OF HOLE VARIES WITH THE SIZE OF THE ROOT BALL. REMOVE ALL STRINGS OR ROPES FROM TOP OF ROOT BALL AND AROUND TRUNKS AFTER TRANSPLANTING APPROVAL.
10. WATER THOROUGHLY AFTER INSTALLATION AND UNTIL PROJECT TURN-OVER MEETING WITH SCHOOL STAFF.
11. REPAIR ALL DAMAGED ADJACENT GRASS WITH SOD. INSTALL MULCH IN MINIMUM 1000 DIAMETER CIRCLE OVER PLANTING PIT OR AS SHOWN ON LAYOUT PLAN.
12. ALL TWINE AND BURLAP MUST BE BIO-DEGRADABLE.
13. ALL SHRUB PLANTINGS TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.

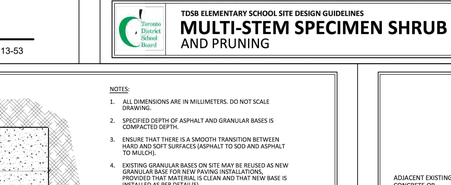
PRUNING:

14. ALL PRUNING TO BE TO BEST ARBORICULTURAL PRACTICE. ALL CUTS TO BE MADE AT NARROWEST PART OF BRANCH (DO NOT DAMAGE BRANCH COLLAR) USING CLEAN AND SHARP TOOLS.
15. ALL PROTRUSION HAZARDS (AS DEFINED BY CAN/CSA-Z614 LATEST EDITION) ARE TO BE REMOVED.

SOIL PLANTING MIX:

WHEN PLANTED IN TURF FIELD (NOT ADJACENT TO ASPHALT), BACKFILL WITH **TS 5.10.05.05 - TYPE 1 - STANDARD MIX** AS PER CITY OF TORONTO **CONSTRUCTION SPECIFICATION FOR GROWING MEDIUM - TS 5.10** (MOST RECENT ADDITION).

WHEN PLANTED ADJACENT TO ASPHALT OR CONCRETE BACKFILL WITH **TS 5.10.05.07 - TYPE 3 - BOULEVARD MIX** AS PER CITY OF TORONTO **CONSTRUCTION SPECIFICATION FOR GROWING MEDIUM - TS 5.10** (MOST RECENT ADDITION).

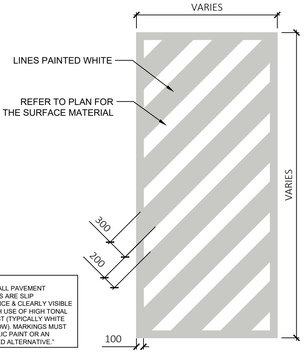


THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES

2 MULTI-STEM SPECIMEN SHRUB PLANTING AND PRUNING

SCALE: NTS	ISSUE/REVISION: FINAL
DATE: JULY 2025	DWG NO.: 24.04

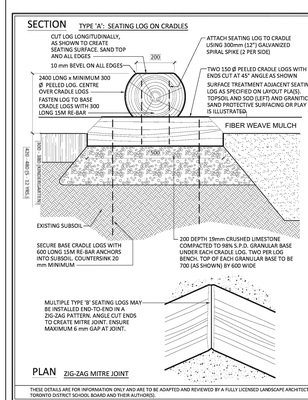


●NOTE:
ENSURE ALL PAVEMENT MARKINGS ARE SLIP RESISTANCE & CLEARLY VISIBLE THROUGH USE OF HIGH TONAL CONTRAST (TYPICALLY WHITE OR YELLOW). MARKINGS MUST BE ACRYLIC PAINT OR AN APPROVED ALTERNATIVE."

3 PAINTED LINES

N.T.S. 324143-19

SECTION TYPE 'A': SEATING LOG ON CRADLES



PLAN ZIG-ZAG MITRE JOINT

●NOTE:
PROVIDE SHOP DRAWINGS FOR APPROVAL

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWING.
2. SPECIFIED DEPTHS OF SAND AND TOPSOIL IS DEPTH AFTER SETTLEMENT. SPECIFIED DEPTH OF LIMESTONE SCREENINGS AND GRANULARS IS COMPACTED DEPTH.
3. ALL LOGS TO BE INSTALLED WITH SEATING SURFACE LEVEL END-TO-END.
4. ALL SEATING LOGS TO BE SOLID HARDWOOD (OAK, ASH OR MAPLE) WITH BARK REMOVED AND SKINNED/TURNED TO REMOVE IRREGULARITIES SUCH AS BRANCH STUBS.
5. ALL TIMBER, LUMBER AND LOGS TO BE FREE FROM WARPS, CHECKS AND CRACKS.
6. LOG BENCH INSTALLATION TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.
7. ENSURE MINIMUM 2000mm DISTANCE BETWEEN STRUCTURE AND TREE TRUNKS AND/OR TREE CAGES, PLAY FEATURES, FENCING, SEATING OR ALL OTHER STRUCTURES.

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES

4 SEATING LOG KINDERGARTEN AND AGES 5 - 12

1104-13

SCALE: NTS	ISSUE/REVISION: FINAL
DATE: JULY 2025	DWG NO.: 24.13

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

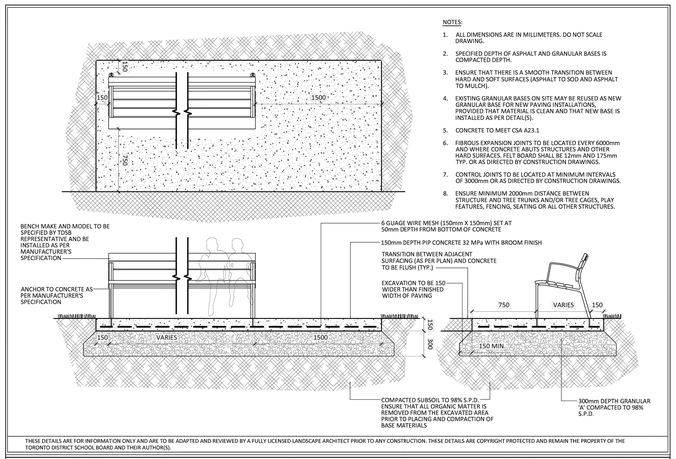
CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- [ ] CONCEPTUAL
- [ ] PRELIMINARY
- [ ] SITE PLAN
- [ ] PERMIT
- [x] TENDER
- [ ] CONTRACT
- [ ] CONSTRUCTION
- [ ] AS-BUILT



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWING.
2. SPECIFIED DEPTH OF ASPHALT AND GRANULAR BASES IS COMPACTED DEPTH.
3. ENSURE THAT THERE IS A SMOOTH TRANSITION BETWEEN HARD AND SOFT SURFACES (ASPHALT TO SOD AND ASPHALT TO MULCH).
4. EXISTING GRANULAR BASES ON SITE MAY BE REUSED AS NEW GRANULAR BASE FOR NEW PAVING INSTALLATIONS, PROVIDED THAT MATERIAL IS CLEAN AND THAT NEW BASE IS INSTALLED AS PER DETAIL(S).
5. CONCRETE TO MEET CSA A23.1.
6. FIBROUS EXPANSION JOINTS TO BE LOCATED EVERY 6000mm AND WHERE CONCRETE ABUTS STRUCTURES AND OTHER HARD SURFACES. FELT BOARD SHALL BE 12mm AND 175mm TYP. OR AS DIRECTED BY CONSTRUCTION DRAWINGS.
7. CONTROL JOINTS TO BE LOCATED AT MINIMUM INTERVALS OF 3000mm OR AS DIRECTED BY CONSTRUCTION DRAWINGS.
8. ENSURE MINIMUM 2000mm DISTANCE BETWEEN STRUCTURE AND TREE TRUNKS AND/OR TREE CAGES, PLAY FEATURES, FENCING, SEATING OR ALL OTHER STRUCTURES.

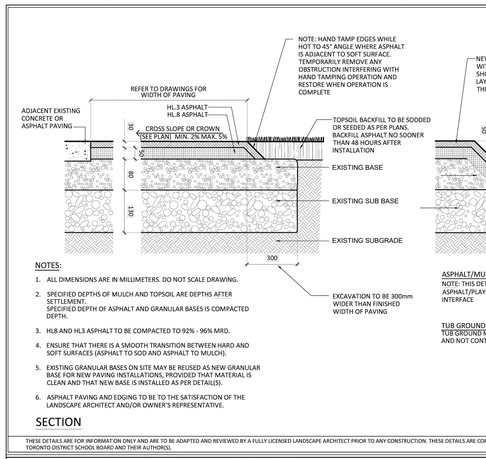
THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES

5 CONCRETE PAD FOR SEATING

1104-10

SCALE: NTS	ISSUE/REVISION: FINAL
DATE: JULY 2025	DWG NO.: 24.10



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS. DO NOT SCALE DRAWING.
2. SPECIFIED DEPTHS OF MULCH AND TOPSOIL ARE DEPTHS AFTER SETTLEMENT. SPECIFIED DEPTH OF ASPHALT AND GRANULAR BASES IS COMPACTED DEPTH.
3. HL8 AND HL3 ASPHALT TO BE COMPACTED TO 92% - 96% MRD.
4. ENSURE THAT THERE IS A SMOOTH TRANSITION BETWEEN HARD AND SOFT SURFACES (ASPHALT TO SOD AND ASPHALT TO MULCH).
5. EXISTING GRANULAR BASES ON SITE MAY BE REUSED AS NEW GRANULAR BASE FOR NEW PAVING INSTALLATIONS, PROVIDED THAT MATERIAL IS CLEAN AND THAT NEW BASE IS INSTALLED AS PER DETAIL(S).
6. ASPHALT PAVING AND EDGING TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.

SECTION

ASPHALT/MULCH INTERFACE
NOTE: THIS DETAIL IS NOT TO BE USED FOR ASPHALT/PLAYGROUND PROTECTIVE SURFACING INTERFACE

TUB GROUND MULCH:
TUB GROUND MULCH SHALL BE SHREDDED AND FIBROUS AND NOT CONTAIN CHIPS OF WOOD OR BARK.

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES

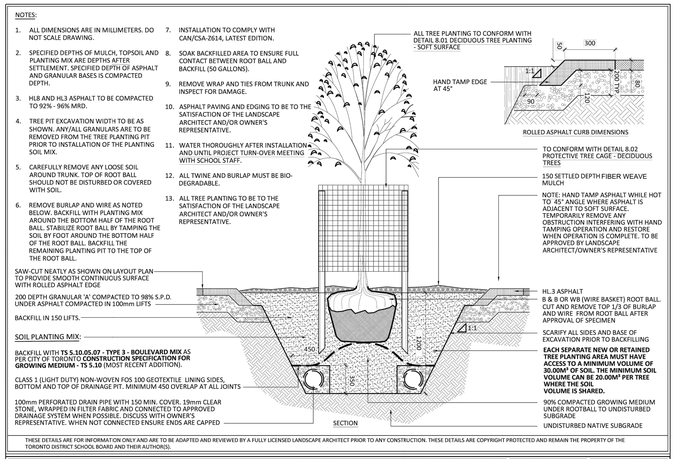
6 ASPHALT PAVING MEDIUM DUTY

1104-06

SCALE: NTS	ISSUE/REVISION: FINAL
DATE: JULY 2025	DWG NO.: 24.06

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED
2. ALL DIMENSIONS ARE TO BE VERIFIED ON SITE BY CONTRACTOR PRIOR TO CONSTRUCTION.
3. ALL TREE PLANTING TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.
4. ALL TREE PLANTING TO CONFORM WITH DETAIL 8.01 DECIDUOUS TREE PLANTING - SOFT SURFACE
5. ALL TREES TO BE PLANTED AS PER DETAIL 8.02 PROTECTIVE TREE CAGE - DECIDUOUS TREES
6. ALL TREES TO BE PLANTED AS PER DETAIL 8.03 PROTECTIVE TREE CAGE - CONIFEROUS TREES
7. INSTALLATION TO COMPLY WITH CAN/CSA-Z614, LATEST EDITION.
8. SOAK BACKFILLED AREA TO ENSURE FULL CONTACT BETWEEN ROOT BALL AND BACKFILL (50 GALLONS).
9. REMOVE WRAP AND TIES FROM TRUNK AND INSPECT FOR DAMAGE.
10. ASPHALT PAVING AND EDGING TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.
11. WATER THOROUGHLY AFTER INSTALLATION AND UNTIL PROJECT TURN-OVER MEETING WITH SCHOOL STAFF.
12. ALL TWINE AND BURLAP MUST BE BIO-DEGRADABLE.
13. ALL TREE PLANTING TO BE TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR OWNER'S REPRESENTATIVE.



THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES

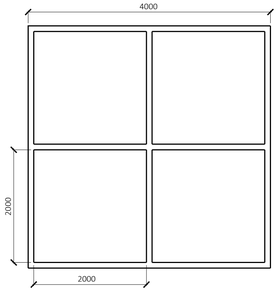
7 TREES IN ASPHALT WITH DRAINAGE

1104-03

SCALE: NTS	ISSUE/REVISION: FINAL
DATE: JULY 2025	DWG NO.: 24.03

NOTES:

1. ALL LINES TO BE 100MM WIDE.
2. NO ADDITIONAL PAINTING REQUIRED FOR BLANK SPACES.
3. SEE PLAN FOR SURFACE AND LOCATION.
4. CONTRACTOR TO RECEIVE APPROVAL OF LOCATION FROM LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION.
5. ALL DIMENSIONS GIVEN IN MILLIMETERS
6. PRODUCT DETAIL AS PER SPECIFICATIONS

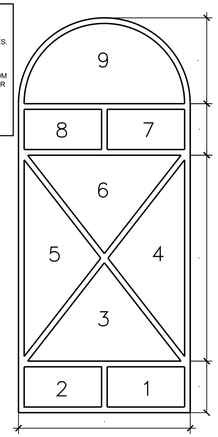


8 FOUR SQUARE LAYOUT - WHITE PAINT

NTS 321870-11

NOTES:

1. ALL LINES TO BE 50MM WIDE.
2. NO ADDITIONAL PAINTING REQUIRED FOR BLANK SPACES.
3. SEE PLAN FOR SURFACE AND LOCATION.
4. CONTRACTOR TO RECEIVE APPROVAL OF LOCATION FROM LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION.
5. ALL DIMENSIONS GIVEN IN MILLIMETERS
6. PRODUCT DETAILS AS PER SPECIFICATIONS

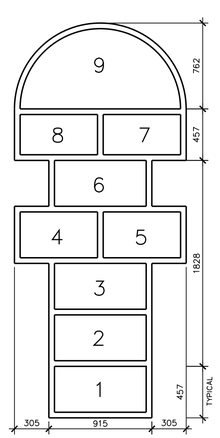


9 HOPSCOTCH LAYOUT A - WHITE PAINT

N.T.S. 321870-12

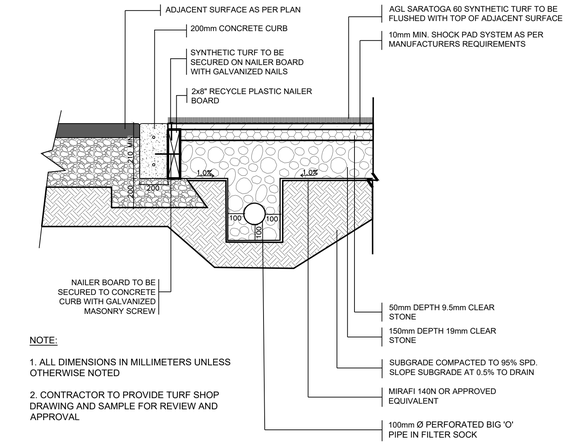
NOTES:

1. ALL LINES TO BE 60MM WIDE.
2. NO ADDITIONAL PAINTING REQUIRED FOR BLANK SPACES.
3. SEE PLAN FOR SURFACE AND LOCATION.
4. CONTRACTOR TO RECEIVE APPROVAL OF LOCATION FROM LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION.
5. ALL DIMENSIONS GIVEN IN MILLIMETERS
6. PRODUCT DETAILS AS PER SPECIFICATIONS



10 HOPSCOTCH LAYOUT C - WHITE PAINT

N.T.S. 321870-14



NOTE:

1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

2. CONTRACTOR TO PROVIDE TURF SHOP DRAWING AND SAMPLE FOR REVIEW AND APPROVAL

11 ARTIFICIAL TURF

N.T.S. 321816.13-26

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
KYLE FOCHT
MEMBER

HENRY KERTKAS - ASSOCIATES INC.
HKLA
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-5599 I: Email: info@hkla.ca I: Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED; AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

PROJECT: SPA FILE #

HEYDON PARK RENOVATION
TDSB

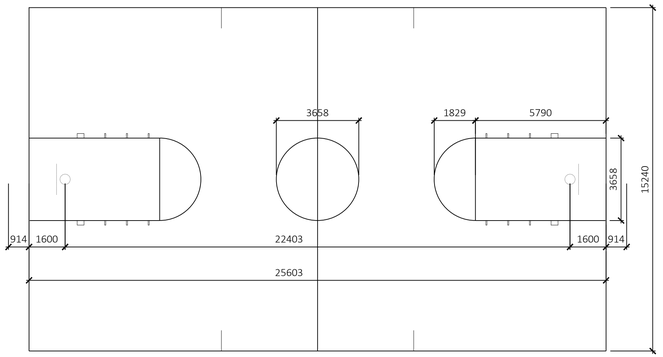
DRAWING:

DETAILS

DRAWN BY: CT	SCALE: AS SHOWN
CHECKED BY: KF	DATE: 2026-09-15
JOB NO.: 2026-082	

L-D2
DRAWING 6 of 8

File #2026-082



NOTES:
ALL LINES TO BE PAINTED 50mm WIDE USING WHITE ACRYLIC PAINT ONLY
CONTRACTOR TO RECEIVE APPROVAL OF LOCATION FROM LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION.
ALL DIMENSIONS GIVEN IN MILLIMETERS.

1 BASKETBALL COURT LINE PAINTING

N.T.S. 116823.13-07

500 SERIES

MBE-0510-00012
Legacy # MLBS10-M-C



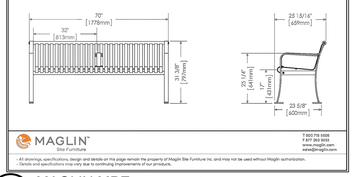
MATERIALS: Bench ends and seat are made from solid steel flat bar and H.S. steel tube.

FINISH: All steel components are protected with E-Coat rust proofing.
The Maglin Powdercoat System provides a durable finish on all metal surfaces.

INSTALLATION: The bench is delivered pre-assembled. Holes (0.5") are provided in each foot for securing to base.
Surface mounted
install as per manufacturer's specification

TO SPECIFY: Select MBE-0805-00003
Choose:
– Powdercoat Color

HEIGHT: 31.38" (79.7cm) LENGTH: 70" (177.8cm) DEPTH: 25.3/4" (65.9cm) WEIGHT: 160.37lbs (72.74kg)

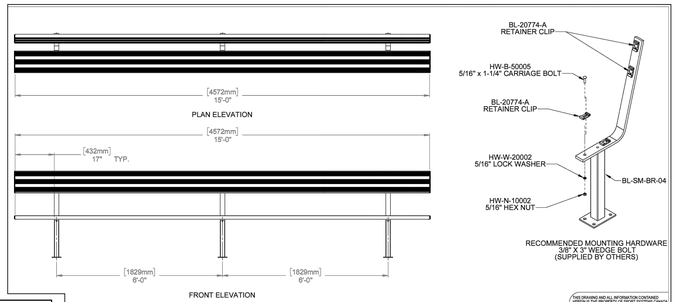


MAGLIN Site Furniture
T 800 716 6956
F 877 359 9935
www.maglin.com
sales@maglin.com

* All drawings, specifications, design and details on this page remain the property of Maglin Site Furniture Inc. and may not be used without Maglin authorization.
* Details and specifications may vary due to continuing improvements of our products.

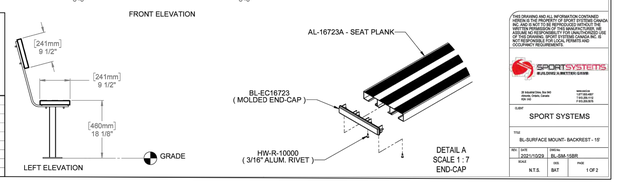
2 MAGLIN MBE 0510-00012

N.T.S. 323312-02



● NOTE:
PROVIDE SHOP DRAWINGS FOR APPROVAL

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	AL-16723A-15	2" X 15" NOMINAL BEAVERTIMBER PLANK ANODIZED FINISH – 15'-0"	2
2	BL-20774	RETAINER CLIP - ALUMINUM	12
3	BL-EC16723	MOLDED END CAP 4 HOLE BLACK POLYCARBONATE	4
4	BL-SM-BR-04	SURFACE MOUNT WITH BACK REST	3
5	HW-B-50005	5/16" x 1-1/4" HDG, GR 2 CARRIAGE BOLT	12
6	HW-N-10002	5/16" HDG, GR 2 HEX NUT	12
7	HW-R-10000	ALUMINUM POP RIVET 5/16" x 5-32/-0.075	8
8	HW-W-20002	5/16" LOCK WASHER, HDG.	12



THIS DRAWING AND ALL INFORMATION CONTAINED HEREIN IS THE PROPERTY OF SPORT SYSTEMS (ONTARIO) INC. AND SHALL NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION OF THE MANUFACTURER. WE ASSUME NO RESPONSIBILITY FOR UNAUTHORIZED USE OF THIS DRAWING AND WILL PROSECUTE TO THE FULLEST EXTENT OF THE LAW. IT IS THE RESPONSIBILITY OF THE PURCHASER TO OBTAIN ALL PERMITS AND COMPLY WITH ALL APPLICABLE BUILDING CODES AND REGULATIONS.

SPORT SYSTEMS
BUILDING ALTHLETES GENIUS

25 WANKLING, Bay 600 Woodbridge, ON L4L 8A1
TEL: 905-850-1900 FAX: 905-850-1901
TOLL FREE: 1-800-268-3767
www.sportsystems.ca

SUBJECT: SPORT SYSTEMS

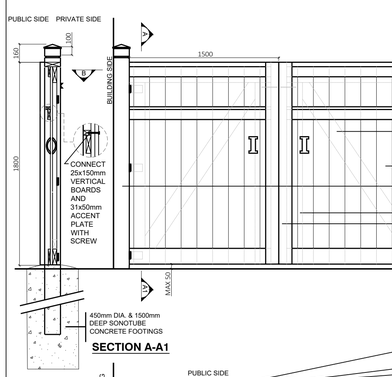
TITLE: BL-SURFACE MOUNT - BACKREST - 15'

REV	DATE	DESCRIPTION
A	2021/10/26	BL-SM-15BR

SCALE: N.T.S. | DES: | PAGE: 1 OF 2

3 SPORTSYSTEM - SURFACE MOUNTED BENCH - BL-SM-15BR

1:20 323312-05



4 TYPICAL SIGNAGE INSTALLATION

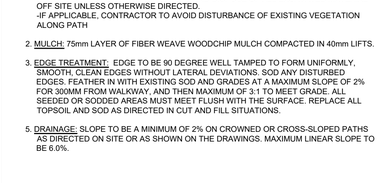
N.T.S. 324123.03-188



1. EXCAVATION: EXCAVATE TO THE MINIMUM DEPTH AS REQUIRED. REMOVE ALL EXCAVATED MATERIAL OFF SITE UNLESS OTHERWISE DIRECTED. SUBGRADE SHALL BE COMPACTED TO 100% S.P.M.D.D.
2. GRANULAR BASE: 100mm SUBBASE OF GRANULAR A COMPACTED TO 100% S.P.D. ON 300mm SUBBASE OF GRANULAR B COMPACTED TO 100% S.P.D. (IN 100mm LIFTS)
3. ASPHALT: 50mm LAYER (AFTER COMPACTION) OF HOT MIX HL3 ON 50mm LAYER (AFTER COMPACTION) OF HOT MIX HL8A IN ACCORDANCE WITH OPSD STANDARDS.
4. EDGE TREATMENT: ASPHALT EDGE TO BE 45 DEGREE WELL TAMPED TO FORM UNIFORMLY, SMOOTH, CLEAN EDGES WITHOUT LATERAL DEVIATIONS. SOD TO FEATHER IN WITH EXISTING SOD AND GRADES AT A MAXIMUM SLOPE OF 3:1. ALL SEEDED OR SODDED AREAS MUST MEET FLUSH WITH THE ASPHALT SURFACE. REPLACE ALL TOPSOIL AND SOD AS DIRECTED IN CUT AND FILL SITUATIONS.
5. DRAINAGE: SLOPE TO BE A MINIMUM OF 2% ON CROWNED OR CROSS-SLOPED PATHS AS DIRECTED ON SITE OR AS SHOWN ON THE DRAWINGS.
6. TREATMENTS: PRIMER COAT: EMULSIFIED ASPHALT CONFORMS TO SS-1 OPSS 1103.
TACK COAT: EMULSIFIED ASPHALT CONFORMS TO SS-1 OPSS 1103.
SEAL COAT: SEALER TO CONFORM TO AI MS-19, SLURRY TYPE.
7. ALL GIVEN DIMENSIONS IN MILLIMETERS

5 HEAVY DUTY ASPHALT SURFACE

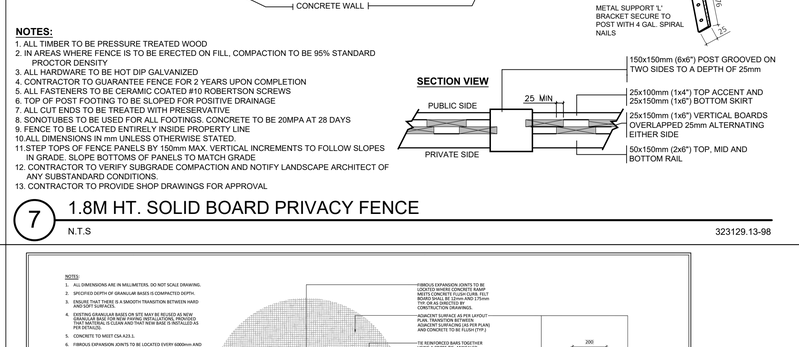
N.T.S. 321216-513



1. EXCAVATION: EXCAVATE TO MINIMUM DEPTH AS REQUIRED. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL AND REPLACEMENT OF ANY UNSUITABLE SUBGRADE MATERIAL SUCH AS TOP-SOIL, ALL SOFT SPOTS AND/OR ORGANIC MATTER AND REPLACEMENT WITH CLEAN SUBSOIL FILL. SUBGRADE SHALL BE CONSOLIDATED TO 95% S.P.D. REMOVE AND DISPOSE OF ALL EXCAVATED MATERIAL OFF SITE UNLESS OTHERWISE DIRECTED.
-IF APPLICABLE, CONTRACTOR TO AVOID DISTURBANCE OF EXISTING VEGETATION ALONG PATH
2. MULCH: 75mm LAYER OF FIBER WEAVE WOODCHIP MULCH COMPACTED IN 40mm LIFTS.
3. EDGE TREATMENT: EDGE TO BE 90 DEGREE WELL TAMPED TO FORM UNIFORMLY, SMOOTH, CLEAN EDGES WITHOUT LATERAL DEVIATIONS. SOD ANY DISTURBED EDGES. FEATHER IN WITH EXISTING SOD AND GRADES AT A MAXIMUM SLOPE OF 2% FOR 300MM FROM WALKWAY, AND THEN MAXIMUM OF 3:1 TO MEET GRADE. ALL SEEDED OR SODDED AREAS MUST MEET FLUSH WITH THE SURFACE. REPLACE ALL TOPSOIL AND SOD AS DIRECTED IN CUT AND FILL SITUATIONS.
5. DRAINAGE: SLOPE TO BE A MINIMUM OF 2% ON CROWNED OR CROSS-SLOPED PATHS AS DIRECTED ON SITE OR AS SHOWN ON THE DRAWINGS. MAXIMUM LINEAR SLOPE TO BE 6.0%.

6 FIBER WEAVE WOODCHIP MULCH

NTS 329113.16-05



NOTES:
1. ALL TIMBER TO BE PRESSURE TREATED WOOD
2. IN AREAS WHERE FENCE IS TO BE ERECTED ON FILL, COMPACTION TO BE 95% STANDARD PROCTOR DENSITY
3. ALL HARDWARE TO BE HOT DIP GALVANIZED
4. CONTRACTOR TO GUARANTEE FENCE FOR 2 YEARS UPON COMPLETION
5. ALL FASTENERS TO BE CERAMIC COATED #10 ROBERTSON SCREWS
6. TOP OF POST FOOTING TO BE SLOPED FOR POSITIVE DRAINAGE
7. ALL CUT ENDS TO BE TREATED WITH PRESERVATIVE
8. SONOTUBES TO BE USED FOR ALL FOOTINGS. CONCRETE TO BE 20MPA AT 28 DAYS
9. FENCE TO BE LOCATED ENTIRELY INSIDE PROPERTY LINE
10. ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED.
11. STEP TOPS OF FENCE PANELS BY 150mm MAX. VERTICAL INCREMENTS TO FOLLOW SLOPES IN GRADE. SLOPE BOTTOMS OF PANELS TO MATCH GRADE
12. CONTRACTOR TO VERIFY SUBGRADE COMPACTION AND NOTIFY LANDSCAPE ARCHITECT OF ANY SUBSTANDARD CONDITIONS.
13. CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR APPROVAL

SECTION VIEW

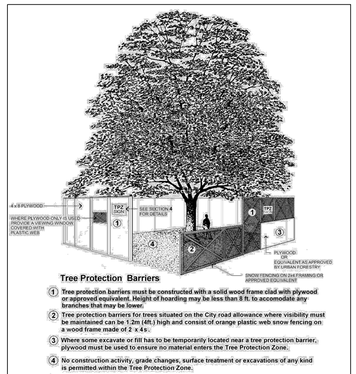
7 1.8M HT. SOLID BOARD PRIVACY FENCE

N.T.S 323129.13-98

NOTES
1. ALL TIMBER TO BE WESTERN RED CEDAR
2. IN AREAS WHERE FENCE IS TO BE ERECTED ON FILL, COMPACTION TO BE 95% STANDARD PROCTOR DENSITY
3. ALL HARDWARE TO BE HOT DIP GALVANIZED
4. CONTRACTOR TO GUARANTEE FENCE FOR 2 YEARS UPON COMPLETION
5. ALL FASTENERS TO BE CERAMIC COATED #10 ROBERTSON SCREWS
6. TOP OF POST FOOTING TO BE SLOPED FOR POSITIVE DRAINAGE
7. ALL CUT ENDS TO BE TREATED WITH PRESERVATIVE
8. SONOTUBES TO BE USED FOR ALL FOOTINGS. CONCRETE TO BE 20MPA AT 28 DAYS
9. ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED
10. ONLY FASTEN TO BUILDING FACADE IF ITS BRICK, BLOCK OR STONE. DUPLICATE POST AND FOOTING IF UNABLE TO FASTEN TO BUILDING STRUCTURE.
11. CONTRACTOR TO VERIFY SUBGRADE COMPACTION AND NOTIFY LANDSCAPE ARCHITECT OF ANY SUBSTANDARD CONDITIONS.
12. CONTRACTOR TO PROVIDE SHOP DRAWING FOR APPROVAL

8 1.8M HT. PRIVACY DOUBLE SWING GATE

1:25 WESTERN RED CEDAR (PRESSURE TREATED) 32 3129.13-102



Tree Protection Barriers

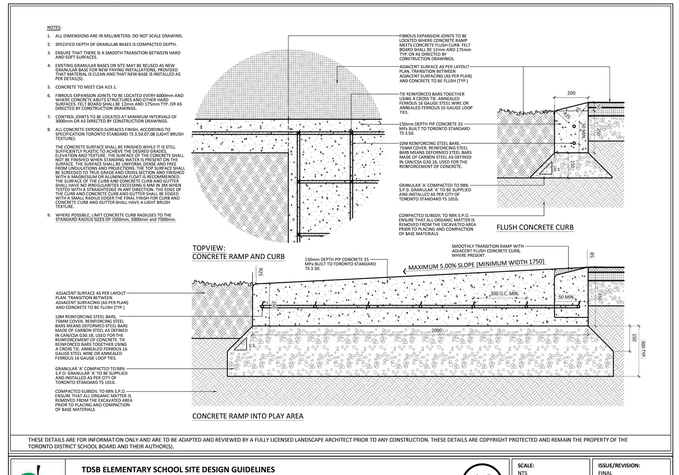
1. Tree protection barriers must be constructed with a solid wood frame clad with plywood or approved equivalent. Height of hoarding may be less than 8 ft. to accomodate any branches that may be lower.
2. Tree protection barriers for trees situated on the City road allowance where visibility must be maintained can be 1.2m (4ft.) high and consist of orange plastic web snow fencing on a wood frame made of 2 x 4 s.
3. Where some excavate or fill has to be temporarily located near a tree protection barrier, plywood must be used to ensure no material enters the Tree Protection Zone.
4. No construction activity, grade changes, surface treatment or excavations of any kind is permitted within the Tree Protection Zone.

Note:
Sediment control fencing shall be installed in locations indicated in an Urban Forestry approved Tree Protection Plan. The sediment control fencing must be installed to Ontario Provincial Standards (OPSD-219.130) heavy duty silt fence barrier and to the satisfaction of Urban Forestry. See Detail TP-2

TORONTO Parks, Forestry and Recreation
Urban Forestry February 2016 **Detail TP-1**

9 TREE PRESERVATION FENCE

NTS 32 3133.09-01



THESE DETAILS ARE FOR INFORMATION ONLY AND ARE TO BE ADAPTED AND REVIEWED BY A FULLY LICENSED LANDSCAPE ARCHITECT PRIOR TO ANY CONSTRUCTION. THESE DETAILS ARE COPYRIGHT PROTECTED AND REMAIN THE PROPERTY OF THE TORONTO DISTRICT SCHOOL BOARD AND THEIR AUTHOR(S).

Toronto District School Board

TDSB ELEMENTARY SCHOOL SITE DESIGN GUIDELINES
CONCRETE CURB AND ACCESS RAMP
FOR AREAS REQUIRING FALL PROTECTION SURFACES

10

SCALE: NTS | ISSUE/REVISION: FINAL
DATE: JULY 2025 | DWG NO.: **24.09**

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- ☐ CONCEPTUAL
- ☐ PRELIMINARY
- ☐ SITE PLAN
- ☐ PERMIT
- ☒ TENDER
- ☐ CONTRACT
- ☐ CONSTRUCTION
- ☐ AS-BUILT

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
KYLE FOCH
OALA
MEMBER

HENRY KORTEKAAS, ASSOCIATES INC.
HKLA
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-5599 \ Email: info@hkla.ca \ Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

PROJECT: SPA FILE #
HEYDON PARK RENOVATION
TDSB

DRAWING: DETAILS

DRAWN BY: CT | SCALE: AS SHOWN
CHECKED BY: KF | DATE: 2026-09-15
JOB NO.: 2026-082

L-D3
DRAWING 7 of 8

File #2026-082

GENERAL NOTES

1. THE CONTRACTOR IS TO VERIFY ALL EXISTING SITE CONDITIONS AND REPORT ANY DISCREPANCIES BEFORE COMMENCING WORK.
2. ALL WORK IS PROPOSED UNLESS OTHERWISE STATED AS EXISTING.
3. ALL MEASUREMENTS & GRADES MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO INSTALLATION. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES TO THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. ANY ALTERATIONS THAT MAY BE REQUIRED DURING CONSTRUCTION MUST BE APPROVED BY THE LANDSCAPE ARCHITECT.
4. ALL MATERIALS ARE TO BE INSTALLED AS PER MANUFACTURERS' SPECIFICATIONS UNLESS OTHERWISE DIRECTED. SHOP DRAWINGS AND SPECIFICATIONS ARE TO BE PROVIDED BY THE CONTRACTOR FOR ALL OTHER UNSPECIFIED FEATURES & APPROVED PRIOR TO INSTALLATION. SAMPLES ARE TO BE PROVIDED BY THE CONTRACTOR & APPROVED PRIOR TO ORDERING OF ANY MATERIALS.
5. ALL DESIGNS OF STRUCTURAL ELEMENTS (FENCING, GUARDRAILS, WALLS, ETC.) & FOOTINGS ARE TO BE REVIEWED & CERTIFIED BY AN ONTARIO LICENSED STRUCTURAL ENGINEER PRIOR TO INSTALLATION.
6. BASE INFORMATION WAS TAKEN FROM A SURVEY PROVIDED BY THE ARCHITECT AND PRODUCED BY GENESIS DATED SEPTEMBER 21ST, 2026.
7. THE CONTRACTOR MUST SURVEY, LOCATE & MARK ALL UTILITIES PRIOR TO COMMENCING CONSTRUCTION AND MUST KEEP DOCUMENTATION OF SUCH LOCATES ON SITE AT ALL TIMES. IF NO UTILITIES ARE PRESENT THEN THIS MUST BE OUTLINED IN A WRITTEN NOTICE FROM THE LOCATOR & UTILITIES. HAND DIG WITHIN 2m OF UTILITIES AND REPAIR ANY DAMAGES TO THE SATISFACTION OF THE AFFECTED AGENCY.
8. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO EXISTING SERVICES, HARDSCAPING & VEGETATION OR ANY OTHER FEATURES TO BE RETAINED AND MUST REPAIR ANY DAMAGES THAT OCCUR TO THEM DURING CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER. THE CONTRACTOR MUST ENSURE ADEQUATE COVER WILL BE PROVIDED ABOVE UTILITIES WITH PROPOSED GRADING CONDITIONS.
9. THE CONTRACTOR IS RESPONSIBLE FOR ACQUIRING, MANAGING & CLOSING ANY & ALL PERMITS REQUIRED FOR THE CONSTRUCTION UNLESS OTHERWISE SPECIFIED.
10. ALL PERMIT DOCUMENTS ARE TO BE POSTED IN A VISIBLE LOCATION AS DIRECTED BY THE MUNICIPALITY AND MUST REMAIN POSTED UNTIL THE END OF CONSTRUCTION.
11. WRITTEN PERMISSION MUST BE PROVIDED BY ADJACENT LAND OWNERS PRIOR TO COMMENCING ANY WORK ON NEIGHBOURING PROPERTIES.
12. THE CONTRACTOR SHALL DISPOSE OF ALL EXISTING WASTE/GARBAGE & EXCESS MATERIAL OFF SITE. ALL REMOVALS & WASTE IS TO BE HANDLED & DISPOSED OF IN ACCORDANCE WITH PROVINCIAL ENVIRONMENTAL & WASTE MANAGEMENT REGULATIONS.
13. THE CONSTRUCTION SITE MUST REMAIN ORGANIZED, ORDERLY & FREE OF HAZARDS. A PORTABLE TOILET MUST BE PROVIDED FOR CONTRACTORS AND SITE VISITORS IF NO PUBLIC BATHROOMS ARE NEARBY.
14. ALL SETBACKS MUST BE FOLLOWED FOR PROPOSED WORK AND FEATURES AS DIRECTED BY THE MUNICIPALITY AND OTHER REGULATING AUTHORITIES UNLESS WRITTEN APPROVAL FROM THESE PARTIES INDICATES OTHERWISE. ANY DISCREPANCIES MUST BE REPORTED TO THE LANDSCAPE ARCHITECT.
15. DRAWINGS ARE SHOWN IN METRIC SCALE. ALL DIMENSIONS & ELEVATIONS ARE IN METERS UNLESS OTHERWISE STATED. DETAILS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE STATED. DO NOT SCALE LANDSCAPE DRAWINGS.
16. ALL MEASUREMENTS MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO INSTALLATION. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES TO THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. ANY ALTERATIONS THAT MAY BE REQUIRED DURING CONSTRUCTION MUST BE APPROVED BY THE LANDSCAPE ARCHITECT.
17. ALL HARDSCAPED AREAS, LANDSCAPE FEATURES AND PLANTING BEDS ARE TO BE MARKED OR STAKED OUT BY THE CONTRACTOR AND APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
18. LANDSCAPE PLANS ARE TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT & AVAILABLE DOCUMENTS PROVIDED BY THE OTHER CONSULTS (SURVEYOR, ARBORIST, ARCHITECT, ENGINEER, ETC.).

GRADING & EARTHWORKS NOTES

1. EXISTING FEATURES MUST BLEND AND MATCH FINAL ELEVATIONS. PROPOSED GRADING TO BE 33% (3:1) MAXIMUM SLOPE, 1% MINIMUM SLOPE FOR HARDSCAPING AND 2% MINIMUM SLOPE FOR SOFTSCAPING UNLESS OTHERWISE STATED.
2. APPROVAL OF ROUGH GRADING IS REQUIRED FROM THE OWNER AND LANDSCAPE ARCHITECT PRIOR TO FINE GRADING. CONTRACTOR TO IDENTIFY GRADES UPON REQUEST.
3. CONTRACTOR SHALL PROVIDE DRAINAGE OR PUMPING MEASURES AS NEEDED DURING EXCAVATION.
4. REUSE EXCESS SOILS AND BASE MATERIAL ON-SITE WHEREVER POSSIBLE TO REDUCE OR ELIMINATE THE NEED FOR EXCESS SOIL EXPORTS. CONTRACTOR SHALL PROVIDE ANY REQUIRED TESTS, REPORTS, DOCUMENTATION, TRACKING AND SERVICES TO ENSURE EXCESS SOIL IS PROPERLY MANAGED, MOVED, USED AND/OR DISPOSED OF OFF-SITE IN ACCORDANCE WITH PROVINCIAL REGULATIONS (O. REG. 406/19 OR OTHERWISE).
5. CONTRACTOR IS RESPONSIBLE FOR IMPORTING ADDITIONAL TOPSOIL IF REQUIRED AND REMOVING ANY UNUSED TOPSOIL OR GRANULAR FILL.
6. ALL EXCAVATION AND CONSTRUCTION WORKS SHALL COMPLY WITH THE CURRENT PROVINCIAL OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
7. CONTRACTOR IS RESPONSIBLE FOR ENSURING ALL EXCAVATION IS PROPERLY SHORED.
8. TOPSOIL IN FILL AREAS MUST BE STRIPPED. CLEAN FILL MUST BE PLACED AND COMPACTED TO 98% STANDARD PROCTOR DRY DENSITY OR AS DIRECTED BY A GEOTECHNICAL ENGINEER. NO ORGANIC MATERIAL SHALL BE USED AS BACKFILL.
9. SUITABILITY AND COMPACTION OF FILL MATERIALS TO BE CONFIRMED BY A GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF BASE COURSE MATERIAL.
10. EXPOSED NATURAL SUBGRADE TO BE INSPECTED AND APPROVED BY A GEOTECHNICAL CONSULTANT AND UNIFORMLY COMPACTED AND PROOF ROLLED PRIOR TO FILL PLACEMENT. UNSUITABLE SOILS TO BE REMOVED AND REPLACED WITH APPROVED COMPACTED FILL COMPATIBLE WITH SUBGRADE CONDITIONS.
11. APPROVED FILL TO BE PLACED IN LAYERS NOT EXCEEDING 150mm BEFORE COMPACTION AND UNIFORMLY COMPACTED AND PROOF ROLLED TO THE SATISFACTION OF THE GEOTECHNICAL CONSULTANT. WORK TO BE SUPERVISED BY GEOTECHNICAL PERSONNEL.
12. FILL SHALL NOT BE CONSTRUCTED DURING WINTER MONTHS WHEN PERSISTENT OR INTERMITTENT FREEZING OCCURS. IF FILL AREAS ARE LEFT EXPOSED FOR EXTENDED PERIODS, A SUITABLE SOIL COVER MUST BE PROVIDED TO PREVENT FROST ACTION AND DISTURBANCE.
13. ALL SELECTED FILL AND BASE MATERIAL MUST BE APPROVED BY THE GEOTECHNICAL CONSULTANT.
14. NO GRADING IS PERMITTED ATOP SHALLOW UNDERGROUND UTILITIES THAT ARE TO REMAIN (IRRIGATION, GAS, SEPTIC, ELECTRICAL) WITHOUT MITIGATION MEASURES PROPOSED BY THE CONTRACTOR TO SUFFICIENTLY PROTECT THEM. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO UTILITIES.
15. WITHIN AREAS OF DISTURBANCE, NATIVE TOPSOIL IS TO BE STRIPPED, STOCKPILED, AND REPLACED TO A MINIMUM DEPTH OF 150mm. TOPSOIL STOCKPILES MUST NOT EXCEED 1200mm IN HEIGHT TO MAINTAIN MICROORGANISM HEALTH.
13. FOOTINGS MUST BE REVIEWED AND CERTIFIED BY A STRUCTURAL ENGINEER PRIOR TO AND DURING CONSTRUCTION.
14. CONTRACTOR SHALL VERIFY ALL BENCHMARKS PRIOR TO CONSTRUCTION.

DRAINAGE NOTES

1. ALL DRAINAGE INSTALLATIONS SHALL BE REVIEWED BY THE LANDSCAPE ARCHITECT AND/OR A CIVIL ENGINEER PRIOR TO COVERING. ALL UNDERGROUND SERVICES MUST COMPLY WITH MUNICIPAL STANDARDS.
2. EXISTING DRAINAGE PATTERNS MUST BE MAINTAINED WHEREVER POSSIBLE. ENSURE POSITIVE DRAINAGE AWAY FROM ALL BUILDINGS, STRUCTURES, AND OTHER FEATURES.
3. ALL INVERTS AND CONNECTIONS TO STORM SYSTEMS, INCLUDING CATCH BASINS AND MANHOLES, ARE APPROXIMATE AND MUST BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO INSTALLATION.
4. UNLESS OTHERWISE INDICATED, ALL DRAINAGE PIPES SHALL BE RIGID PVC (SCHEDULE 40 or DBII) OR FLEXIBLE HDPE WITH A MINIMUM DIAMETER OF 100mm (4") AND RATED FOR VEHICULAR LOADS. SUBDRAINAGE PIPING AND SURROUND MUST BE INSTALLED A MINIMUM OF 150mm BELOW GRADE, BASE MATERIAL. ALL RIGID ELBOWS AND CONNECTIONS SHALL BE 45 DEGREES MAXIMUM.
5. SOLID PIPES SHALL BE SURROUNDED WITH A MINIMUM 150mm OF BRICK SAND AND WRAPPED IN FILTER FABRIC. PERFORATED PIPES SHALL BE WRAPPED WITH A FILTER SOCK, SURROUNDED BY A MINIMUM 150mm OF FINE CLEAR STONE, AND WRAPPED WITH FILTER FABRIC.
6. DRAINAGE PIPES SHALL HAVE A MINIMUM SLOPE OF 1% AND SHALL CONNECT TO THE NEAREST STORM SYSTEM OR DAYLIGHT IN SOFTSCAPE AREAS AS SHOWN OR WHEREVER POSSIBLE. DAYLIT PIPES SHALL BE VISUALLY CONCEALED AND FITTED WITH RODENT GUARDS (OPENINGS NOT LESS THAN 7 MM).
7. A PERIMETER LOOP AND SHORT RUNS (APPROXIMATELY 3 M LONG) OF PERFORATED PIPES SHALL BE PROVIDED ENTIRELY AROUND CATCH BASINS AND CONNECTED TO THE CATCH BASINS.
8. AT A MINIMUM, PERFORATED SUBDRAINAGE PIPING SHALL BE PROVIDED ALONG THE PERIMETERS OF ALL HARDSCAPED AREAS AND AT THE BASE OF CURBS AND FOOTINGS. THESE SUBDRAINS SHALL BE CONNECTED TO THE NEAREST STORM SYSTEM. CONFIRM WITH THE GEOTECHNICAL ENGINEER IF ADDITIONAL SUBDRAINAGE IS REQUIRED PRIOR TO BACKFILLING WITH BASE MATERIAL AND OBTAIN APPROVAL FROM THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
9. ADDITIONAL PERFORATED SUBDRAINAGE PIPING SHALL BE PROVIDED ALONG THE TOP OF CURBS AND CONNECTED TO THE NEAREST STORM SYSTEM WHERE ADJOINING GRADES ARE HIGHER, TO INTERCEPT WATER ENTERING THE SUBGRADE AND GRANULAR MATERIALS.

CONSTRUCTION PROGRAM NOTES

1. ALL CONSTRUCTION VEHICLES TO ENTER AND LEAVE THE SITE AT THE APPROVED LOCATION ONLY.
2. A SPILL KIT MUST BE ON-SITE DURING CONSTRUCTION, ANY REFUELING OF EQUIPMENT SHALL BE DONE GREATER THAN 30m FROM ANY WATERCOURSE TO PREVENT A PETROLEUM SPILL. IF GENERATORS ARE USED, A DRIP PAN SHALL BE PLACED UNDERNEATH TO CONTAIN ANY PETROLEUM PRODUCTS.
3. CONTRACTORS TO PARK VEHICLES ON THE ROADWAY WHERE PERMITTED. PARKING ON THE DRIVEWAY OR SITE ACCESS ROUTE IS PERMITTED IF PARKING ALONG THE ROAD IS NOT ALLOWED. IF NEITHER OF THESE OPTIONS ARE AVAILABLE, THEN THE CONTRACTOR IS TO PARK AT THE NEAREST PUBLIC PARKING LOT OR RETAIL PARKING AREA. ANY PARKING FEES OR TICKETS ARE TO BE COVERED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. CONFIRM PARKING ARRANGEMENTS WITH THE OWNER.
4. ALL MATERIALS ARE TO BE STORED IN LOCATIONS AS INDICATED ON THE PLANS. IF NO LOCATION IS IDENTIFIED THEN MATERIALS CAN BE STORED ON THE ACCESS ROUTE OR AS OTHERWISE APPROVED BY THE OWNER. MATERIALS MUST BE STORED ATOP SKIDS, PLYWOOD AND/OR TARPS TO PREVENT DAMAGE TO SURFACE BELOW AND MATERIALS. SOILS ARE TO BE UNCOMPACTED & THE AREA RESTORED OR FINISHED AS SPECIFIED UPON COMPLETION OF CONSTRUCTION. NO MATERIALS ARE TO BE STORED WITHIN THE DRIP LINE OF EXISTING TREES TO BE PRESERVED.
5. ALL EXISTING FEATURES THAT ARE DAMAGED INCLUDING WITHIN THE MUNICIPAL RIGHT-OF-WAY, ON ADJACENT LANDS AND INSIDE OR OUTSIDE OF THE CONSTRUCTION AREA INCLUDING, BUT NOT LIMITED TO, SOD, ASPHALT, CURBING, GUTTERS, CATCH BASINS, LAMP STANDARDS & SIDEWALKS ARE TO BE RESTORED/REPAIRED BEFORE CONSTRUCTION COMPLETION TO THEIR ORIGINAL CONDITION OR BETTER AND AS PER MUNICIPAL STANDARDS AND TO THE SATISFACTION OF THE OWNER AND AT NO ADDITIONAL COST TO THE OWNER.
6. ACCESS IS NOT PERMITTED ONTO ADJACENT LANDS. NOISE & DUST ARE TO BE MINIMIZED DURING TIMES WHEN PEDESTRIANS ARE OUTDOORS AND USING THE ADJACENT AREAS.
7. ALL CONSTRUCTION WORKS SHALL BE IN ACCORDANCE WITH CURRENT PROVINCIAL OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS. THE CONTRACTOR SHALL INFORM THEMSELVES OF ALL ADMINISTRATIVE PRACTICES REQUIRED AND SHALL ENSURE THE SAFETY OF STAFF AND PUBLIC AT ALL TIMES.
8. THE CONTRACTOR MUST INSTALL ALL COMPONENTS, CLEAN ALL SURFACES, REMOVE STAINS, SMUDGES AND DIRT PRIOR TO SUBSTANTIAL PERFORMANCE AND TOTAL COMPLETION.

CONTRACT & CLOSEOUT NOTES

1. THE CONTRACTOR IS TO CONFIRM ISSUED DRAWINGS ARE THE LATEST REVISED DRAWINGS PRIOR TO TENDERING AND/OR CONSTRUCTION.
2. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS ON SITE AND SATISFY THEMSELVES OF SITE CONDITIONS PRIOR TO CONSTRUCTION. THE CONTRACTOR IS TO ADVISE THE CONSULTANT IMMEDIATELY OF ANY CONCERNS OR DISCREPANCIES.
   2.1. NO EXTRA COSTS WILL BE CONSIDERED FOR DISCREPANCIES BETWEEN THE DRAWINGS AND ACTUAL SITE CONDITIONS UNLESS REPORTED IN WRITING TO THE CONSULTANT PRIOR TO CONSTRUCTION.
3. ALL LANDSCAPE WORKS SHALL BE EXECUTED BY ON SITE CREW WITH A MINIMUM OF THREE YEARS OF RELATED EXPERIENCE.
4. ALL LANDSCAPE WORKS INCLUDING MATERIAL AND WORKMANSHIP WILL BE INSPECTED AND IS UNDER WARRANTY FOR A MINIMUM OF TWO YEARS. THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT WHEN WORK IS COMPLETED. THE WARRANTY PERIOD WILL COMMENCE FROM DATE OF WRITTEN ACCEPTANCE BY THE OWNER ACCOMPANYING THE CERTIFICATE OF SUBSTANTIAL PERFORMANCE IF REQUIRED AND SUBJECT TO DEFICIENCIES. A WARRANTY/MAINTENANCE HOLDBACK OF 5% WILL BE RETAINED UNTIL THE END OF THE WARRANT PERIOD.
5. THE CONTRACTOR MUST PROVIDE AN AS-BUILT SURVEY & REDLINE PLANS (IN PDF AND CAD FORMAT), OPERATIONS & MAINTENANCE MANUAL, WARRANTY DOCUMENTS & SPARE PARTS PRIOR TO OBTAINING TOTAL COMPLETION AND FINAL PAYMENT.

BY-LAW, STANDARDS AND COORDINATION NOTES

1. REFERENCE MAY BE MADE TO THE LATEST DESIGN STANDARDS PROVIDED BY THE MUNICIPALITY, REGULATING AUTHORITY, REGION OR PROVINCE. THESE STANDARD CONSTRUCTION DETAILS MAY NOT BE SHOWN ON THE DRAWINGS, BUT WILL BE NOTED WITH THEIR OWN PREFIXES. IT IS THE CONTRACTORS RESPONSIBILITY TO ACQUIRE & RETAIN COPIES OF THESE DOCUMENTS ON SITE AT ALL TIMES.
2. THE CONTRACTOR SHALL CONTACT THE OWNER, MUNICIPALITY AND/OR THE REGION (IF REQUIRED) TO SCHEDULE A PRE-CONSTRUCTION MEETING A MINIMUM 2 WEEKS PRIOR TO COMMENCEMENT OF THE PROPOSED WORKS.
3. ALL EXISTING PAVEMENT, CURBS, SIDEWALKS, DRIVEWAYS AND BOULEVARD AREAS DISTURBED BY CONSTRUCTION MUST BE REINSTATED TO THE SATISFACTION OF THE MUNICIPALITY AND/OR REGION.
4. BOULEVARDS TO BE FINE GRADED WITH A MINIMUM 200mm DEPTH OF TOPSOIL AND SODDED BY CONTRACTOR TO THE SATISFACTION OF THE MUNICIPALITY AND/OR REGION. DISTURBED AREAS ON SITE ARE TO BE REINSTATE WITH A MINIMUM OF 200mm DEPTH OF TOPSOIL AND SODDED OR SEEDED TO THE SATISFACTION OF THE OWNER AND MUNICIPALITY.
5. LANDSCAPE WORKS WITHIN THE RIGHT-OF-WAY AND PROPERTY SHALL FOLLOW ALL MUNICIPAL SETBACKS. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT. THE COST OF ANY UTILITY RELOCATION IS THE RESPONSIBILITY OF THE DEVELOPER/OWNER.
6. THE CONTRACTOR MUST FOLLOW ALL PROVINCIAL, REGIONAL AND MUNICIPAL BY-LAWS, STANDARDS AND REGULATIONS AS IT PERTAINS TO THE DESIGN, LAYOUT, INSTALLATION AND CONSTRUCTION OF THE WORKS. IN CASE OF DISCREPANCIES, THE MOST STRINGENT REQUIREMENT MUST APPLY.
7. ALL BARRIER FREE FEATURES, ENTRANCES AND PATHS OF TRAVEL MUST COMPLY WITH THE ONTARIO BUILDING CODE (OBC) SECTION 3.8, ACCESSIBILITY FOR ONTARIANS WITH DISABILITIES ACT (AODA) AND THE MUNICIPAL ACCESSIBILITY STANDARDS.
8. THE CONTRACTOR SHALL SUPPLY ALL ACCESSIBLE PARKING SIGNS AND MARKINGS AS SET OUT IN THE MUNICIPAL BY-LAWS AND DESIGN CRITERIA.
9. THE CONTRACTOR SHALL VERIFY THE BENCHMARK WITH MUNICIPALITY PRIOR TO CONSTRUCTION.

TREE REMOVAL & INJURY FINES

CITY OF TORONTO, URBAN FORESTRY DEPARTMENT

1. A PERMIT IS REQUIRED TO REMOVE, CUT DOWN OR IN ANY OTHER WAY INJURE A TREE WITH A DIAMETER AT BREAST HEIGHT (DBH) OF 30cm (12 INCHES OR THE APPROXIMATE THICKNESS OF A TELEPHONE POLE) OR MORE ON PRIVATE PROPERTY. THE TREE DIAMETER MEASUREMENT MUST BE TAKEN AT 1.4 M (4.5 FEET OR APPROXIMATELY AT CHEST HEIGHT) ABOVE GROUND LEVEL. IT APPLIES TO TREES ON ALL LAND USE TYPES INCLUDING, SINGLE AND MULTI-FAMILY RESIDENTIAL PROPERTIES.
2. TREES OF ALL DIAMETERS ON PRIVATE PROPERTY WITHIN RAVINE PROTECTION AREAS OF THE CITY OF TORONTO ARE PROTECTED UNDER THE PROVISIONS OF CITY OF TORONTO MUNICIPAL CODE CHAPTER 658, RAVINES. TREES OF ALL DIAMETERS ON CITY OWNED PROPERTY ARE PROTECTED UNDER CHAPTER 813.
3. A PERMIT TO INJURE, REMOVE OR DESTROY A TREE SHALL BE CARRIED OUT BY OR UNDER THE SUPERVISION OF AN ARBORIST.
4. A PERSON CONVICTED OF AN OFFENCE UNDER CITY OF TORONTO MUNICIPAL CODE CHAPTER 813, ARTICLE III IS SUBJECT TO A MINIMUM FINE OF $500.00 AND A MAXIMUM FINE OF $100,000.00 PER TREE INVOLVED IN AN OFFENSE; A SPECIAL SUPPLEMENTARY FINE OF $100,000.00 IS ALSO POSSIBLE.
5. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING THE TREE PROTECTION MEASURES INCLUDING FENCING AND FINALIZING THE TREE PROTECTION PERMIT IN COORDINATION WITH THE CONSULTANT. THE CONTRACTOR IS RESPONSIBLE FOR ANY FEES, FINES AND/OR PENALTIES INCURRED DURING CONSTRUCTION FOR NOT ATTAINING THE TREE PERMIT OR FOLLOWING PERMIT AND BY-LAW REQUIREMENTS.

PAVEMENT STRUCTURE NOTES

1. THE MINIMUM PAVEMENT STRUCTURE LISTED IN THE DETAILS MAY BE MODIFIED AS PER GEOTECHNICAL CONSULTANT'S RECOMMENDATION AND/OR TO MEET THE REQUIREMENTS OF THE MUNICIPALAL AND/OR REGIONAL DESIGN CRITERIA.
2. PAVEMENT DESIGN MUST BE VERIFIED BY A GEOTECHNICAL CONSULTANT PRIOR TO GRADING AND BASE CONSTRUCTION.
3. DURING PAVEMENT CONSTRUCTION, A GEOTECHNICAL CONSULTANT IS TO BE AVAILABLE ON SITE TO TEST, INSPECT AND REPORT ON THE WORK.
4. COMPACTION TESTS ARE TO BE CARRIED OUT TO THE SATISFACTION OF THE GEOTECHNICAL CONSULTANT.
5. THE GRANULAR SUBBASE AND BASE MATERIALS SHOULD BE UNIFORMLY COMPACTED TO AT LEAST 98 PERCENT OF THEIR STANDARD PROCTOR MAXIMUM DRY DENSITIES. THE ASPHALT MATERIALS SHOULD BE COMPACTED TO AT LEAST 95 PERCENT OF THEIR MARSHALL MAXIMUM RELATIVE DENSITIES, AS MEASURED IN THE FIELD USING A NUCLEAR DENSITY GAUGE.
6. EVEN IF THE COMPACTION REQUIREMENTS HAVE BEEN MET, THE SUBGRADE STRENGTH MAY NOT BE ADEQUATE TO SUPPORT HEAVY CONSTRUCTION LOADING ESPECIALLY DURING WET WEATHER OR WHERE BACKFILL MATERIALS WET OF OPTIMUM HAVE BEEN PLACED. IN THIS EVENT, THE DESIGN SUBBASE THICKNESS MAY NOT BE SUFFICIENT FOR A CONSTRUCTION HAUL ROAD AND ADDITIONAL BASE (IN THE ORDER OF 300mm TO 450mm) MAY BE REQUIRED. THE SUBGRADE SHOULD BE PROOFROLLED AND INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACING THE SUBBASE AND ADDITIONAL MATERIAL MUST BE PLACED, AS REQUIRED, CONSISTENT WITH THE PREVAILING WEATHER CONDITIONS AND ANTICIPATED USE BY CONSTRUCTION TRAFFIC.
7. ALL MATERIALS & COLOURS TO BE APPROVED BY THE LANDSCAPE ARCHITECT BEFORE INSTALLATION.
8. PROVIDE A SURFACE CROSS SLOPE OR CROWN OF 1% MINIMUM TO SHED WATER AS REQUIRED & ALWAYS ENSURE POSITIVE DRAINAGE.

PLANTING NOTES

MATERIAL REQUIREMENTS

1. PLANT MATERIAL LISTED IN THE PLANT SCHEDULE ARE MINIMUM SIZES OF NURSERY GROWN AND UNIFORM SPECIMENS. NO SUBSTITUTIONS WILL BE PERMITTED WITHOUT WRITTEN APPROVAL FROM THE LANDSCAPE ARCHITECT.
2. DECIDUOUS TREES SHALL HAVE A STRAIGHT CENTRAL LEADER AND WELL BRANCHED 1.5m ABOVE GRADE UNLESS OTHERWISE STATED.
3. CONIFEROUS TREES SHALL HAVE A STRAIGHT CENTRAL LEADER AND DENSELY BRANCHED TO WITHIN 0.3m OF THE GROUND UNLESS OTHERWISE STATED.
4. ALL PLANTING MATERIAL AND OPERATIONS TO MEET OR EXCEED THE HORTICULTURAL STANDARDS OF THE CANADIAN NURSERY LANDSCAPE ASSOCIATION AND THE HORTICULTURAL TRADES ASSOCIATION. ALL PLANT MATERIAL TO BE NO.1 GRADE NURSERY STOCK. UNSATISFACTORY STOCK WILL BE REFUSED ON THE SITE. PLANTS TO BE HEALTHY, TRUE TO SPECIFICATIONS & INSTALLED AS PER THESE STANDARDS.
5. ALL MATERIALS & PLANTS TO BE APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION & PREFERABLY BEFORE REMOVING FROM THE DELIVERY VEHICLE.
6. SOD TO BE CANADA NO.1 NURSERY SOD, MEETING ONTARIO SOD GROWERS ASSOCIATION STANDARDS. ALL SOD AND SEED AREAS TO RECEIVE MINIMUM OF 150mm DEPTH OF TOPSOIL UNLESS OTHERWISE INDICATED. SOD IS TO BE CUT A MINIMUM OF THREE (3) TIMES BEFORE ACCEPTANCE.
7. ALL TREE PROTECTION ITEMS USED IN NATURALIZED/RESTORED AREAS ARE TO BE BIODEGRADABLE AND REMOVED AFTER THE WARRANTY PERIOD (E.G. CHOIR WEED MATS, BURLAP TRUCK PROTECTION, WOODEN SUPPORT STAKES).

GENERAL NOTES

8. LOCATIONS FOR PLANT MATERIAL AND PLANTING BEDS ARE TO BE MARKED OR STAKED OUT BY THE CONTRACTOR AND APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
9. ALL PLANT MATERIAL WHICH ARE SHOWN AND SPECIFIED BY OC (ON CENTER SPACING) ARE TO BE PLANTED AS PER THESE NOTES & IN ACCORDANCE WITH THE PLANT LIST/SCHEDULE.
10. IN THE EVENT OF A DISCREPANCY BETWEEN THE PLANT LIST/SCHEDULE, KEYS AND/OR GRAPHICS ON THE DRAWING, THE GREATER TOTAL SHALL TAKE PRECEDENT. THE CONTRACTOR IS RESPONSIBLE FOR ANY QUANTITY DISCREPANCIES REPORTED AFTER CONTRACT AWARD.
11. ALL MASS PLANTINGS OF SHRUBS & PERENNIALS SHALL BE IN CONTINUOUS BEDS WITH A MINIMUM 100mm DEPTH OF MULCH OR AS OTHERWISE SPECIFIED. ALL PLANT BEDS ARE TO BE AMENDED WITH A MINIMUM OF 300mm OF TOPSOIL MIX BEFORE PLANTING. IN AREAS WHERE EXCAVATION IS DIFFICULT/PROHIBITED (UNDERNEATH TREES) THEN PLANT BEDS ARE TO BE TOPDRESSED WITH 100mm MINIMUM OF BIOEARTH BY HERMANNS AND WORKED INTO THE SOIL DURING PLANTING. PLANT BEDS ARE TO BE FINISHED WITH A 150mm LAYER OF SHREDDED FIBER WEAVE CEDAR MULCH AFTER PLANTING OR AS OTHERWISE INDICATED.
12. ALL TREE PITS AND ANY MECHANICALLY DUG HOLES SHALL BE SCARIFIED AND INCLUDE TREATMENT WITH MICORRHIZAL FUNGI OF THE SIDES BEFORE PLANTING.
13. ALL TREES ARE TO BE STAKED OR GUY WIRED ACCORDING TO DETAILS PROVIDED OR AS OTHERWISE SPECIFIED.
14. REMOVE BURLAP AND ROPE FROM THE TOP 2/3 OF ROOT BALLS. ANY WIRE MESH AND CONTAINERS MUST BE COMPLETELY REMOVED.
15. WATER AT TIME OF PLANTING AND WHENEVER DEEMED NECESSARY TO MAINTAIN PLANTS IN A HEALTHY CONDITION UNTIL SUBSTANTIAL PERFORMANCE AND THE END OF THE WARRANTY PERIOD.
16. ALL PLANT MATERIALS WHICH CANNOT BE PLANTED IMMEDIATELY UPON ARRIVAL ON SITE SHALL BE PROPERLY HEELED IN OR WELL PROTECTED WITH SOIL OR SIMILAR MATERIALS TO PREVENT DRYING OUT AND SHALL BE KEPT MOIST UNTIL COMMENCEMENT OF PLANTING. PLANT MATERIAL MUST BE PLANTED WITHIN 24 HOURS OF ARRIVING ON SITE.
17. NO ACCESSIBLE OPEN HOLE PLANTING PITS SHALL BE PERMITTED OVERNIGHT. ALL OPEN PITS SHALL BE ADEQUATELY PROTECTED BY BARRIERS OR FILLED IN WITH SOIL PRIOR TO THE END OF EACH PLANTING DAY.
18. ALL NEW WORK TO BLEND NEATLY AND SMOOTHLY WITH EXISTING CONDITIONS.

INSPECTION, MAINTENANCE & WARRANTY

19. GIVE TIMELY NOTICE TO THE LANDSCAPE ARCHITECT FOR THE REQUIRED START UP MEETING AND SITE INSPECTIONS TO REVIEW SITE CONDITIONS AND SCHEDULE FOLLOW UP INSTALLATIONS.
20. INSTALLATION OF PLANT MATERIAL PRIOR TO INSPECTION BY THE LANDSCAPE ARCHITECT WILL BE THE CONTRACTOR'S RESPONSIBILITY AND NO ADDITIONAL COSTS WILL BE CONSIDERED FOR REPLACEMENT.
21. THE LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY PLANTS, WHETHER INSTALLED OR NOT, WHICH DO NOT CONFORM TO THE SPECIFICATIONS AND/OR SITE DRAWINGS. REMOVE ALL REJECTED PLANTS FROM THE SITE IMMEDIATELY. DO NOT REMOVE ANY LABELS FROM PLANTS UNTIL PLANTS HAVE BEEN INSPECTED AND APPROVED BY THE LANDSCAPE ARCHITECT.
22. ALL PLANT MATERIAL AND WORKMANSHIP WILL BE INSPECTED AND IS UNDER WARRANTY FOR A MINIMUM OF TWO YEARS FROM DATE OF WRITTEN ACCEPTANCE OR SUBSTANTIAL PERFORMANCE, WHICHEVER IS LATER. ALL PLANT MATERIAL MUST BE IN A HEALTHY, VIGOROUS GROWING CONDITION SATISFACTORY TO THE LANDSCAPE ARCHITECT AT THE END OF THE WARRANTY PERIOD OR THEY ARE TO BE REPLACED AT THE CONTRACTOR'S EXPENSE WITH A FURTHER TWO YEAR WARRANTY PROVIDED.
23. WATERING BAGS (TREEGATOR OR APPROVED ALTERNATIVE) WILL BE USED TO WATER NEWLY INSTALLED TREES FOR THE FIRST 2 YEARS. THESE WATER BAGS ARE NOT ALLOWED TO RUN DRY OVER THE GROWING SEASON. NON-POTABLE DRIP OR SPRAY IRRIGATION CONNECTED TO A TIMER AND RAIN SENSOR SHALL BE PROVIDED FOR ALL PLANT BEDS, SOD AND SEED. THIS SYSTEM IS TO BE DESIGNED AND APPROVED BY AN IRRIGATION SPECIALIST OR ENGINEER. REGULAR & SCHEDULED MANUAL WATERING IS PERMITTED AS AN ALTERNATIVE IF APPROVED.
24. THE CONTRACTOR IS RESPONSIBLE FOR MONTHLY CLEANUP, TOPSOIL & MULCH TOP-UP, FERTILIZING AND WEEDING OF ALL SOFTSCAPED AREAS INCLUDING PLANT BEDS, SOD AND SEED DURING THE GROWING SEASON AND THROUGHOUT THE WARRANTY PERIOD UNLESS OTHERWISE INDICATED.
25. FINAL ACCEPTANCE OF THE PROJECT WILL BE CARRIED OUT UPON COMPLETION OF ALL WORK INCLUDED IN THE CONTRACT.

TOPSOIL REQUIREMENTS

26. PROVIDE MINIMUM SOIL VOLUME PER TREE AT 0.45m DEPTH FOR STREET TREES ABOVE UTILITIES, 0.9m FOR STREET TREES NOT ABOVE UTILITIES AND 1.2m IN OTHER AREAS UNLESS NOTED OTHERWISE:
    - 30 m^3 FOR LARGE TREES (MATURE CANOPY OF 5m Ø OR MORE) OR AS PER MUNICIPAL STANDARDS
    - 20 m^3 FOR SMALL TREES (MATURE CANOPY OF 5m Ø OR LESS) AND TREES IN SHARED TRENCHES OR AS PER MUNICIPAL STANDARDS
25. PREPARED SOIL MIXTURE FOR ALL TREE PITS AND OTHER PLANTINGS SHALL CONSIST OF HIGH QUALITY SOIL FREE OF CLAY LUMPS, REFUSE, DEBRIS, TOXIC AND DELETERIOUS SUBSTANCES, STONES, WOODY MATERIAL, WEED SEEDS, GRASS OR WEED ROOTS, PLANT AND SOIL PESTS, INVASIVE SPECIES AND MEET THE BELOW REQUIREMENTS UNLESS OTHERWISE INDICATED:
    - **STANDARD MIX (FOR PLANTINGS IN TURF & SEED) :**
        - TEXTURE TO BE 50–75% SAND, 20–40% SILT, AND 5–20% CLAY;
        - ORGANIC MATTER 4–6% BY DRY WEIGHT;
        - pH 6.0–7.8;
        - PHOSPHORUS 10–60 ppm;
        - POTASSIUM 80–250 ppm;
        - CALCIUM < 5000 ppm;
        - MAGNESIUM 100–300 ppm;
        - SOLUBLE SALT < 1.5 mmhos/cm;
        - INFILTRATION / PERMEABILITY / HYDRAULIC CONDUCTIVITY 50–75 mm/hr (AT 85% PROCTOR DENSITY).
    - **PLANT BED MIX (FOR PLANTINGS IN PLANT BEDS) :**
        - VOLUMETRIC MIX OF 50% TOPSOIL, 20% COARSE SAND, AND 30% ORGANIC COMPONENTS;
        - ORGANIC MATTER 4–6% BY DRY WEIGHT;
        - pH 6.0–7.8;
        - PHOSPHORUS 10–60 ppm;
        - POTASSIUM 80–250 ppm;
        - CALCIUM < 5000 ppm;
        - MAGNESIUM 100–300 ppm;
        - SOLUBLE SALT < 1.5 mmhos/cm;
        - INFILTRATION / PERMEABILITY / HYDRAULIC CONDUCTIVITY 50–75 mm/hr (AT 85% PROCTOR DENSITY).
26. EXISTING SITE SOIL FOR SEEDING, SODDING, TREE PLANTINGS AND PLANT BEDS MAY BE REUSED AS GROWING MEDIUM WHERE THE EXISTING SOIL HAS BEEN ANALYZED BY AN AGRICULTURAL SOIL SCIENTIST AND DETERMINED TO BE SUITABLE FOR ITS INTENDED PURPOSE. THE LANDSCAPE ARCHITECT AND MUNICIPALITY MUST APPROVE THE REUSE OF EXISTING SOILS AND MAY REQUIRE ADDITIONAL AMENDMENTS FOR THE SOIL WHERE RECOMMENDED BY THE SOIL REPORT. SOIL AMENDMENTS MUST BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.

TREE REMOVAL, PRESERVATION & PROTECTION NOTES

GENERAL NOTES FOR SETUP, COORDINATION & COMMENCEMENT

1. THE INTENT OF THE TREE PRESERVATION AND PROTECTION PLAN IS TO PROVIDE AN INVENTORY OF EXISTING TREES ON SITE. IT IS NOT A SURVEY AND THEREFORE THE EXACT LOCATION OF EXISTING TREES MUST BE VERIFIED ON SITE PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION WORKS.
2. ALL TREES TO BE PRESERVED SHALL BE INDICATED AND MARKED AS SUCH ON SITE BY THE CONTRACTOR AND APPROVED BY THE LANDSCAPE ARCHITECT, ARBORIST AND/OR MUNICIPAL STAFF PRIOR TO COMMENCEMENT OF CLEARING AND GRUBBING.
3. AS PART OF THE CLEARING AND GRUBBING WORK, TREES LOCATED AT THE EDGES OF ALL PRESERVATION AREAS REGARDLESS OF SIZE ARE TO BE PRUNED OF DEAD AND DISEASED LIMBS. INDIVIDUAL SPECIMENS ARE TO BE REMOVED IN ACCORDANCE WITH ACCEPTED HORTICULTURAL PRACTICES AND TO THE SATISFACTION OF THE MUNICIPALITY UNDER THE DIRECT SUPERVISION OF THE LANDSCAPE ARCHITECT OR ARBORIST.
4. IN THE EVENT THAT A TREE WHICH HAS BEEN DESIGNATED FOR PRESERVATION IS DAMAGED OR REMOVED WITHOUT PRIOR WRITTEN PERMISSION FROM THE LANDSCAPE ARCHITECT, ARBORIST AND/OR MUNICIPAL STAFF, THE CONTRACTOR AND LAND OWNER SHALL BE HELD RESPONSIBLE.
5. ALL NECESSARY TREE REMOVAL WILL BE COMPLETED OUTSIDE THE PRIMARY BIRD NESTING AND BAT ACTIVITY PERIODS (I.E., TO BE COMPLETED BETWEEN OCTOBER 1 AND MARCH 31). IF LIMITED TREE REMOVAL IS REQUIRED DURING THESE PERIODS, A SURVEY WILL BE CONDUCTED BY A QUALIFIED ECOLOGIST WITHIN TWO (2) DAYS OF THE COMMENCEMENT OF TREE REMOVAL ACTIVITIES TO DETERMINE HABITAT SUITABILITY AND/OR CONFIRM THE PRESENCE/ABSENCE OF NESTING BIRDS AND ROOSTING BATS. SHOULD A NESTING BIRD OR ROOSTING BAT BE IDENTIFIED, A MITIGATION PLAN MUST BE DEVELOPED (WHICH MAY INCLUDE DISCUSSIONS WITH RELEVANT AGENCIES) TO ADDRESS REGULATORY REQUIREMENTS.

SPECIFICATIONS FOR PRESERVATION & PROTECTION

6. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION WORKS, ALL TREES OR BLOCKS OF TREES THAT HAVE BEEN DESIGNATED FOR PRESERVATION, AS INDICATED ON THE ACCOMPANYING PLAN SHALL BE FULLY PROTECTED BY THE ERECTION OF HOARDING OUTSIDE OF OR AT THE DRIP LINE WHICH WILL BE DESIGNATED AT THE STANDARD TREE PROTECTION ZONE (TPZ) UNLESS OTHERWISE SPECIFIED. AN INSPECTION BY THE MUNICIPALITY MUST BE ARRANGED BY THE CONTRACTOR AND WRITTEN APPROVAL/PERMITS MUST BE PROVIDED BY MUNICIPAL STAFF PRIOR TO ANY SITE WORK.
7. EQUIPMENT OR VEHICLES SHALL NOT BE PARKED, REPAIRED OR REFUELED WITHIN THE TPZ. CONSTRUCTION MATERIALS SHALL NOT BE STORED AND EARTH MATERIALS SHALL NOT BE STOCKPILED WITHIN THE TPZ OF ANY TREE NOT DESIGNATED FOR REMOVAL.
8. TREES THAT ARE TO REMAIN SHALL NOT HAVE RIGGING CABLES ATTACHED OR WRAPPED AROUND THEM. NOR SHALL ANY CONTAMINANTS BE DUMPED WITHIN THE TPZ. FURTHERMORE, NO CONTAMINANTS SHALL BE DUMPED OR FLUSHED WHERE THEY MAY COME INTO CONTACT WITH THE FEEDER ROOTS OF THE TREES TO BE PRESERVED.
9. THE CONTRACTOR AND LAND OWNER SHALL TAKE EVERY PRECAUTION TO PREVENT DAMAGE TO TREES OR SHRUBS THAT ARE NOT DESIGNATED FOR REMOVAL AS PER THE ACCOMPANYING PLANS.
10. UNLESS THE PLANS SPECIFICALLY REQUIRE WORK WITHIN THE TPZ OF TREES NOT DESIGNATED FOR REMOVAL, EQUIPMENT SHALL NOT BE OPERATED WITHIN THAT TPZ & ALL WORK MUST BE DONE BY HAND WITH EXCAVATION BY HYDROVAC. ANY WORK REQUIRING THE OPERATION OF EQUIPMENT WITHIN THAT DRIP LINE SHALL BE KEPT TO THE MINIMUM AMOUNT REQUIRED. PRIOR TO THE COMMENCEMENT OF SUCH WORKS THE LANDSCAPE ARCHITECT, ARBORIST AND/OR MUNICIPAL STAFF MUST BE GIVEN WRITTEN NOTIFICATION AND WILL SUBSEQUENTLY BE REQUIRED TO OVERSEE AND INSPECT SAID WORKS.
11. THE CONTRACTOR'S OPERATION SHALL IN NO WAY CAUSE DAMAGE TO THE TRUNK OR BRANCHES OF TREES NOT DESIGNATED FOR REMOVAL. FURTHERMORE, THE CONTRACTOR'S OPERATION SHALL NOT CAUSE FLOODING OR SEDIMENT DEPOSITS IN AREAS WHERE TREES ARE TO BE PRESERVED.
12. IF AN EXISTING TREE IS DAMAGED DURING CONSTRUCTION THEN THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SAID TREE AT HIS EXPENSE AND REPLACING IT WITH A SIMILAR PLANT(S) AT A SIZE AND QUANTITY THAT MEETS THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND/OR MUNICIPAL STAFF.
13. IN THE EVENT THAT IT IS NECESSARY TO REMOVE LIMBS OR PORTIONS OF TREES NOT DESIGNATED FOR REMOVAL, WRITTEN APPROVAL AND DIRECTION MUST BE GIVEN BY THE LANDSCAPE ARCHITECT, ARBORIST AND/OR MUNICIPAL STAFF PRIOR TO ANY WORKS. THE REMOVALS MUST BE EXECUTED CAREFULLY AND IN ACCORDANCE WITH STANDARD ARBORICULTURAL & HORTICULTURAL PRACTICES AND TECHNIQUES.
14. IN THE EVENT THAT GRADES AROUND A TREE DESIGNATED FOR PRESERVATION ARE TO BE CHANGED, THE CONTRACTOR SHALL BE REQUIRED TO TAKE PRECAUTIONS TO PRESERVE THE TREE THROUGH HAND, AIR OR HYDRO EXCAVATION, DRY WELLING, ROOT PRUNING AND ROOT FEEDING. ALL WORK AND PROTECTION MEASURES MUST BE UNDERTAKEN TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND MUNICIPAL STAFF. ALL OF SUCH WORK IS TO BE OVERSEEN BY AN ARBORIST.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND/OR REMOVAL OF DEAD, DYING, DISEASED TREES WITHIN THE LIMIT OF THIS PLAN UNTIL END OF THE MAINTENANCE PERIOD.
16. PROPER HORIZONTAL TREE PROTECTION MEASURES MUST BE INSTALLED BY THE CONTRACTOR PRIOR TO ANY WORK WITHIN THE TPZ. TEMPORARY HOARDING OR OTHER SUPPLEMENTARY TREE PROTECTION MEASURES MUST ALSO BE AS DIRECTED BY THE LANDSCAPE ARCHITECT, ARBORIST OR MUNICIPAL STAFF AND AT NOT ADDITIONAL COST TO THE OWNER.

LOCATION MAP



GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

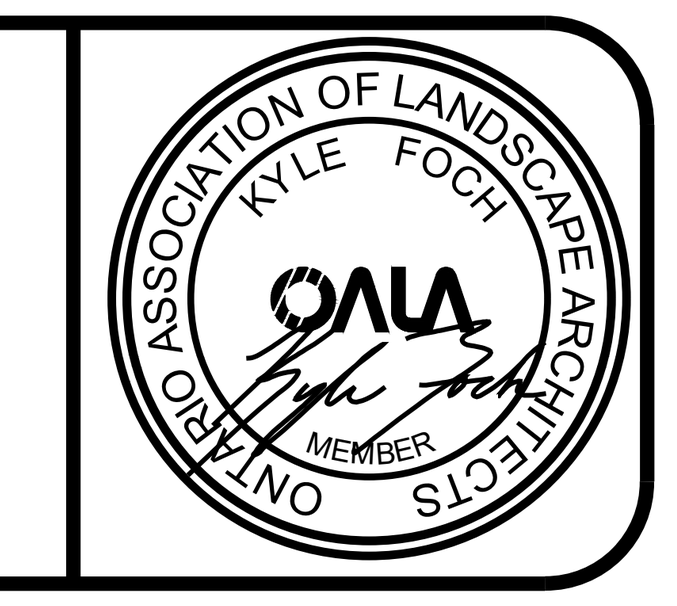
CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

NO.	DATE	NOTES	BY
1	2026-11-18	ISSUED FOR TENDER	RN

THESE LANDSCAPE DRAWINGS SHALL ONLY BE USED FOR THE PURPOSES INDICATED BELOW AS NOTED AND WHEN SIGNED BY THE CONSULTING LANDSCAPE ARCHITECT.

- [ ] CONCEPTUAL
- [x] TENDER
- [ ] PRELIMINARY
- [ ] CONTRACT
- [ ] SITE PLAN
- [ ] CONSTRUCTION
- [ ] PERMIT
- [ ] AS-BUILT



HKLA
HENRY KORTEKAAS + ASSOCIATES INC.
Landscape Architects & Consulting Arborists
230 Westney Road S Unit 308, Ajax, ON L1S 7J5
O: (905) 839-5599 \\ Email: info@hkla.ca \\ Web: www.hkla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED, AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

SPA FILE #

PROJECT: HEYDON PARK RENOVATION
TDSB

DRAWING: NOTES

DRAWN BY: CT	SCALE: AS SHOWN	L-N1
CHECKED BY: KF	DATE: 2026-09-15	DRAWING 8 of 8
JOB NO.: 2026-082		

File #2026-082

APPENDIX D - REFERENCES

References

1. Council of Tree Landscape Appraisers. 2016. Guide for Plant Appraisal. 10th Edition. International Society of Arboriculture.
2. International Society of Arboriculture of Ontario. 2016. Ontario Supplement to Guide for Plant Appraisal 10th Edition. Ontario Chapter, International Society of Arboriculture.
3. City of Toronto. 2019. Urban Forestry Services. www.Toronto.ca/trees .
4. City of Toronto. 2019. Tree Protection Policy and Specifications for Construction near Trees (including detail PD-101). Toronto Parks, Forestry & Recreation.
5. City of Toronto. 2019. Application to Injure or Destroy Trees. Toronto Parks, Forestry & Recreation.
6. City of Toronto. 2019. Information about the Ravine and Natural Feature Protection By-Law Municipal Code Chapter 658. Toronto Parks, Forestry & Recreation.
7. City of Toronto. 2022. Toronto Municipal Code Chapter 813 (Trees).
8. City of Toronto. Detail HTP-1. Horizontal Tree protection Toronto Parks, Forestry & Recreation.