

HWDSB

SPECIFICATIONS

INTERIOR RENOVATIONS TO WATERDOWN SECONDARY SCHOOL

**215 PARKSIDE DRIVE,
WATERDOWN, ONTARIO**

BJC

architects + assoc. inc.

**INTERIOR RENOVATIONS TO
WATERDOWN SECONDARY SCHOOL**

**215 PARKSIDE DRIVE,
WATERDOWN, ONTARIO**

**ISSUED FOR TENDER
PROJECT NO 23-075
MARCH 2024**

SPECIFICATION

for

**INTERIOR RENOVATIONS TO
WATERDOWN DISTRICT HIGH SCHOOL**

**215 PARKSIDE DRIVE
WATERDOWN, ONTARIO**

for

**HAMILTON-WENTWORTH DISTRICT SCHOOL BOARD
20 EDUCATION COURT
HAMILTON, ONTARIO**

PREPARED BY

**BJC architects + assocs. inc.
R.R. #2, 8016 HIGHWAY #7
GUELPH, ONTARIO
N1H 6H8**

PROJECT NO. 23-075

MARCH 2024

**INTERIOR RENOVATIONS TO
WATERDOWN DISTRICT HIGH SCHOOL
215 PARKSIDE DRIVE
WATERDOWN, ONTARIO**

PROJECT NO. 23-075

OWNER:

Hamilton-Wentworth District School Board
20 Education Court
Hamilton, Ontario
L9A 0B9

ARCHITECT:

BJC architects + assocs. inc.
R.R. #2, 8016 Highway #7
Guelph, Ontario
N1H 6H8
Tel: 519-822-7390
Fax: 519-822-5881
Email: Barry.Johnson@bjcarchitects.com
Attn: Mr. Barry R. Johnson

ENGINEERS:

MECHANICAL/ELECTRICAL:

SAB Engineering Inc.
588 Edward Avenue, Unit #25
Richmond Hill, Ontario
L4C 9Y6
Tel: 905-787-8771
Attn: Ms. Gabriela Stashun

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(Bidder) _____

(Owner) _____

Dated _____ and which is an integral part of the Bid Form.

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DIVISION 01 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 GENERAL REQUIREMENTS

- .1 Contractor to supply and install all equipment and items not supplied and installed by Owner.
- .2 Contractor to provide all services ready for hook-up for all Owner supplied and installed equipment and items requiring mechanical and/or electrical services.
- .3 The Contractor will make final connections for all equipment indicated.
- .4 Reference to the Contractor (G.C) in this document is not meant to be trade specific, or to imply specific responsibility.

3.0 DESCRIPTION

- .1 The following is a general summary of the work and equipment to be provided by the Owner under Other Contracts related to the project as well as material provided by the Owner for installation by the Contractor. These Other Contracts may be referred to as Furniture, Fixtures and Equipment or F.F. & E. This work will be installed by the Owner with his own Contractors. This Contractor is to co-ordinate his work and his subcontractor's work, with the Owner's Contractors and provide construction and connections required for the proper installation of the Owner's work and equipment
- .2 The Contractor is required to co-ordinate, schedule and supervise the Owner's Contractors in order to ensure that the quality of the workmanship of the Owner's Contractors is of a high level and consistent with that of the rest of the Contract. The Contractor shall reject unacceptable work and request that it be redone.
- .3 Ensure that the fastenings, connections, access panels, supports and such other requirements as may be necessary for the installation of the Owner's work are installed in the proper locations and that the Owner's Contractors have a layout of the installations indicating service connections access panels, supports and fastenings.
- .4 If the Contractor does not make the Owner's Contractor aware of requirements for the work to be installed under the F.F. & E. contract, this Contractor shall assume responsibility for any additional work and costs.

3.0 DESCRIPTION (CONT'D)

- .5 The Contractor is required to receive, store, log in binder and accept the delivery of Owner furnished items to the site, arrange for their storage and protection, and take responsibility for loss or damage until such items are taken over by Owner's Representatives. Contractor is to ensure that all invoices are received and recorded. Provide a duplicate copy to the Owner's Project Manager.
- .6 The Contractor is to identify ALL equipment when received and label with the proper tags attached. The contractor is to use the Equipment location on drawings as a basis for identification and location.

4.0 MATERIALS

- .1 The following is a general list of items, which are supplied by the Owner, and installed by the Contractor. This list is not exclusive of any items which are shown or noted on the drawings.
 - .1 Soap Dispensers
 - .2 Paper Towel Dispensers
 - .3 Toilet Paper Dispensers

5.0 PREPARATION AND INSTALLATION

- .1 Provide Owner with a schedule of dates listing required delivery dates for installation of Owner items.
- .2 Co-ordinate, schedule and supervise the Owner's sub Contractors. Co-ordinate the location of work with Owner's Contractor.
- .3 Make arrangements to allow access to the work or for Owner's Contractor and for receiving and storing materials.
- .4 Protect work and property of Owner stored or installed on site.
- .5 Do not overload structure beyond its design capacity when storing Owner's materials.
- .6 Co-ordinate location for storing with Owner's Contractor.
- .7 Schedule this finish work at the end of construction when interference from tradesmen is at a minimum.
- .8 Do not allow heavy or rough items to rest against finished surfaces. Do not store materials on finished carpeting.
- .9 Owner's Contractor will be responsible for protection of their finished surfaces, but care must be taken not to break these coverings.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 CASH ALLOWANCES

- .1 Refer to GC 4.1.
- .2 Include in the Contract Price, cash allowances stated herein.
- .3 Cash Allowances, unless otherwise specified, cover the net cost to the Contractor, Subcontractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, and other authorized expenses incurred in performing the Work.
- .4 The Contract Price will be adjusted by written order to provide for an excess or deficit to each cash allowance.
- .5 Where costs under a cash allowance exceed the aggregate amount of all allowances, 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.
- .6 Progress payments on accounts of work authorized under cash allowance shall be included in the Architects monthly certificate for payment. The Contractor shall include copies of invoices with the progress billing.
- .7 A schedule shall be prepared jointly by the Architect and the Contractor to show when items called for under cash allowances must be authorized by the Architect for ordering purposes so that the progress of the work will not be delayed.
- .8 HST (Harmonized Sales tax) are not included in Cash Allowance.
- .9 Unexpended portions of the cash allowances will be credited to the Owner by written change order as Cash Allowance Reconciliation.
- .10 Any required Mechanical and Electrical allowances to be carried by the General Contractor. Allowances shown below shall be carried by the General Contractor.
- .11 Include all Cash Allowances in the total Bid Price.

2.0 CASH ALLOWANCES (CONT'D)

- .12 "Supply Only", Allowances shall include:
- .1 Net cost of Products.
 - .2 Delivery to Site.
 - .3 Applicable taxes and duties, excluding HST.
- .13 "Supply and Install", Allowances shall include:
- .1 Net cost of Products.
 - .2 Delivery to Site.
 - .3 Unloading, storing, handling of Products on Site.
 - .4 Installation, finishing and commissioning of Products.
 - .5 Applicable taxes and duties, excluding HST.
- .14 "Inspection and Testing", Allowances shall include:
- .1 Net cost of inspection and testing services.
 - .2 Applicable taxes and duties, excluding HST.
- .15 Other costs related to work covered by Cash Allowances are not covered by the allowance but shall be included in the Contract Amount.
- .16 Contractor to submit for review a minimum of 3 written competitive quotes for allowances as per the Supplemental Conditions.
- .17 Cash Allowances are as follows to be carried in Bid Amount by General Contractor:
- .1 Cash Allowances: including Signage & Testing & Inspections \$ 12,000.00
- .18 **Total Cash Allowances listed in items 17.1 is to be Included in Bid Amount.** \$ 12,000.00
- .19 In accordance with G.C.4.1.2 Cash Allowances will not be subject to any Contractor mark-up.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 CLARIFICATIONS

- .1 Request written clarifications when the meaning or intent of the Contract Documents is unclear.
- .2 Do not proceed with the related parts of the work until clarification is received.
- .3 Failure to notify the consultant when the Contract Documents are unclear or inconsistent will result in the Contractor incurring the responsibility for resulting deficiencies and all additional costs.
- .4 Clarification to the Contract Documents will be issued by the Consultant through Supplemental Instruction (S.I).
- .5 Clarifications issued by the Consultant are deemed to supersede the relevant parts of the Contract Documents, regardless whether those documents are cited in the written clarification.

3.0 REQUESTS FOR INTERPRETATION

- .1 The Contractor may, after exercising due diligence to locate the required information, request from the Consultant, Clarification or Interpretation of the Contract Documents. Herein referred to as a Request For Interpretation (RFI).
- .2 Include a detailed description of the Contractors review of the Contract Documents leading up to the issuance of the RFI. Requests for Interpretation that fail to include a detailed review description, or whose description is insufficient in the opinion of the Consultant, may not be considered and may be rejected.
- .3 Maintain a log of RFI's sent to and responses received from the Consultant, complete with corresponding dates. Include an updated RFI log with each Project Meeting set of minutes.
- .4 Submit RFI's to Consultant sufficiently in advance of affected parts of the work so as not to cause delay in the Work. Additional costs incurred as a result of failure to submit an RFI in sufficient time will not be reimbursed by the Owner.

3.0 **REQUESTS FOR INTERPRETATION (CONT'D)**

- .5 RFI's will only be received from the Contractor. RFI's received directly from Subcontractors or Suppliers will not be considered.
- .6 Submit RFI's individually per submission, numbered consecutively, in a single sequence, in order submitted.
- .7 The Consultants response to the RFI will not be considered a Change Order or Change Directive, nor does it authorize changes in the Work, the Contract Price and the Contract Time.
- .8 If the information requested in an RFI is apparent from field observations, is contained in the Contract Documents or is reasonably inferable from them, the Contractor shall be responsible to the owner for reasonable costs charged by the Consultant for additional services required to prepare and issue such information.

4.0 **CHANGE ORDERS**

- .1 Refer to GC 6.2.
- .2 When a change in the work is contemplated the Consultant will issue a "Proposed Change (P.C.)".
- .3 Upon receipt of the change request, the Architect will initiate the change order process and determine if additional consultants will be required for comment.
- .4 General Contractor upon notification of the change order request, the GC will go out to the trades for pricing and complete their portion of the change order. Within five (5) of date of issue of a P.C., the General Contractor shall submit a detailed breakdown of the cost of the Proposed Change P.C. including a breakdown of materials, labour rates and costs for all parties, involved in the Change.
- .5 The valuation of changes in the work may include fees for overhead and profit as follows:
 - .1 Profit and overhead charges will be calculated on the net difference in the cost of the changes.
 - *.2 Over head charges and not the cost breakdown will include supervision, superintendent, project management, administrative and clerical costs.
 - .3 Increase to bonding and insurance is to be shown separate when applicable.
 - .4 Identify any affects to the Baseline Schedule.

4.0 **CHANGE ORDERS (CONT'D)**

- .5 Once the value of the Proposed Change is approved by the Consultants and Owner a Change Order signed by the Owner will be issued with the same corresponding number.
- .6 H.S.T. shall be shown separately.
- .7 For clarity, no mark up or other charges shall be permitted for overhead and profit where the change results in a net decrease (credit) to the contract price.

5.0 **CHANGE DIRECTIVES**

- .1 Refer to GC 6.3.
- .2 When a change in work is required to maintain an item or critical path of the construction schedule and timing does not permit the Owner to review pricing from the General Contractor before approving the work, a "Change Directive (C.D.)" will be issued.
- .3 The "Change Directive (C.D.)" will describe the work in short form and may include sketches or drawings to describe the work.
- .4 Within 10 days of date of issue of a C.D., submit a breakdown of the costs for the Change Directive, including breakdown of material, labour rates and costs for all parties involved in the change. The G.C. will provide all sufficient details and information necessary for the Consultants and Client to review and assess the costs.
- .5 The valuation of changes in the work may include fees for overhead and profit as follows:
 - .1 Profit and overhead charges will be calculated on the net difference in the cost of the changes.
 - *.2 Over head charges and not the cost breakdown will include supervision, superintendent, project management, administrative and clerical costs.
 - .3 Increase to bonding and insurance is to be shown separate when applicable.
 - .4 Identify any affects to the Baseline Schedule.
 - .5 Once the value of the Proposed Change is approved by the Consultants a Change Order signed by the Owner will be issued with the same corresponding number.
 - .6 H.S.T. shall be shown separately.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 CODES AND STANDARDS

- .1 Execute Work in accordance with National Building Code of Canada (NBC) or relevant Provincial Code, wherever is applicable in the Place of the Work, all Provincial amendments and all codes and standards specified within the text of this specification.
- .2 Conform to the latest issue of codes and standards specified, as amended and revised on date for receipt of tenders.

3.0 GENERAL CONDITIONS

- .1 Coordination of the work of all Sections of the Specifications as required to complete the Project is the responsibility of the Contractor.
- .2 The Contractor will be deemed to possess the necessary technical skills to carefully evaluate all requirements of the Contract, and to have included in the Stipulated Price all project coordination and supervision for the proper implementation of these requirements.
- .3 Entry by the Owner's own forces and by Other Contractors shall not mean acceptance of the Work and shall not relieve the Contractor of their responsibility to complete the Contract.
- .4 Placing, installation, application and connection of work by the Owner's own forces or by the Other Contractors on and to the Contractor's Work shall not relieve the Contractor of his responsibility to provide and maintain the specified warranties.

4.0 CONTRACT SUBMISSIONS

- .1 At the commencement of the Contract submit the following:
 - .1 Performance and payment bonds.
 - .2 Public Liability and Property Damage Insurance Certificates.
 - .3 Fire Insurance Policy.
 - .4 List of Subcontractors by Firm name.

4.0 **CONTRACT SUBMISSIONS (CONT'D)**

- .5 Permits as required by the work.
- .6 Contract cost breakdown by subtrade, schedule of values and detailed breakdown.
- .7 Construction Schedule
- .8 Notice of Project (NOP)
- .9 Workplace Safety & Insurance Board (WSIB) Certificate

5.0 **SPECIFICATIONS**

- .1 Sections of the Specifications are numbered in conformance with the 2012 Master List of Section titles and Numbers, CSC Document 004E, published jointly by Construction Specifications Canada and the Construction Specifications Institute (USA). Sections are arranged in their Standard Master format Divisions 03 to 32.
- .2 Sections are written as units of the Work which have been assigned numbers in conformance with the CSC/CSI system. They are arranged in sequence for this Specification. Gaps in the order of numerical sequence do not indicate that a section is not required for completion of the Work, but rather the scope of work for particular section does not warrant a specification.
- .3 The Owner and his Consultants will not arbitrate on any dispute between the General Contractor and its subcontractors or suppliers as to the limits of their responsibilities.
- .4 The provisions of all Sections of Division 01 shall apply to each Section of Divisions 03 to 32, inclusive, which are included in the Specifications.
- .5 Division 01, General Requirements, of the Specifications generally specifies work and coordination that is the direct responsibility of the Contractor, but shall not be interpreted to define absolutely the limits of responsibility that must be established between the Contractor and his Subcontractors by their separate agreements.
- .6 Ensure that Subcontractors understand that the General Conditions of the Contract, Supplementary Conditions, and Division 01, General Requirements, apply to Sections of the Specifications governing their work.
- .7 It is intended that Work supplied under these Contract Documents shall be complete and fully operational in every detail for the purpose required. Including materials not herein mentioned, but which may be found necessary to complete or perfect any portion of Work in accordance with the Contract Documents.

5.0 SPECIFICATIONS (CONT'D)

- .8 Work in the Specifications is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractors. The Contractor shall organize division of labour and supply of materials essential to complete the Project in all its parts and provide a total enclosure and protection from weather of interior spaces, as established in the General Conditions of the Contract.
- .9 Specifications, Schedules and Drawings are complementary, and items mentioned or indicated on one may not be mentioned or indicated on the others.
- .10 Mention in the specifications or indication on the drawings of materials, Products, operations, or methods, requires that the Contractor Provide each item mentioned or indicated of the quality or subject to the qualifications noted; perform according to the conditions stated each operation prescribed; and provide labour, materials, Products, equipment and services to complete the Work.
- .11 Where the singular or masculine is used in the Contract Documents, it shall be read and construed as if the plural, feminine or neuter had been used when the context or the statement so requires and as required to complete the Work, and the rest of the sentence, clause, paragraph, or Article shall be construed as if all changes in grammar, gender or terminology thereby rendered necessary had been made.
- .12 Work designated as "N.I.C." is not included in this Contract.
- .13 Wherever the Contract Documents the word "include" is used in any form, the item of Work listed following shall be interpreted to be restricted to only those items that are listed.
- .14 Wherever in the Contract Documents the words "indicated" or "shown" are used they shall apply as meaning "indicated on Drawings" or "shown on Drawings" unless the context expresses another meaning.
- .15 Wherever the Specification is specified that work to which reference is made shall proceed or shall meet approval, direction, selection or request of jurisdictional authorities or others, such approval, direction, selection or request shall be in writing.
- .16 Wherever in the Specifications it is specified that work shall be repaired, make good or replaced, it shall be performed without any additional cost to the Owner.

6.0 ERRORS AND OMISSION

- .1 If errors or omissions are observed in the Contract Documents, immediately notify the Consultant in writing of all such errors or omissions. In the event no such notice is given, the contractor will be held responsible for the results of any such error or omission and the cost of rectifying the same.

7.0 **SUPPLEMENTARY DEFINITIONS**

- .1 In the Specification, reference such as "Shown on the Drawings", "Specified", "Scheduled", "Called for" and the like shall be deemed to include work required by any of the Contract Documents.
- .2 In the Specifications the expression Trade(s) is synonymous with Subcontractor(s) if the context permits. The expression "All Trades" shall be deemed to include the Contractor.
- .3 When the "Work Included", optional listing, is included in the Specification, the statement "Work Included" is not intended to "Scope" the section or to imply a trade responsibility. "Work Included" is merely a convenient listing of the significant items described within the section. "Work Included" must be read in conjunction with related work and the total specification in order to specify the item that could be referenced somewhere else in the specification. "Work Included" is not a critical portion of the specification and is intended only as a quick reference guide. The specification section integrity or completeness does not require its inclusion.
- .4 Wherever the word "building" occurs in the Contract Documents it shall be taken to mean all the buildings included in the Contract.
- .5 Wherever in the Contract Documents the words "approval" "approved", "direction", "directed", "selection", "selected", "request", "requested", "report", and similar requests and
- .6 Wherever in the Contract Documents the word "provide" is used in any form it shall mean that the Work concerned shall include both supply and installation of the products required for completion of that part of the Work.
- .7 Wherever in the Specification it is specified that Work is to proceed or to meet approval, direction, selection or request of jurisdictional authorities or others, such approval, direction, selection or request shall be in writing.
- .8 Wherever in the Contract Documents the word "G.C." is used, it means General Contractor.

8.0 **SATISFACTION/ APPROVAL**

- .1 The expression "to the satisfaction or approval of the Architect" shall be implied throughout the Specification in regard to all materials and workmanship.
- .2 "Submit for approval" means that the item in question is to be submitted to the Architect for approval and that a written acceptance of it and authorization for its use in the work shall be obtained before it is incorporated in the work. Trades shall submit items for approval to the Consultant via the Contractor.
- .3 An "approved method" means that which has the manufacturer's recommendation, or which is generally accepted as good trade practice. The Architect's approval is also required.

9.0 SITE REGULATIONS

- .1 All on site activities must be coordinated with Owner.
- .2 The General Contractor must conform to the Landlords "Building Regulations & Contractors Regulations "such as listed but not limited to the following:
 - Clean-up
 - Safety
 - Material handling & hoisting
 - Scheduling
 - Deliveries
 - Hours of work
 - Temporary Services
- .3 Pay all charges imposed by the Regulations or resulting from failure to comply with the regulations.
- .4 Provide the owner with copies of such non-compliance charges.

10.0 WORKING LIMITS / USE OF SITE

- .1 Accept full responsibility for assigned work areas from the time of Contract award until Total Completion of the Work.
- .2 The Contractor shall confine construction equipment, temporary work, storage of products, waste products & debris and operations of Employees and sub contractors to limits indicated by laws, ordinances, permits, or the Contract Documents and shall not unreasonably encumber the place of work.
- .3 Check means of access and egress, rights and interests which may be interfered with. Do not block lanes, roadways, entrances and exits. Direct construction traffic and locate access to site as directed by municipality.
- .4 Where encroachment beyond property limits is necessary make arrangements with respective property Owners.
- .5 Provide protection to existing underground services during construction period.

11.0 NO SMOKING POLICY

- .1 The Owner has a no smoking policy for its premises.
- .2 No smoking will be allowed on this property.
- .3 Offenders will be asked to leave the site.

12.0 SITE DELIVERIES

- .1 All deliveries to site must be scheduled due to the limited amount of space within the building and on the site.

12.0 SITE DELIVERIES (CONT'D)

- .2 The General Contractor shall provide all necessary security and protection for safe storage on site and within the building.

13.0 SITE WORKS

- .1 The General Contractor shall confine all equipment, debris, offices and storage to the defined work site.

14.0 EXAMINATION

- .1 Each Trade shall examine surfaces prepared by Other Trades which effect its work and shall ensure that defects are corrected. Commencement of work shall imply acceptance of prepared work.
- .2 All Trades shall check and verify with the Contractor all surfaces, dimensions and figures shown on drawings, (especially those pertaining to the work of more than just their trades) and notify the Owner of any discrepancies found herein so that they may be corrected as necessary. The General Contractor will be held responsible for any error resulting from his failure to exercise such precautions.
- .3 Any dimensions of existing works or structure are approximate and the General Contractor must take actual measurements before ordering materials, equipment and the like. Failure to comply with this requirement shall make the General Contractor fully responsible for replacing unsuitable material or equipment as necessary. All costs incurred therewith shall be borne by the General Contractor.
- .4 All details and measurements of any work which is to fit to, or conform with, work already installed by Other Trades, shall be taken at the job site by the Trades concerned, prior to shop drawings submission, fabrication and installation.

15.0 EXISTING SERVICES

- .1 The Owner will not be liable for any loss, damage, delay or claim whatsoever resulting or arising from the absence in whole or in part of services.
- .2 Without limiting the generality of the foregoing, this includes roads, water, storm and sanitary services, electricity, data, communication, satellite, fibre optics and condition of drainage from or to the site.
- .3 This Contractor is to maintain all existing services during the demolition & construction phases of this project. Location of existing underground utility lines indicated on drawings is schematic only. Prior to start of Work, locate and mark exact locations of underground services, which are within or adjacent to the construction area.
- .4 Supply and install all materials, labour & equipment as required to maintain these services during the phasing of the project.

15.0 EXISTING SERVICES (CONT'D)

- .5 Refer to proposed phasing in drawings and final approved submitted phasing schedule by G.C. to define scope.

16.0 BURIED SERVICES

- .1 Make all necessary enquiries and employ all necessary services to determine the location of any existing services such as hydro, telephone, data/communication, water, gas, sewer, etc. This applies to interior as well as exterior work, whether represented on the contract drawings or not, and within designated easements.

17.0 EMERGENCIES

- .1 Notify the Architect and Owner immediately should an emergency arise on the site, including personal injuries and accidents. Provide complete details on extent of emergency, cause and the action being taken. This notification shall be by telephone or telegram immediately after the occurrence.

18.0 FIELD MARKING

- .1 Do not use wick pens to mark face of products to be installed in the work. Such pen marks will show through applied paint or vinyl coatings in due course. The Contractor will be held responsible and required to remedy such defects, classified as "latent defects" regardless of when they occur.

19.0 TRADEMARKS AND LABELS

- .1 Trademarks and labels, including applied labels shall not be visible in the finished work. Such trademarks or labels shall be removed by grinding if necessary or painted out where the particular material has been painted.
- .2 The exception of this requirement shall be those essential to obtain identification of mechanical and electrical equipment and those required to be visible by Authorities having jurisdiction and those on plumbing fixtures and trims.

20.0 TEMPORARY WORK

- .1 All work damaged by temporary installation shall be repaired and made good at no expense to the Owner.

21.0 MECHANICAL AND ELECTRICAL WORK

- .1 Coordination of the installation of systems specified in Divisions 22, 23, 26 and 28, including the interrelating operation and functioning between components of a system and between systems, is the responsibility of those performing the work of Divisions 22, 23, 26 and 28 with final coordination the responsibility of the Contractor.

21.0 MECHANICAL AND ELECTRICAL WORK (CONT'D)

- .2 Ensure that service poles, pipes, conduit, wired, fill-pipes, vents, regulators, meters and similar Project service installations are located in inconspicuous locations. If not indicated on Drawings, verify location of service installations with Consultant before commencing installation.
- .3 Install and arrange ducts, piping, tubing, equipment and fixtures in such a way as to conserve headroom and space as much as possible, to provide minimum interference and to be neat, orderly and tidy. Unless otherwise noted, run pipes, duct, tubing and conduit, vertical, horizontal and square with building grid. Conceal pipes, ducts, tubing and conduit above ceiling, rooms and unfinished spaces, unless indicated or specified otherwise. Maximum ceiling heights must be maintained. Dimensions on drawings constitute minimum standards.
- .4 The general intent is that the Contractor shall include for all cutting and patching indicated on the Mechanical and Electrical Drawings and as required to meet the requirements and Specifications Division 20,21,22, 23, 26, 27 and 28 unless requirements are not given, in which case the Trades shall assume all costs.

22.0 CO-ORDINATION

- .1 Co-ordinate all Work in each area and Work on which subsequent Work depends to facilitate mutual progress, and to prevent conflict between parts of the Work.
- .2 Ensure that each Section makes known, for the information of the Contractor and other Sections, the environmental and surface conditions required for the execution of its Work; and that each Section makes known the sequence of others' Work required for installation of its Work.
- .3 Ensure that each Section before commencing Work, knows requirements for subsequent Work and that each Section is assisted in the execution of its preparatory Work by Sections whose Work depends upon it.
- .4 When work is to be installed above ceilings, adequate clearance must be maintained to allow for access, repairs, and removal of all devices without adjusting ceiling heights. Each Contractor shall be responsible for protecting his installation from being blocked off by others. Should this condition occur, he shall bring the matter to the attention of the other Contractor for correction.
- .5 Each Subcontractor shall be responsible for any layout associated with the performance of his work. Should a subcontractor's work be subsequent to the contingent upon layout by another, he shall check said layout prior to proceeding with his work, reporting any discrepancies to the General Contractor. Proceeding with the layout shall be considered as acceptance of the layout.

22.0 CO-ORDINATION (CONT'D)

- .6 Ensure that setting drawings, templates and all other information necessary for the location and installation of materials, holes, sleeves, inserts, anchors, accessories, fasteners, connections and access panels are provided by each Section whose Work requires co-operative location and installation by other Sections and that such information is communicated to the applicable installer.
- .7 Deliver materials supplied by one Section to be installed by another well before the installation begin.
- .8 Sections giving installations information in error, or too late to incorporate in the Work, shall be responsible for having Work done which was thereby additionally made necessary.
- .9 Remove Work installed in error which is unsatisfactory for subsequent Work.
- .10 Pay cost of extra work caused by and make up time lost as a result of failure to provide necessary co-operation, information or item to be fixed to or built-in, in adequate time.
- .11 Provide interference drawings for submission to consultants and for review if conflicts exist, prior to fabrication or installation.

23.0 CUTTING AND PATCHING

- .1 Before cutting, drilling, or sleeving structural load-bearing elements, obtain approval of location and methods.
 - .1 Submittals:
 - .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of 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.

23.0 CUTTING AND PATCHING (CONT'D)

- .2 Do not endanger Work or property by cutting, digging, or similar activities. No Section shall cut or alter the Work of another Section who has installed it unless approved by that Section.
- .3 Cut and drill with true smooth edges to minimum suitable tolerances.
- .4 Fit construction tightly to ducts, pipes and conduit to stop air movement completely. The Section performing Work that penetrates a fire, air, vapour, moisture, thermal or acoustic separation element of the building shall pack voids tightly with insulation; seal air, vapour and moisture barriers; and caulk joints as may be required to ensure that no air movement through the penetration is possible.
- .5 For Firestopping refer to Section 07 84 00.
- .6 Cutting, drilling and sleeving of Work shall be done only by the Section who has installed it. The Section requiring drilling and sleeving shall inform the Section performing the Work of the location and other requirements for drilling and sleeving. The Contractor shall directly supervise performance of cutting and patching.
- .7 Replace, and otherwise make good, damaged Work. Make the affected parts of the affected work come together properly.
- .8 This Section shall be responsible for all cutting and patching in addition to that specified for mechanical and electrical Work.
- .9 Patching or replacement of damaged Work shall be done by the Subcontractor under whose Work it was originally executed, and at the expense of the Subcontractor who caused damage.
- .10 Make patches invisible in final assessment.

24.0 LINTELS AND BRIDGING

- .1 The Contractor shall ensure correct formation and bridging of openings in masonry and structural walls required by the Trades. Conform with lintel requirements shown on Structural Drawings or Standard Details.

25.0 FASTENINGS

- .1 Use exposed metal fasteners and accessories of a permanent type that are of same texture, colour and finish as base metal on which they occur.
- .2 Keep exposed fasteners to a minimum, evenly spaced and neatly laid out. Show on Shop Drawings.

25.0

FASTENINGS (CONT'D)

- .3 Use metal fasteners of the same materials as the metal component they are anchoring or of a metal which will not set up an electrolytic action which would cause damage to the fastening or component.
- .4 Use fasteners of a type and size and install them in a manner to provide positive anchorage of the unit to be anchored in position. Install anchors at required spacing to provide required load bearing or shear capacity.
- .5 Fasteners which cause spalling or cracking of material to which anchorage is being made are not permitted.
- .6 Limitations for Use of Powder Actuated Tools:
 - .1 The use of powder actuated fasteners is prohibited.
 - .2 Where such authority is given, it will be for low velocity type powder actuated fasteners and for horizontal application only.
 - .3 Fasteners shall not be nearer than 63 mm (2 ½ inch) to the edge of any cast-in-place formed concrete member.
 - .4 The manufacturer of the equipment selected, Ramset, Hilti or equal, shall send a representative to the site to demonstrate the equipment prior to its use, and this representative shall make periodic inspections to ensure compliance with instructions issued by him and correct application of material. In all cases a shield shall be used where fasteners are to be applied to concrete. The use of fasteners in pre-cast concrete is to be avoided if possible as there is an increased tendency to shatter surfaces.
 - .5 Under no circumstances shall such fasteners be used on concrete members less than 75 mm (3 inch) in thickness.
 - .6 Such fasteners shall not be in areas where corrosion can take place, for instance due to high humidity or condensation.
- .7 Generally use support anchorage of cast-in-place type set into concrete forms prior to pouring concrete, or self-drilling type such as "Red Head" T-32 tie wire type. When drilling upwards, use jig to hold drill steady and plumb.
- .8 Provide pull-out tests on anchors, or otherwise test to ensure anchorage is sufficient for the particular application including a minimum safety factor of seven. Provide evidence of such tests if requested.
- .9 Submit samples of proposed anchoring or hanging devices with technical data and test data.

26.0 FIRE SAFETY PLAN

- .1 Submit a detailed Fire Safety Plan as required by the local Authorities Having Jurisdiction.
- .2 Post Fire Safety Plans on backboards complete with Lexan cover in all locations requested by local Authority.
- .3 Plans required to be posted on the exterior of the building are to be etched on aluminium and sufficient to hold up to weather conditions.
- .4 Provide lockable 'Fire Safety Boxes' located per local Authority.
- .5 Provide copies of plans and documents with As-Built submissions.
- .6 Provide letter of approval from local Authorities to Architect.

27.0 PROGRESS PHOTOS

- .1 The General Contractor shall submit a comprehensive, chronological collection of photos of the site, building interior, building exterior, roof, interior finishes, Mechanical & Electrical equipment, building foundations & structure, equipment, millwork and any Key Note events recording the work as it progresses.
- .2 A minimum of 12 Photos in colour, are to be taken weekly in a jpeg format and submitted by **E Mail**.
- .3 Additional photos may be requested by Owner and Consultant if required.
- .4 Identify all photos with project name, a description, date and time.

28.0 SITE PROGRESS RECORDS

- .1 Maintain at site a permanent written record of progress of the Work. Make the record available at all times with copies provided when requested. Include in record each day:
 - .1 Commencement and completion dates of the work of each trade in each area of Project.
 - .2 Attendance of Contractor's, Subcontractor's, Owners Sub trade work forces at Project and a record of the work they perform.
 - .3 Visits to site by Owner, Consultant, jurisdictional authorities, testing companies, Contractor Subcontractors, and supplies.
- .2 Maintain a progress chart in a format approved from sample submitted. Show on chart proposed construction schedule and the progress achieved by Contractor and each Subcontractor.

29.0

PRE-CONSTRUCTION CONFERENCE

- .1 Immediately prior to construction, upon notification attend a pre-construction conference, along with authorized representatives of certain sub-contractors as specifically indicated in conference notice. Purpose of conference is as follows:
 - .1 To resolve administrative procedures and responsibilities;
 - .2 To identify all critical points on construction schedule for positive action;
 - .3 Appoint/Identify official representatives of participants in the work, their responsibilities and lines of communications;
 - .4 Establish time and location.
 - .5 To identify any product availability problems.
 - .6 To establish schedule of time for submission of items required under all Sections of Specifications; **(2 Weeks)**.
 - .7 To establish Site arrangements and temporary facilities; and to review any points which, in Contractor's opinion require clarification.
 - .8 Review process of phase completion and progress draws.
 - .9 Review designated substances / hazardous materials audit report.
 - .10 Review Survey Certificate.
- .2 PROPOSED AGENDA
 - .1 Identification of participants.
 - .2 Identification of Contract Documents (Drawings & Specs) including addenda, agreed upon variations and changes negotiated into contract price.
 - .3 Schedule of all submissions: shop drawings/samples etc.
 - .4 Schedule of work, progress schedule submissions/phases.
 - .5 Hours of work and operations.
 - .6 Temporary facilities, signs, office, storage, utilities, fences, hoarding, access.
 - .7 Security.
 - .8 Deliveries.

29.0 **PRE-CONSTRUCTION CONFERENCE**

- .9 Supplemental Instructions, Proposed Change, Change Orders, Progress Draws, Approvals, Inspections, Mark-Ups, Overtime.
- .10 Owner sub-trades/responsibilities.
- .11 Insurances, safety.
- .12 Inspection, testing services.

30.0 **PROJECT MEETINGS**

- .1 Administrative:

Schedule and administer project progress meetings throughout the progress of the work once every two weeks and weekly when the pace of construction warrants increased coordination and review between the consultants, owner and contractor.
- .2 Provide physical space and make arrangements for meetings.
- .3 Record the minutes. Include significant proceedings and decisions. Identify 'comment by', & 'action by' parties. Refer to sample in Schedule 'B'.
- .4 Provide an assigned stenographer to accurately keep all meeting minutes. Stenographer is not to be the Project Manager or Superintendent.
- .5 Reproduce and distribute copies of minutes within **(3) three days** after each meeting and transmit to meeting participants, affected parties not in attendance, the Consultants, the Owner and the Architect **by E-Mail**.
- .6 **PROPOSED AGENDA:**

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 project schedule
 - .7 Revision to construction schedule

30.0 **PROJECT MEETINGS (CONT'D)**

- .8 Progress, schedule, during succeeding work period
- .9 Review submittal schedule for shop drawings/samples expedite as required. Log to be included in meeting minutes.
- .10 Maintenance of quality standards
- .11 Cleaning- prior to fixturing/ finishing/ painting.
- .12 Pending changes and substitutions- PC's and CO's – Log in minutes
- .13 Review proposed changes for effect on construction schedule and on completion date.
- .14 Review of Owners supplied and received equipment, unloading, counts, storage location & receipt of delivery slips.
- .15 Identifying any equipment or material supplies shortages in shipping.
- .16 Monthly Progress Draws, Schedule, CD of Progress Photographs and **3 month Cash Flow Projection.**
- .17 New business

- .7 The Prime consultant may request additional project meetings as he may deem necessary during construction or within the guarantee period.

31.0 **SYSTEMS DEMONSTRATION**

- .1 Prior to final inspection, demonstrate operation of each system to Owner and his representative(s).
- .2 Instruct personnel in operation, adjustment, and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.
- .3 Note: Operation and Maintenance Manuals are to be provided five (5) days after the Substantial Performance.

32.0 **WORK SITE HEALTH AND SAFETY REQUIREMENTS**

- .1 The Contractor will appoint a safety representative to attend Site meetings, conduct inspections, and to conduct periodic safety reviews.
- .2 The authorities having jurisdiction include but are not limited to the following:
 - .1 Workers Compensation Act and Policies.

32.0

WORK SITE HEALTH AND SAFETY REQUIREMENTS (CONT'D)

- .2 Occupational Health and Safety Act, Regulations and Code.
- .3 National Fire Code of Canada.
- .4 Public Health Act - Regional Health Authorities.
- .5 Workplace Hazardous Materials Information System (WHMIS) and Transportation of Dangerous Goods (TDG).
- .6 Owner Security.
- .7 Any other authority having jurisdiction.
- .3 Work Site Safety: The Contractor is "Constructor", "Prime Contractor", "Principal Contractor", "Contractor" or the equivalent local designation:
 - .1 The Contractor will for the purpose of the Occupational Health and Safety Act and for the duration of this Contract:
 - .1 Be the "Constructor", "Prime Contractor", "Principal Contractor", "Contractor" or the equivalent local designation for the identified "Work Site" and
 - .2 Shall comply with all of the requirements of the:
 - .1 Occupational Health and Safety Act, Regulation, and Code,
 - .2 The Workers Compensation Board for the jurisdiction in which work takes place,
 - .3 The Contract Documents,
 - .4 Any other applicable laws or legislation that govern the Work Site safety,
 - .4 The boundaries of the Work Site are as outlined on the construction drawings. The boundaries may be described by hours of operation within a specific area.
 - .5 Work Site Safety: Subcontractors, Other Contractors, Suppliers, Or Visitors:
 - .1 The Prime Contractor, Constructor, etc. will obtain a Notice of Project, where required by law and any other construction safety related permits. The Prime Contractor, Constructor, etc. will provide information to their subcontractors and suppliers regarding the presence and location of hazardous materials if applicable to the work site.
 - .2 The Contractor shall be responsible for all persons with respect to Work Site safety. The Contractor must fulfill the "Constructor", "Prime Contractor", "Principal Contractor", "Contractor" or the equivalent local designation responsibilities pursuant to the applicable Occupational Health & Safety (OH&S) Act, Regulation, and Code, regardless of:

32.0

WORK SITE HEALTH AND SAFETY REQUIREMENTS (CONT'D)

- .1 Whether or not any contractual relationship exists between the Contractor and any of these entities and
- .2 Whether or not such entities have been specified in this Contract.
- .3 The Workers location, with respect to the Work Site, as long as the Work is being done specifically for the Contractor. This will include such things as the unloading of materials in close proximity to the Work Site.
- .6 The Contractor will ensure that emergency procedures and response equipment including appropriate First Aid facilities, and First Aid personnel are in place at the Work Site at all times, for the duration of the Contract.

33.0

WORK SITE SAFETY IMPLEMENTATION

- .1 The Contractor is responsible for, but not limited to, the following:
 - .1 Maintain on Site sufficient quantities of personal protection equipment, including but not limited to: hearing protection, hard hats, safety glasses, and any other items of clothing or special equipment as necessary to ensure that visitors to the Site, the Consultant, and the Owner's representatives are adequately protected.
 - .2 The Contractor shall ensure that persons on Site meet clothing requirements of shirts with sleeves no shorter than midway between shoulder and elbow and full-length pants. Muscle shirts or sleeveless shirts, cut-offs or shorts will not be allowed on the Work Site.
 - .3 Notifying all Subcontractors, in writing about all safety requirements and documentation for the duration of the Project and ensuring compliance by the various trades and Subcontractors with all applicable safety requirements of the Specifications and related legislation.
 - .4 Ensure all aspects of the Contractors Health and Safety Program are in effect for the duration of the Project or Work.
 - .5 Conducting and participating in pre-construction safety orientation meetings prior to commencement of Work and for all personnel entering Site upon first visit.
 - .6 Conducting and participating in all weekly Site safety meetings and any other required safety meetings.
 - .7 Performing weekly inspections of Work area to monitor compliance with this policy and with the Occupational Health & Safety (OH&S) Act, Regulation.
 - .8 Providing adequate Site safety supervision for the duration of this Contract.

33.0

WORK SITE SAFETY IMPLEMENTATION (CONT'D)

- .9 Maintaining a Notice of Non-Compliance, and recording all cases of non-compliance.
- .10 Taking corrective action in cases of imminent danger and non-compliance with health and safety standards up to and including “stop Work” orders to ensure safety. Corrective action must be identified and implemented in a timely manner.
- .11 Seeking the assistance of specialists to review specific hazardous conditions (e.g. infection control practitioners, industrial hygienists, and asbestos abatement specialists).
- .12 Providing adequate personal protection equipment as necessary to ensure that visitors to the Site, the Consultant, and the Owner’s representatives are adequately protected.
- .13 Maintain controlled, secured access to the site at all times until the Owner assumes responsibility for security. Maintain a “sign in/sign out” system for site visitors.
- .14 Ensuring that all persons on Site are wearing and properly using the required personal protection equipment.
- .15 Providing all necessary precautions required to ensure the safety of the public.
- .16 Coordinating a mock emergency evacuation.
- .17 Providing First Aid trained personnel.
- .18 Providing and maintaining adequate First Aid and Fire Protection Response Equipment, for the duration of this Contract.
- .19 Maintaining emergency access to the Site at all times.
- .20 Inspecting and ensuring certification of all heavy equipment.
- .21 Working and complying with the security personnel and their procedures.
- .22 Compliance Monitoring: Provide the following information for assessing the effectiveness of health and safety program:
 - .1 Completed Hazard Assessment reports,
 - .2 Copies of weekly Health and Safety meeting minutes,
 - .3 Copies of Worker incident and injury reports and investigation finding as soon as practical following an incident or injury.

33.0

WORK SITE SAFETY IMPLEMENTATION (CONT'D)

- .4 Working and complying with the Facility security personnel and their procedures with respect to site access control,
 - .5 Copies of the SDS for all controlled Products that will be brought onto the Work Site and an additional information of which the Contractor is or ought to be aware of concerning use, storage and handling of controlled Product,
 - .6 A copy of all other required safety documents, including but not limited to: safe Work permits, safety plans, fall protection plan, confined space entry.
- .2 Sub-Contractors and all of the various trades are responsible for the following:
- .1 Before commencing operations, demonstrating and providing the Contractor with the following:
 - .1 Evidence of appropriate insurance coverage,
 - .2 Provide adequate representation at the start-up meeting and orientation,
 - .3 Acknowledge and adhere to the safety requirements from the Contractor.
 - .4 Comply with and cooperate with the Contractor's health safety program, and all other applicable legislation,
 - .5 The appropriate Workers' Compensation Board Coverage.
 - .6 A hazard assessment process.
 - .2 Demonstrating they are striving to continually improve their health and safety program, for the duration of the Contract.
 - .3 Selecting and delegating a representative to attend the safety meetings called by the Contractor.
- .3 Cooperate with the Owner, the Consultants, and the Contractor in their Site visits.
- .4 Seek the assistance of specialists to identify and review specific hazardous conditions (e.g. infection control practitioners, industrial hygienists, and asbestos abatement specialists), and provide the Contractor with all necessary reports including assessing potential/actual exposures.
- .5 Refer to Section 01 35 29 for specific health and safety requirements.

34.0 **SCHEDULE OF VALUES**

- .1 The Contractor shall submit to the Architect a detailed schedule of values prior to application of the initial payment claim. This schedule shall coincide with values previously submitted in the supplementary tender information Section 00 41 00.
- .2 The degree of detail for the schedule of values shall be established by the Prime Consultant after contract award and shall be used to form the basis of authorization of payment.
- .3 The Architect may request on the schedule of values the breakdown of labour and material for certain elements of the work.
- .4 Refer to Schedule "C" in this Section for an example of progress draw.

35.0 **OWNER'S OCCUPANCY**

- .1 The owner reserves the right to occupy and use portions of the building, whether partially or entirely completed, or whether completed on schedule or not, provided such occupancy does not interfere with the contractor's continuing work.
- .2 Partial occupancy or installation by the owner of his equipment shall not imply acceptance of the building in whole or in part, nor shall it imply acknowledgement that the terms of the contract are fulfilled.

36.0 **PROJECT CLOSURE SUBMISSIONS**

- .1 All the Project Closure submissions must be 100% complete before the release of the Deficiency and Project Record Documents hold back (**1% of Contract value**).
- .2 There will not be any phased or partial releases.
- .3 Refer to Schedule "D" in this Section for comprehensive list.

37.0 **PRE-OCCUPANCY LIFE SAFETY REQUIREMENTS**

- .1 Refer to Schedule "D" in the Section for a comprehensive list of pre-occupancy items that must be in place and completed for early occupancy:
 - .1 Note that these systems need to be coordinated with the Owner issued opening notice through the Owner Project Manager.

38.0 **INSPECTION AND TAKE OVER PROCEDURES**

.1 General:

- .1 The General Contractor shall complete all outstanding construction deficiencies within (10) ten business days from the date of turnover. If such deficiencies are not completed to the satisfaction of the owner within the specified time frame, the owner may have such outstanding deficiencies completed by others. All costs, plus a **50%** administration **FEE** will be deducted from the General Contractors Contract and Hold Back monies. (Where circumstances dictate an extension to this deadline are warranted, with the Owner's approval).
- .2 The Owner has engaged the project consultants to do one (1) Substantial Performance Inspection and one (1) Final Completion Inspection.
- .3 Re-inspection for incomplete or deficient work will be at the contractors' expense and deducted from his contract.
- .4 All submissions and paperwork for extras, claims and credits must be submitted, resolved and finalized for completion of the contract to establish final contract amount, 30 days after completion and final opening. **SUBMISSIONS AFTER THIS DATE WILL NOT BE CONSIDERED BY THE OWNER."**

.2 Schedule, make arrangements for and administer final inspection and close out in the following stages:

- .1 Inspection by Contractor to determine Substantial Performance:
 - .1 Determination that Project meets requirements for Substantial Performance is the responsibility of the Contractor.
 - .2 The Contractor together with Subcontractors involved shall inspect the Work.
 - .3 The Contractor shall prepare a list of uncompleted and unsatisfactory Work from these inspections.
 - .4 Issue these lists to Subcontractors concerned, and the Owner's Project Manager.
- .2 Application for Certificate of Substantial Performance:
 - .1 Upon completion of the preceding stage, submit a written application for a Certificate of Substantial Performance from the Owner.

38.0

INSPECTION AND TAKE OVER PROCEDURES (CONT'D)

.2 Include in Application:

- .1 A statement from the General Contractor that the Work is Substantially Performed and the date upon which Total Performance is scheduled.
- .2 A statement from the General Contractor indicating the work yet to be completed and the detailed value of uncompleted Work.
- .3 All Maintenance Manuals and Operating Instructions requested in the individual sections.
- .4 Extra Stock: All Certificates and reports listed in the individual section.
- .5 All as-built documents requested.
- .6 All calculations of square footage requirements and location certificates.
- .7 Listing of all extended warranties and extension dates required by each.

.3 Certificate of Substantial Performance:

- .1 Within 10 days of receipt of the application, an inspection will then be undertaken with the Architect, Contractor and relevant Sub-Contractors.
- .2 Within five days of the inspection, the Architect shall notify the Contractor of his approval or reasons for disapproval of the application.
- .3 Upon approval, a Certificate of Substantial Performance will be issued by the Architect with a copy delivered to the Contractor.
 - .1 The Certificate of Substantial Performance will establish the date of the Architect's inspection as the date of Substantial Performance of the Contract and will commence the required **60-day** period before release of the holdback amount.
 - .2 The Contractor shall immediately deliver to the Architect specified submissions upon receipt of the Certificate of Substantial Performance.
 - .3 A list of remaining deficiencies to be rectified before Total Completion is achieved will be attached to the Substantial Completion Certificate. The Owner will arrange to withhold this amount.

38.0

INSPECTION AND TAKE OVER PROCEDURES (CONT'D)

- .4 During the **60**-day period, Work shall continue to complete the Work.
- .5 A copy of the substantial performance certificate is to be posted at the main entrance window of the project.
- .4 Establishment of Extended Warranties:
 - .1 Warranties shall commence at date of Substantial Performance of the Contract except for those items not completed on that date.
- .5 Certificate for Payment of Holdback Amount:
 - .1 The Contractor shall submit statement and supporting documents for application of Release of the **10% percent** - Holdback amount.
 - .2 Within five working days of receipt of application for Release of Holdback amount the Architect will prepare a Certificate for Payment of the holdback amount provided all documents are in order. This Certificate will be issued to the Contractor.
 - .3 The Owner will ensure that no liens related to the Contract are registered and that no notice of liens has been received at the end of the **60** day period.
 - .4 Should no liens exist; the holdback will be due and payable.
- .6 Total Performance:
 - .1 The Contractor shall inspect the Work to establish its completion in accordance with the Contract Documents and when satisfied of it's completion request of the Architect a final inspection.
 - .2 The final inspection shall be scheduled to take place within ten working days of receipt of the Contractor's request.
 - .3 Present at the final inspection will be: The Owner's Representatives, upon notification by the Contractor, the Architect, Contractor and such Subcontractors that he considers are required.
 - .4 The Contractor and Architect shall agree upon a final deficiency list at this inspection. The Owner will compile and issue to the Contractor.
 - .5 The Contractor shall correct final deficiencies before a date agreed upon by the Contractor and the Architect.

38.0

INSPECTION AND TAKE OVER PROCEDURES (CONT'D)

- .6 When the Contractor has satisfied himself that these corrections have been completed in a satisfactory manner by his inspection, he shall schedule a re-inspection by the Architect within five days of the Contractor's request.
- .7 Certificate of Final Payment:
 - .1 Upon completion of the Final Inspection, the Contractor shall submit to the Architect a claim for final release of monies owing.
 - .2 The Architect will issue to the contractor a certificate of final payment when he is satisfied the work has been completed.
 - .3 The certificate will be in an amount equal to the remaining money due the Contractor under the Contract and shall indicate the date of total Performance.
- .8 Deficiency & Project Record Documents Hold Back:
 - .1 Will only be released as 1 payment when all deficiencies are complete, and documents submitted and accepted.
- .9 Warranty Period:
 - .1 The Owner will advise the Contractor of defects observed during Warranty periods and request him to remedy the defects in accordance with the Contract Documents.
 - .2 Thirty days before expiration of Warranties the Owner's representatives, and the Contractor will inspect the Work as arranged by the Contractor noting defects of products and workmanship.
 - .3 The Contractor shall immediately remedy such noted defects.
 - .4 The owner will conduct a review prior to the lapse of warranty items. This review will be conducted with the General Contractor.
- .10 1 Year Warranty Holdback:
 - .1 **1%** (to be set) of Contract Value will be held for a period of one year for One Year Deficiency Holdback.
 - .2 This Holdback will only be released when all Deficiencies are completed to the satisfaction of the Client and Consultants.

39.0

REINSPECTION FEES

- .1 Should it become evident, at the time of inspection by the Consultant, that Substantial Performance has not been achieved, the Contractor will be responsible for all expenses incurred for a re- inspection and any subsequent inspections required due to lack of completeness of the project.
- .2 If the project is deemed to be NOT Complete – the General Contractor will bear the cost of the consultant's re-inspections of the site charged at \$ 1,000.00 per Consultant.

END OF SECTION

SCHEDULE “A”

**CONSTRUCTION & DESIGN MANAGEMENT
 Pre-Construction Meeting Agenda**

	Item	Issue	Action
1.0	Identification of participants	<ul style="list-style-type: none"> - Client. - General Contractor (G.C.) - Sub-trades - CV's of key personnel - Consultants - Architect (BJC) 	All
2.0	Point People	Identify “point people” from: <ul style="list-style-type: none"> - Owner - General Contractor - Consultants - Architect (BJC) 	BJC Owner G.C.
3.0	Identification of Contract Documents:	<ul style="list-style-type: none"> - Drawings - Specs - Schedules - Including addenda - Agreed upon variations - Changes negotiated into contract price - Itemized prices 	All
4.0	Protocol of Communication	<ul style="list-style-type: none"> - Paperwork (SI's, PC's, CO's, CD's, RFI's progress draws, approvals, inspections, markups) - Directions on site - Submission of all other paperwork (shop drawings, distribution) - Overtime - PC's, RFI, SI, CO, CD and shop drawings Log included in meeting minutes. 	G.C. BJC
5.0	Schedule of Work	<ul style="list-style-type: none"> - Progress schedule - Submission schedule - Phasing of work - Hoarding, access, weather protection 	G.C.
6.0	Schedule of Submissions:	<ul style="list-style-type: none"> - Require all shop drawings <u>submitted within 2 weeks of issuance of tender award in binder format</u> - \$ 10,000.00 hold back for full submission <u>requirements</u> - Shop drawings log attached to meeting minutes. 	G.C.

		<ul style="list-style-type: none"> - Insurance certificate - Progress Draws & 3 month Cash Flow Projection - Bonding - Sub-trade list - Construction schedule - Schedule of values - Fire insurance policy - WSIB Certificate - Notice of Project - Note: CV's for key personnel - Refer to Appendix "C" for Submission prior to starting Construction 	
7.0	Temporary Facilities	<ul style="list-style-type: none"> - Signs - Office - Storage - Utilities - Washrooms 	G.C.
8.0	Garbage	<ul style="list-style-type: none"> - no garbage bins out front – keep clear 	Owner G.C.
9.0	Cleaning	<ul style="list-style-type: none"> - Daily cleaning. 	G.C.
10.0	Security	<ul style="list-style-type: none"> - All times. - Review access in receiving. - Night work – coordinate with staff. 	G.C.
11.0	Deliveries	<ul style="list-style-type: none"> - G.C. to unload, receive, document counts and shortages. - Delivery / packing slips to the Owner - Designate a storage area (large enough) for delivered construction materials and equipment. - Check No. of pieces / quantities - Report any shortages - Identify any long-term delivery items. (i.e.: HVAC units, Elevator, Light Fixtures) 	G.C. Owner (rep.)
12.0	Protection: - Roof	<ul style="list-style-type: none"> - Safety and protection of roof membrane, prior to any work / construction. 	G.C.
13.0	Meetings	<ul style="list-style-type: none"> - Timing, dates, and attendance for project meetings. 	All
14.0	Superintendent	<ul style="list-style-type: none"> - Site superintendent to be on site all times. e-mail to owner & architect. 	G.C.
15.0	Instructions	<ul style="list-style-type: none"> - G.C. to take instructions from Owner's Project Manager, Architect or Consultants. 	G.C.

16.0	Meeting Minutes	<ul style="list-style-type: none">- General Contractor to follow attached example of meeting minutes, and <u>e-mail</u> minutes within 3 days of site meeting- Specific reference to attached Logs (SI's, PC's, CO's, CD's, RFI's Shop Drawings)- Weekly Progress photos.	G.C.
17.0	Project Close-Out	<ul style="list-style-type: none">- <u>timing</u>: 30 days to clean up all outstanding paper work, after which time consultants will access costs and issue revised holdback.- <u>timing</u>: 30 days after issuance of the final deficiency report for all deficiency to be completed. After which time the value to complete outstanding deficiencies will be accessed by consultants and will be deducted from contract.- 1% Contract Value holdback for completion of all Project Record Documents submissions.- 1% Contract Value Holdback for 1-year warranty deficiency completion.	G.C.

SCHEDULE 'B'

EXAMPLE OF MEETING MINUTES
SITE MEETING # *xx*
WATERDOWN D.H.S., WATERDOWN, ONTARIO
Day, Month *xx*th, 2024 @ 10:30 a.m.

ATTENDANCE:

Owner = **Hamilton-Wentworth District School Board**

BJC = **BJC architects inc.**

Consultants= **SAB**

*G.C. = **General Contractor**

No.	Source	Item	Action
1.3	Owner	Xxxx	BJC
1.4	G.C.	Xxxx	BJC
3.2	G.C.	- xxxx	BJC
3.10	BJC	Xxxx	G.C.
3.12	G.C.	Xxxx	Owner
4.5	Owner	Xxxx	G.C.
4.7	G.C.	Xxxx	Owner
6.1	Owner	Xxxx	INFO
6.2	Owner	Xxxx	INFO
		NEW BUSINESS	
7.0	G.C.	RFIs During Construction	INFO
7.1	BJC	Something important	INFO
7.2		Review of PC'S & CO schedule	
7.3		Review of shop drawings log	
7.4	Owner	XXXXXX	XXX

NOTE:

"No." refers to previous items carried from previous meetings
Number consists of *meeting No. portion, period, item number*
i.e.: 3.12 (is item number 12 from meeting No. 3)

"Source" refers to person / company who raised this item.

"Action" refers to person / company who is to take action with this item.

SCHEDULE 'C'

WASHROOM RENOVATIONS AT WATERDOWN D.H.S.
 EXAMPLE OF PROGRESS DRAW
 PROGRESS DRAW # xx

PROGRESS DRAW	<u>SCHEDULE OF VALUES AND WORK PERFORMED</u>	FILE NO.	PROJECT NO.	REPORT NO.
		DATE ISSUED		PAGE NO. 1 OF 1

**Application Draw
Number:**

Project Name:

Projected Location:

Contractor:

Please check if the following are up to date:

Statutory Declaration ..

Insurance ..

WSIB ..

Description of Work	Schedule Value (Contract Amount)	Completed to Date		Balance to Complete		Comments
		%Complete	\$Value	%Complete	\$Value	
A - CONTRACTS						
General Expenses						
Site Supervision						
Health & Safety						
Bonding						
1% Holdback of contract price for Project Record Documents						
1% one Year Warranty Holdback						
Shop Drawing Holdback	\$10,000.00					
Concrete Formwork						
Structural Steel						
Cast-In-Place Concrete						
Concrete Finishing						
Glazed Aluminum Railing Assemblies						
Structural Metal Framing						

Description of Work	Schedule Value (Contract Amount)	Completed to Date		Balance to Complete		Comments
		%Complete	\$Value	%Complete	\$Value	
A - CONTRACTS						
Metal Fabrications						
Glazed Aluminum Railings						
Rough Carpentry						
Finish Carpentry						
Waterproofing						
Bituminous Damproofing						
Building Insulation						
Air & Vapour Barriers						
SBS Roofing 2 Ply						
Flashings & Sheet Metal						
Fire Stopping						
Joint Protection						
Hollow Metal Doors & Frames						
Door Hardware						
Glazing						
Gypsum Board Assemblies						
Acoustic Ceilings						
Resilient Tile Flooring						
Painting						
Plumbing & HVAC:						
Mobilization & Shop Drawings (max \$2000.00)						
Plumbing Fixtures						
Specialty Piping						
Plumbing & HVAC:						
Above grade rough in plumbing & drainage						
Plumbing Fixtures						
Sprinkler System & Heads						
Expansion Fittings and Loops						
Thermometers & Pressure Gauges						
Bases, Hangers & Supports						
Seismic Restraint						
Vibration Control Measures						
Testing, Adjusting, Balancing						
Wet Pipe Fire Suppression						
Plumbing Piping Insulation						
Domestic Water Piping-Copper						
Domestic Water Piping-PEX						
Backflow & Cross Connection Measures						

Domestic Water Circulation Pump				
Potable Water Auxiliary Equipment				
Sanitary Drains				
Sanitary Waste & Vent Piping-Cast Iron & Copper				
Sanitary Waste & Vent Piping-Plastic				
Sanitary Sewage Pumps				
Storm Drainage Piping-Cast Iron & Copper				
Fuel-Fired Domestic Water Heaters				
Plumbing Auxiliary Equipment				
Duct Insulation				
HVAC Piping Insulation				
Facility Natural-Gas & Propane Piping				
Hydronic Accessories				
Hydronic Piping (Welding)				
Hydronic Piping (Rolled Grooved)				
Pumps Hydronic				
Refrigerant Piping & Specialties				
Water Treatment for Closed Loop Hydronic Systems				
Metal Ducts				
Duct Accessories				
Fire Dampers				
Smoke Control Dampers				
Operating Dampers				
Flexible Ducts				
Duct Liners				
Packaged Exhausters				
Diffusers, Registers & Grilles				
Louvres & Vents for Intake & Exhaust				
Stainless Steel Condensing Boilers				
Packaged Terminal Heating or Cooling Units				
Maintenance Manuals & As Built drawings (min. \$2,000.00)				
System commissioning & start up (min 3%).				
Mechanical Sub Total				

Electrical:				
Permits & Fees				
Mobilization (maximum 1%)				
Commissioning & Integrated Testing of Life Safety & Fire Protections				
Wires & Cables				
Splitters, Junction & Pull Boxes				
Outlet boxes, Conduit Boxes & Fittings				
Wire & Box Connectors				
Grounding Secondary				
Seismic Restraint for Electrical Systems				
Conduits, Conduit Fastenings & Conduit Fittings				
Installation of Cables in Trenches & Ducts				
Short Circuit/ Coordination Study				
Auxiliary Systems				
Electric Heating Systems				
Dry Type Transformers				
Service Entrance Board				
Panelboards				
Molded Case Circuit Breakers				
Wiring Devices				
Fuses – Low Voltage				
Disconnect Switches				
Starters & Contactors				
Power Generation-Natural Gas				
Lighting Equipment				
Digital Occupancy & Daylight Control Systems				
Fire Alarm Systems				
Commissioning (min 3%)				
Electrical Sub Total				
Totals				
B – CHANGE ORDERS				
CO - 1				
CO - 2				
Change Directive A				
Totals				
TOTALS A & B				

SCHEDULE 'D'	
GENERAL LIST OF	
PRE-OCCUPANCY LIFE SAFETY REQUIREMENTS &	
PROJECT RECORD DOCUMENTS	
	Item (As Applicable)
	Architectural Requirements
1.	All doors and hardware's, Automatic Door Operator & exit devices to be operable (energized)
2.	All stairs and elevator
3.	Flooring (Completed)
4.	Washrooms (Operational)
5.	Guard rails and handrails interior & exterior
6.	Clear path of travel to all required exits
7.	All fire rating/stopping in place
8.	Sidewalks/pads at entrances
	Mechanical & Electrical completion Requirements
1.	Emergency lighting & Exit signs
2.	General Lighting
3.	Exterior building and parking lot lighting
4.	Sprinkler system
5.	Stand pipe system
6.	Fire alarm system
7.	Annunciator panel
8.	Heating system
9.	Exhaust systems
10.	Back Flow Test Certificate
	Project Record Documents
1.	Final City Inspection and Occupancy Certificate
2.	NFPA 13 Contractors Material and Test Certificate
3.	Sprinkler Design Engineer's Letter
4.	Final Electrical Inspection Certificate
5.	TSSA Gas Pressure Test Tag (copy)
6.	Back flow test certificate
8.	Fire Alarm Engineers System/ Letter c/w hood suppression system and gas solenoid valve interlock to NFPA 96
9.	Commissioning of roof top units.
10.	TAB Reports
11.	Potable water test
12.	As Built Drawings in electronic and paper formats
13.	Maintenance Manuals 5 days after Substantial Performance
14.	Operating Instruction to Owners & Systems Demonstrations
15.	Contract Cost Summary from GC.
16.	Warranties, Guaranties, Spare Materials, As built Drawings
17.	Square footage Certificate (B.O.M.A. current standard)
18.	Final Utility Readings to Reconcile Energy Costs During Construction

DIVISION 01 - GENERAL REQUIREMENTS

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 CONSTRUCTION SCHEDULE

- .1 Prepare and submit to the Owner and the Consultant within 10 Working Days following the Owners request for their approval, a construction schedule indicating critical milestone dates for the Project. Such schedule shall provide sufficient detail of the critical events and their inter-relationship and shall form the baseline schedule (such baseline schedule as amended in accordance with this Agreement being the Baseline Schedule) indicating the Critical Path of the Project, demonstrating that the work will be performed in conformity with the Contract Time. Once accepted by the Owner and the Consultant, the Baseline Schedule submitted by the Contractor shall become the Baseline Schedule against which all future progress will be measured.
- .2 Provide the expertise and resources, including manpower and construction Equipment, as necessary to maintain progress under the BAseline Schedule or any successor or revised Schedule approved by the Owner.
- .3 Continuously monitor the progress of the Work and provide a monthly progress schedule covering all the Baseline activities and including actual start, actual finish and percentage of completion of those activities relative to the Baseline Schedule and/or any successor or revised Baseline Schedule approved by the Owner to replace the Baseline Schedule from time to time, and advise the Consultant and the Owner in writing of any deviation or slippage from the Baseline Schedule within two (2) Working Days of such deviation or slippage becoming apparent. Each month, the Contractor shall submit, for the Owner's approval, any changes made to the Baseline logic and activity durations.
- .4 Without limiting the forgoing, the Contractor shall not amend the Baseline Schedule without the prior written consent of the owner. In addition, at each Progress Meeting, the Contractor shall provide to the Owner and the Consultant a two (2) week look ahead schedule in MS Project format indicating the major activites to be undertaken or constructed in such two (2) week period. Project progress meetings shall be held monthly or as requested by the Owner.
- .5 If at any time it should appear to the Owner or the Consultant that the actual progress of the Work is behind the Baseline Schedule or is likely to become behind the Baseline Schedule, the Contractor shall take appropriate steps to cause the actual progress of the work to conform to the Baseline Schedule or minimize the resulting delay and shall produce and present to the Owner and the Consultant a recovery plan demonstrating how the Contractor will achieve the recovery of the Baseline Schedule.

2.0 CONSTRUCTION SCHEDULE (CONT'D)

- .6 The Contractor's construction Baseline Schedule will include, but shall not be limited to, the following Tasks:
- a. Shop Drawings – including allowance for preparation, review and resubmission.
 - b. Submittals.
 - c. Mockups (as required).
 - d. Fabrication and delivery.
 - e. Temporary works.
 - f. Construction activities.
 - g. Commissioning, testing, start-up and demonstrations.
 - h. Change Orders.
 - i. Critical path.
 - j. Critical Milestones.
- .7 The schedule software used by the Contractor shall be MS Project. The Contractor shall submit to the Consultant an electronic copy in MS Project format and PDF format. Monthly updates of the Contractor's Baseline Schedule shall similarly be submitted as an electronic copy prepared in MS Project format and PDF format.
- .8 The Contractor is required to update the Baseline Schedule and report to the Consultant on a monthly basis. The monthly update of the Contractor's Baseline Schedule shall identify the percentage of completion for every Task, including approved Changes to the Contract.
- .9 As part of each Proper Invoice the Contractor shall submit the actual percentage completed at the end of the invoice period by Subcontract and Contractor Itemized Work Element to the Consultant.

3.0 MATERIAL AVAILABILITY

- .1 Immediately upon signing the Contract the Contractor and its Trade Subcontractors and Suppliers shall review Product delivery requirements and anticipate foreseeable supply delays for Products. If delays in supply of Products are foreseeable, the Contractor shall notify the Consultant of such, in order that substitutions or other remedial action may be authorized in time to prevent delay in performance of the Work.

4.0 COMPLIANCE WITH THE BASELINE SCHEDULE

- .1 The Contractor is required to comply with the Baseline Schedule and is required to coordinate and direct its Trade Subcontractors and Suppliers in accordance with these requirements.
- .2 The Contractor shall provide sufficient number of skilled personnel to maintain the progress of the Work.
- .3 If in the opinion of the Consultant, the Contractor is delaying the work of other Contractors then the Contractor will be responsible for costs to regain time lost, including but not necessarily limited to the premium costs for other Contractors to regain lost time.

4.0

COMPLIANCE WITH THE BASELINE SCHEDULE (CONT'D)

- .4 If in the opinion of the Consultant the Contractor falls behind schedule, he must employ all necessary resources as required to make up the lost time. All associated costs will be at the Contractors expense. If the schedule delay is deemed the responsibility of the Owner, the Contractor will be entitled to fair compensation to maintain the Baseline Schedule.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 CONTRACT SUBMISSIONS

- .1 At the commencement of the Contract submit the following:
 - .1 Refer to Front End for insurance requirements.
 - .2 Supply Clearance Certificate from WSIB for the General Contractor and all Subcontractors.
 - .3 Supply a complete Contract Sum Breakdown of all subtrades or parts of work and general expense items for approval by all consultants. Include Mechanical and Electrical Breakdowns for review and acceptance by Consultants.
 - .4 Supply a competent detailed Construction Schedule that has been reviewed and approved by major subtrades. Identify critical milestone dates.
 - .5 Supply Schedule of Shop Drawing Submissions and comprehensive submission of Mechanical and Electrical Shop Drawings as required in specifications
 - .6 Apply for, post and supply a copy of Notice of Project.
 - .7 Supply a copy of Health & Safety policy as well as post at the job site.
 - .8 Supply interference drawings for all areas requested by the Consultant, Mechanical Engineer or Electrical Engineer.
 - .9 Supply any Shoring Designs or methods statements as required for the proposed execution of the work.

3.0 SCHEDULE

- .1 **ALL SHOP DRAWINGS, PRODUCT LITERATURE AND SAMPLES FOR ARCHITECTURAL, STRUCTURAL, MECHANICAL AND ELECTRICAL MUST BE SUBMITTED WITHIN 2 WEEKS AFTER THE AWARD OF TENDER.**
- .2 Submit one reproducible print and five (5) copies of complete shop drawings and two (2) copies of other information required by the specifications or requested by the Consultant. Where submissions are straight forward and not complicated – PDF electronic submission is acceptable.

3.0 **SCHEDULE (CONT'D)**

- .3 Allow a minimum of 10 working days for Architect to review each submission, exclusive of Architect and Contractor inter-office(s) transmission period and mail periods.
- .4 Shop Drawings for time sensitive deliveries can be expedited as required to meet schedule.
- .5 Refer to "Submittals Schedule 'A': "Sample Shop Drawings Data" submissions sheet included here in.
Note: this is a sample **generic list** which must be edited to reflect each specific project.
- .6 If shop drawings are reviewed and found acceptable, two (2) signed copies and the reproducible print will be returned to the Contractor and fabrication and installation of the work may begin.
- .7 Note: Fixed sum price of **\$10,000.00** / Building, for the submission of all required shop drawings & samples. This amount to be included in contract and identified separately on progress draw. The total amount will be released only once the shop drawings submissions are completed.

4.0 **INTERFERENCE & COORDINATION DRAWINGS**

- .1 Prepare interference drawings for all work in confined spaces, bulkheads and ceiling spaces whether concealed or not. Coordinate with all trades.
- .2 Submit as shop drawings in advance of fabrication or installation of components.
- .3 Site conditions requiring corrections, due to failure to provide interference drawings as required will be corrected at no additional cost to the owner.
- .4 Prepare drawings indicating the relationship of unforeseen conditions at congested areas prior to commencement of work in the area.
- .5 Prepare coordination drawings for efficient use of available space, for proper sequence of installation, and to resolve conflicts as required.
- .6 Identify any conflicts which would affect the **Design** of Ceiling and Bulkheads, Heights and Sizing.
- .7 Interference and coordination drawings are to be initialed by each subcontractor involved, then signed and submitted to the Architect for review and record purposes.

5.0 **SHORING DESIGN DRAWINGS**

- .1 If required as part of this project, it is the contractor's responsibility to provide in advance of any work requiring shoring, detailed Shoring design drawings bearing the seal of a Professional engineer registered in the Province of Ontario and also a Method Statement describing the work sequence.

5.0 **SHORING DESIGN DRAWINGS (CONT'D)**

- .2 Submit to the Consultants as shop drawings in advance of the work.

6.0 **GENERAL**

.1 **Contract Drawings and Specifications take precedence over Shop Drawings.**

- .2 Contractor to note that "Electronic Copies " of the Contract Documents described here-in **will not** be made available for the Contractors use.

- .3 Submit to Architect, for review, Shop Drawing, Product Data and Samples specified.

- .4 Until submittal is reviewed, Work involving relevant product may not proceed.

- .5 Do not use for construction, Shop or Setting Drawings or diagrams which do not bear Architect's Shop Drawing stamp and signature.

- .6 Submission and subsequent review of Shop Drawings constitute a service and does not entitle the supplier or sub-contractor to the right to remuneration until the materials are supplied and installed on the site in accordance with the Contract.

- .7 Indicate in writing any deviations in submissions from contract documents.

- .8 Note - Facsimile submissions will not be accepted.

- .9 The Owner has engaged the project consultants for Shop Drawing Review. This service is for 1 initial review and 1 resubmission. The cost of resubmissions due to the Contractors failure in compliance with the Contract Documents will be at his expense and deducted from his Contract.

- .10 Shop Drawings which, in the opinion of the Consultant, require extensive corrections are in substantial disagreement with the intent of the contract documents will be rejected.

- .11 Refer to the attached Submittal List attached in Submittals Schedule 'A' for a list of shop drawings, product literature and samples required for submission.

- .12 The Shop Drawing, Product Data and samples submittal list is to be attached and enclosed with each project meeting minutes.

7.0 **SHOP DRAWINGS**

- .1 Drawings shall be copies of original drawings prepared by Contractor, sub-contractor, supplier or distributor, for the work of the Contract which illustrates appropriate portions of the Work, showing fabrication layout, setting or erection details, sections, details, interconnections, locations and type of anchorage/fastening, materials and finishes, requirements of other trades and structural loading; as specified in appropriate Sections. Provide Drawings on same size sheets as Contract Drawings generally.

7.0 SHOP DRAWINGS (CONT'D)

- .2 Submit Shop Drawings with transmittal forms listing the name of the manufacturer, the job, the Drawing number, the number of copies and reference in the Specification to which the Shop Drawings refer.
- .3 Show on Shop Drawings clear and obvious notes of any proposed changes from Drawings and Specifications.
- .4 Submit Shop Drawings to authorities having jurisdiction and obtain approval.
- .5 On Shop Drawings for fire rated assemblies show required fire rated and ULC design numbers.
- .6 Submit a minimum of 3 white prints and One (1) Electronic Shop Drawings to the Architect. Provide one additional print for structural, mechanical and electrical items. After review, the Architect will retain one white print and return the other white prints to the Contractor. On completion of the revisions, one complete set of new white prints of Shop Drawings used for construction shall be supplied to the Architect, unless otherwise specified.
- .7 Shop drawings shall be submitted drawn in Imperial Units (SI) unless specifically requested otherwise by the Consultant. No exceptions.

8.0 ENGINEERED SUBMITTALS

- .1 Submittals required to be sealed by a Professional Engineer are to be prepared, sealed, signed and dated under the direct control and supervision of a qualified professional Engineer licenced to practice in the place or Work.
- .2 The design is to include life safety, sizing of supports, anchors, framing, connections, spans and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, authorities having jurisdiction and design requirements of the Contract Documents.
- .3 Engineered Submittals are to include design calculations, complete with references to codes, and standards used in such calculations, supporting the proposed design represented in the submittal. Prepare calculations in a clear and comprehensive manner so that they can be properly reviewed.
- .4 The Submittal Engineer shall undertake periodic field review, including review of associated mock-ups when applicable. Such reviews will include review during fabrication at the point of manufacture and during installation at the Place of Work. Prepare and submit a field review report for each review undertaken.
- .5 Conduct field reviews at intervals appropriate to the progress of the parts of the Work relevant to the Engineered Submittal. Report on progress and quality of the affected parts of the Work. Determine if installation is in general conformity with the Contract Documents and in strict conformance with the accepted Engineered Submittal.

8.0 ENGINEERED SUBMITTALS (CONT'D)

- .6 Upon completion of the parts of the Work affected by an Engineered Submittal, the Submittal Engineer shall prepare and submit a Letter of General Conformity to the Contractor, the Consultant, and the Authorities Having Jurisdiction. Certify that the parts of the work affected by the Engineered Submittal have been designed, fabricated and installed in accordance with the Contract Documents and Applicable Codes.
- .7 Include all costs of the Submittal Engineer's services in the Contract Price.

9.0 ELECTRONICALLY SUBMITTED SHOP DWGS

- .1 Electronically submitted shop drawings are acceptable when submission is in strict compliance with requirements noted here in.
- .2 Submissions must be clear, to scale, complete, specific and correctly transmitted.
- .3 Failure to comply with these requirements will result in their refusal.
- .4 Samples and colour submissions must be originals.
- .5 Note only one Marked up version will be returned (Electronically)

10.0 PRODUCT DATA

- .1 Certain Specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of Shop Drawings.
- .2 The above will be accepted if they conform to the following:
 - .1 Delete information which is not applicable to project.
 - .2 Supplement standard information to provide additional information applicable to project.
 - .3 Show dimensions and clearances required.
 - .4 Show performance characteristics and capacities.
 - .5 Show wiring diagrams and controls.
 - .6 Add to standard sheet the Project identification data.
- .3 Submit 5 copies of each submission.

11.0 SAFETY DATA SHEETS

- .1 Submit all safety data sheets for each controlled product that will be on/used on site.
- .2 Retain a copy for use on site.

12.0 SAMPLES

- .1 Submit samples in duplicate as called for by the Architect.
- .2 Samples shall be labelled with project name, manufacturer's name, contractor's name product name, pattern, texture, design, model number, colour code, etc. Such samples shall be submitted at no additional cost.
- .3 Construct field samples and mock-ups at locations acceptable to Architect.
- .4 Construct each sample or mock-up complete, including Work of all Trades required to finish Work. Ensure all materials used in samples or mock-up conform to materials specified.
- .5 Reviewed samples or mock-ups will become minimum standards of workmanship and material against which installed Work will be checked on Project.

13.0 CONTRACTOR'S RESPONSIBILITY

- .1 Check, certify and sign as correct Shop Drawing, Product Data, and Samples prior to submission.
- .2 Shop Drawings which require the approval of any legally constituted Authority Having Jurisdiction shall be processed to such Authority by the Contractor for approval.
- .3 Verify:
 - .1 Field measurements.
 - .2 Field construction criteria.
 - .3 Catalogue numbers and similar data.
- .4 Co-ordinate each submittal with requirements of Work and Contract Documents.
- .5 Notify Architect, in writing at time of submission of any deviations in submittal from requirements of Contract Documents.
- .6 Indicate on each submission changes from the Contract Drawings & Specifications.
- .7 Stamp, initial or sign each Submission, certifying approval of submission, verification of field dimensions and measurements and compliance with contract Documents.

13.0 **CONTRACTOR'S RESPONSIBILITY (CONT'D)**

- .8 After Architect's review, distribute copies, as follow:
 - .1 Job Site file (2 copies).
 - .2 Record documents file.
 - .3 Subcontractors.
 - .4 Supplier.
 - .5 Fabricator.
 - .6 Authorities having jurisdiction, where required by Codes and/or By Laws, i.e. structural steel and sprinkler.
 - .7 Owner and Data Book where applicable.
- .9 Distribute samples as directed by the Architect.
- .10 Ensure that all samples are approved by authorities having jurisdiction, and other parties such as Owner in time to permit approval prior to ordering of quantity delivery to Site.
- .11 The Contractor shall advise all Trades, Subcontractors and suppliers of the limits of the Architect's responsibility with respect to Shop Drawings and other submittals as detailed under paragraph 14.2 below.

14.0 **ARCHITECT'S RESPONSIBILITY**

- .1 Within 10 working days of the receipt of Samples, Shop Drawings and all other Submissions, the Architect shall return to the Contractor indicating that, the items been:
 - .1 Reviewed (no re-submittal required).
 - .2 Reviewed as indicated (no re-submittal required).
 - .3 Revise and resubmit (re-submittal required).
 - .4 Reviewed by Consultant

14.0 **ARCHITECT'S RESPONSIBILITY (CONT'D)**

- .2 Review by the Architect is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Architect approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Subcontractor, and such review shall not relieve the Subcontractor of his responsibility for errors / omissions in the shop drawings or of his Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the processes or techniques of construction and installation and for co-ordination of all sub-trades.

- .3 The Architect will not be responsible for non-compliance in meeting pre-determined Submission Schedules if initial Submissions by the Contractor are **LATE by the G.C.**

SUBMITTALS SCHEDULE 'A'

REQUIRED SUBMITTALS							
INTERIOR RENOVATIONS WATERDOWN S.S. 215 PARKSIDE DRIVE WATERDOWN, ONTARIO					Project No. 23-075	MARCH 2024	
Sect No.	Section Name	Shop Dwg.	Product Literature	Samples	Warranties	Maintenance Manuals & Materials	Misc. / Other comments
Division 04	Unit Masonry						
04 20 00	Masonry	Yes	Yes	N/A	1 years	N/A	Arch.
Division 06	Wood, Plastics & Composites						
06 20 00	Finish Carpentry	Yes	Yes	Yes	2 years	N/A	Arch.
Division 08	Openings						
08 11 13	HM Door and Frame	Yes	Yes	N/A	1 year	Yes	Arch.
08 71 00	Door Hardware	Yes	Yes	N/A	5 years	N/A	Arch.
08 71 13	Power Door Operators	Yes	Yes	N/A	1 year	Yes	Arch.
08 80 00	Glazing	Yes	Yes	N/A	5 years	N/A	Arch.
Division 09	Finishes						
09 21 16	Gypsum Board Assemblies Structural stud bulkhead	Yes	Yes	Yes	1 Year	N/A	Arch.
09 65 19	Resilient Tile Flooring	Yes	Yes	Yes	1 year	Materials > of 2% or 2 boxes	Arch.
09 91 00	Painting	Yes	Yes	Yes	1 year	Min. 4 litre can each colour	Arch.
Division 20-23	Mechanical						
20 05 31	Expansion Fittings & Loop	Yes					
20 05 32	Thermometers & Pressure Gauges	Yes					
20 05 34	Bases, Hangers & Supports	Yes					
20 05 48	Seismic Restraint	Yes					
20 05 49	Vibration Control Measures	Yes					
20 05 53	Identification of Mechanical Services	Yes					
20 06 11	Testing, Adjusting & Balancing-TAB	Yes					
22 07 19	Plumbing Insulation	Yes					
22 11 16	Domestic Water Piping-Copper	Yes					
22 11 18	Domestic Water Piping-PEX	Yes					
22 11 20	Backflow & Cross Connection Measures	Yes					
22 11 22	Domestic Water Circulation Pump	Yes					

Sect No.	Section Name	Shop Dwgs.	Product Literature	Samples	Warranties	Maintenance Manuals & Materials	Misc. / Other comments
22 11 31	Potable Water Auxiliary Equipment	Yes					
22 13 13	Sanitary Drains	Yes					
22 13 16	Sanitary Storm Waste Piping-Cast Iron and Copper	Yes					
22 13 17	Sanitary Waste & Vent Piping -Plastic	Yes					
22 13 29	Sanitary Sewage Pumps	Yes					
22 36 13	Plumbing Auxiliary Equipment	Yes					
22 44 13	Plumbing Fixtures Combined with Drawing Schedule	Yes					
23 07 13	Duct Insulation	Yes					
23 07 19	HVAC Piping Insulation	Yes					
23 11 23	Facility Natural-Gas & Propane Piping	Yes					
23 21 11	Hydronic Piping (Welded)	Yes					
23 21 14	Hydronic Piping (Rolled Groove)	Yes					
23 21 23	Pumps Hydronic	Yes					
23 23 13	Refrigerant Piping	Yes					
23 31 13	Metal Duct System	Yes					
22 33 13	Duct Accessories	Yes					
23 33 16	Fire Dampers	Yes					
23 33 17	Smoke Control Dampers	Yes					
23 33 18	Operating Dampers	Yes					
23 33 46	Flexible Ducts	Yes					
22 33 53	Duct Liners	Yes					
23 34 23	Packaged Exhausters	Yes					
23 37 13	Diffusers, Registers and Grilles	Yes					
23 37 23	Louvres & Vents for Intake & Exhaust	Yes					
25 40 14	DDC Controls	Yes					
Division 26	Electrical						
26 01 20	Commissioning & Integrated Testing of Life Safety & Fire Protections	Yes					
26 05 19	Wires and Cables	Yes					
26 05 20	Splitters, Junction & Pull Boxes	Yes					
26 05 21	Outlet Boxes, Conduit Boxes & Fittings	Yes					
26 05 22	Wire & Box Connectors	Yes					
26 05 26	Grounding Secondary	Yes					

Sect No.	Section Name	Shop Dwgs.	Product Literature	Samples	Warranties	Maintenance Manuals & Materials	Misc. / Other comments
26 05 33	Conduits, Conduit Fastenings	Yes					
26 05 43	Installation of Cables in Trenches & Ducts	Yes					
26 05 75	Auxiliary Systems	Yes					
26 05 76	Electric Heating Systems	Yes					
26 22 13	Dry Type Transformers	Yes					
26 24 16	Panelboards	Yes					
26 24 17	Moulded Case Circuit Breakers	Yes					
26 27 26	Wiring Devices	Yes					
26 28 13	Fuses – Low Voltage	Yes					
26 28 16	Disconnect Switches	Yes					
26 29 13	Starters & Contactors	Yes					
26 51 13	Lighting Equipment	Yes					
26 51 13	Lighting Equipment	Yes					
28 31 25	Fire Alarm System	Yes					

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 SUBMITTALS

- .1 Submit to Consultant environmental plan, Site waste management implementation plan and sketch showing areas proposed to be used for construction storage, areas for implementation of Site separation of construction waste, and including dimensions of such areas and location and size of trees within and adjacent to these areas.

3.0 INDOOR ENVIRONMENTAL QUALITY

- .1 Conform to requirements of CSA Z204, Guidelines for Managing Indoor Air Quality in Office Building (Occupational Health and Safety).
- .2 Reduce quantity of indoor air contaminants that are odorous or potentially irritating to provide installer and occupant health and comfort as indicated.
- .3 Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality.
- .4 Minimize cross-contamination of regularly occupied occupancy areas by chemical pollutants.
- .5 Comply with recommended measures in SDS sheets to protect health and safety of personnel.
- .6 Take measures to prevent entry of dust into HVAC system throughout construction phase.
- .7 Take into consideration use of electrically powered equipment on Site in lieu of gas or propane to reduce possibility of carbon monoxide sickness and odours of gas or propane spreading throughout building.
- .8 Schedule sequence of installation of finishing materials to reduce harm to indoor air quality. Provide necessary ventilation during and after installation of 'wet' products such as paints, sealants, fireproofing materials, adhesives and of 'packaged dry' products.
- .9 Isolate substances producing hazardous emissions from circulating air. Locate outside air intakes away from potential sources of contaminations.

3.0 INDOOR ENVIRONMENTAL QUALITY (CONT'D)

- .10 Take measures to prevent moisture exposure to finished construction or existing construction. Mould growth on either hidden surfaces or visible surfaces is detrimental to indoor air quality and will be considered deficient and in need of rectification.

4.0 EROSION AND SEDIMENTATION CONTROL

- .1 Provide erosion and sediment plans, including standard details, prior to start of work as required by jurisdictional requirements.
- .2 Provide permanent and temporary measures to:
 - .1 Prevent loss of soil during construction by storm water runoff and / or wind erosion, including protecting topsoil by stockpiling for reuse.
 - .2 Prevent sedimentation of storm sewer or receiving streams.
 - .3 Prevent polluting the air with dust and particulate matter.
- .3 Limit initial earth disturbance to that necessary to install control measures.
- .4 Stabilization: Following initial soil disturbance or re-disturbance, permanent or temporary stabilization shall be completed within:
 - .1 Seven calendar days for the surface of all perimeter controls, and all perimeter slopes.
 - .2 Fourteen calendar days for all other disturbed or graded areas.
- .5 Use the permanent driveway or entrance location as a stabilized construction entrance. Top dress as necessary to prevent tracking of sediment onto public streets or rights-of-way.
- .6 Minimize stripping of topsoil and vegetation. Schedule Work to minimize exposure of subsoils to erosion.
- .7 Perform clearing and grading Work to minimize the effects of erosion on Site.
- .8 Grading shall not impair existing surface drainage, create an erosion hazard, or create a source of sediment to nay adjacent watercourse of property.
- .9 At any location where surface runoff from disturbed or graded areas flows off the property, install control measures to prevent sediment from being transported off-Site.
- .10 Swales or other areas that transport concentrated flow to be sodded.
- .11 Maintain permanent and temporary erosion and sediment control features installed under this Contract. Remove only when authorized by Consultant.
- .12 Remove control features when directed by the Consultant. Take care to avoid causing turbidity, and excessive re-suspension of particles when removing control features.

5.0 PLANT PROTECTION

- .1 Protect trees and plants on Site and adjacent properties not indicated for removal.
- .2 Wrap in burlap, trees and shrubs adjacent to construction Work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 meters.
- .3 Protect roots of designated trees to drip line during excavation and Site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Cleanly cut roots that need to be removed with sharp hand cutting tools. Cover roots exposed during construction and scheduled to remain with moist soil until permanent root cover is in place.

6.0 WORK ADJACENT TO WATERWAYS

- .1 Do not discharge waste waters derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines, directly into storm water system or adjacent waterways.
- .2 Do not discharge rinse water from concrete trucks or mixing drums on Site.
- .3 Do not operate Construction Equipment in waterways.
- .4 Do not use waterway beds for borrow material.
- .5 Do not dump excavated fill, waste material or debris in waterways.
- .6 Design and construct temporary crossings to minimize erosion to waterways.
- .7 Do not skid logs or construction materials across waterways.
- .8 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .9 Do not blast under water or within 100 meters of indicated spawning beds.

7.0 AIRBORNE POLLUTION AND PARTICULATE CONTROL

- .1 Control emissions from equipment and plant to local authority's emission requirements.
- .2 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .3 Demolish to minimize dusting. Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

7.0 AIRBORNE POLLUTION AND PARTICULATE CONTROL (CONT'D)

- .4 Provide dust control for temporary roads. Control dust by application of water, or calcium chloride after obtaining permission from the Consultant.
- .5 Keep paved surfaces clean, including public roadways.
- .6 Cover all Site materials and stockpiles with tarps at the end of each day.

8.0 SPILL CONTAINMENT

- .1 Take precautions to avoid contamination of the Site from fuel and other petroleum products, fertilizers, paints and coatings, and other hazardous fluids.
- .2 Monitor onsite vehicles for fluid leaks. Implement a preventative maintenance program to keep vehicles free from leaks.
- .3 Keep and maintain hydrocarbon containment and clean up materials on Site for the duration of construction activities.
- .4 Ensure personnel are trained in the proper use of containment and clean up materials.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1- GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 CONSTRUCTION & DEMOLITION PHASING

- .1 With-in 2 weeks of Project Award provide a Phasing Drawing complete with time frames, outlining all the works to be completed along the entrance main driveway, including removals, new services, temporary services, tie-ins, street connections, grading, curbing and asphaltting. Refer to Civil and Architectural Dwgs. for full scope.
- .2 Submit to Client and Consultants for review and approval before any works commence.

1.2 EXISTING FACILITIES & NEW CONSTRUCTION

- .1 The existing buildings and parking areas will be in operation throughout duration of construction. Comply with the M.O.L. standards for safety protocols.
- .2 Do not interrupt existing services and facilities, except for authorized and scheduled interruptions of services approved by the owner and Architect. Provide a minimum of 2 weeks prior notice.
- .3 All work which may in any way affect the daily operation of the facility is to be scheduled and approved by the Owner and Architect prior to its commencement.
- .4 Avoid blocking driveways, entrances and pedestrian access to the existing occupied areas of the site with any deliveries. Schedule deliveries between 7:00am and 5:00pm. Notify Architect & owners Project Manager if these hours need to be adjusted to suit special circumstances.
- .5 Provide 72 hour notice to owner prior to anticipated blockage of driveways and exit/entrances to Site and Buildings for Deliveries or Work.
- .6 Have a flag person to control all delivery traffic on the site to keep regular vehicular and pedestrian traffic safe.
- .7 The main site entrance must remain clear and open at all times. At no time is the entrance to be closed or access hindered by the work of this contract.

1.2 EXISTING FACILITIES & NEW CONSTRUCTION (CONT'D)

- .8 During the construction, maintain all the existing services to adjacent Buildings on the site.
- .9 All portions of the site around the existing buildings is to be kept clean and clear of any debris during this project. Keep driveways broom swept and clear of any dirt.
- .10 At all times avoid the hoisting or handling of materials and equipment over pedestrians or vehicles.
- .11 When temporary services are required from the existing Building, the Contractor is to make a formal request through the Owners Project Manager. When this can be accommodated, the owner will coordinate and advise the existing Building. All costs for this service will be billed back to the Contractor.

1.3 DEMOLITION, RECONSTRUCTION, ALTERATIONS AND MAKING GOOD

- .1 Where the alterations interface with existing and where existing Work is altered execute all necessary cutting and fitting required to make satisfactory connections with existing Work under this Contract. Leave the entire Work in a finished workmanlike condition acceptable to Architect.
- .2 Make good all areas disturbed to buildings and exterior site due to the Work of this Contract.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 GENERAL REQUIREMENTS

- .1 The G.C. is solely responsible for all safety on site. It is his responsibility to monitor, apply, reinforce, regulate, educate and report all aspects of site safety.
- .2 This specification section is to represent a guide for the G.C. as a minimum standard. In no way should it be considered an overriding authority to required standards.

3.0 CONSTRUCTION SAFETY MEASURES (REFERENCES)

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Hazardous Products Act, RSC 1985, c H-3 and Controlled Products Regulation.
- .3 Province of Ontario
 - .1 Observe and enforce construction safety measures required by Ontario Building Code 2012,
 - .2 Workplace Hazardous Materials Information System (WHMIS) Regulation, Reg 860,
 - .3 Canadian Construction Safety Code 1977,
 - .4 Occupational Health and Safety Act 1990, Revised Statutes of Ontario 1980 and Subsequent Revisions,
 - .5 Ontario Workplace Safety and Insurance Board – WSIB
 - .6 Municipal statutes and authorities.
- .4 In the event of conflict between provisions of above authorities the most stringent provision applies.
- .5 Where applicable the Contractor shall be designated the "Constructor" as defined by the Construction Lien Act of Ontario "Civil Code. Articles 2724-2732, 2952)."
- .6 Provide and maintain appropriate first aid equipment and supplies in accordance with First Aid Regulations. Obtain and implement recommendations from Occupational Health and Safety Division in province where work is performed specific to the project work site.

4.0 FILING OF NOTICE

- .1 File Notice of Project, and other construction related notices as required by law, with Provincial authorities prior to beginning of Work.

5.0 FIRE SAFETY REQUIREMENTS

- .1 Comply with the requirements of standard for Building Construction Operations FCC No. 301 - June 1982, (latest regulation) issued by the Fire Commissioner of Canada and local fire codes issued by the Office of the Fire Marshall.
- .2 Handle and dispose of gasoline, benzene or other flammable and combustible liquids in accordance with the requirements of the Gasoline Handling Act.
- .3 Place oily waste, rags and the like into suitable safety containers and remove from building at end of each working day.
- .4 When a fire occurs on Site or any extinguisher is used for any reason, submit full written report to Architect within 24 hours.

6.0 FIRE SAFETY PLAN

- .1 In accordance with the Ontario Building Code and the Ontario Fire Code prepare a fire safety plan identifying the following;
 - .1 Emergency procedures to be used in case of fire.
 - .2 Appointment of designated staff to carry out safety duties.
 - .3 Training of supervisory staff.
 - .4 Documents showing the type, location and operation of the buildings fire emergency systems.
 - .5 The holding of fire drills.
 - .6 The control of fire hazards in the building.
 - .7 The inspection and maintenance of the building facilities for fire fighting safety.

7.0 FALSE WORK

- .1 Design and construct false work in accordance with CSA S269.1.

8.0 SCAFFOLD

- .1 Design and construct scaffolding in accordance with CSA S269.2.

9.0 VISITORS

- .1 Provide new hard hats, safety glasses and vests for use by all visitors. Minimum of six (6).

10.0 FIRST AID FACILITIES

- .1 Provide on site, required first aid facilities in accordance with Occupational Health and Safety Act and first aid regulations 2005-130 and WHSCC first aid interpretation most recent issue.

11.0 OVERLOADING

- .1 Ensure no part of a project, including a temporary structure is subjected to load or procedure in excess of the load it is designed and constructed to bear, which will endanger its safety or the safety of project personnel.

12.0 HANDLING AND TRANSPORTATION OF DANGEROUS GOODS

- .1 Observe and enforce all measures required by the regulatory agencies including but not limited to Environment Canada, local authority having jurisdiction and Transport Canada.
- .2 Most current regulatory Guidelines and Acts will apply to the work.
- .3 In the case of any conflict, the more stringent requirements will apply.

13.0 POTENTIAL HAZARDS

- .1 Hazards include, but are not limited to, toxic, flammable and explosion hazards associated with cleaning solvents.
- .2 The Contractor shall become familiar with all potential hazards associated with the work, and shall take necessary measures to avoid injury or damage of any kind.

14.0 HEALTH AND SAFETY PLAN

- .1 Prior to commencement of the work, complete a Health and Safety Plan. Provide a copy to Owner and Architect if requested. The Health and Safety Plan shall comply with the provisions of this Section, and shall illustrate the Contractor's knowledge and understanding of health and safety aspects of the work, the Contractor's intention to maintain a high level of safety on-site, and shall include, but not be limited to:

- .1 General:
 - .1 Company policy statements
 - .2 Duties and Responsibilities
 - .3 Administration
 - .4 Emergency response plan

14.0

HEALTH AND SAFETY PLAN (CONT'D)

- .5 General policies
- .6 Hazard identification and control
- .7 Hazardous material policy
- .8 Orientation and training
- .9 Report forms
- .10 Safe work policies and procedures

- .2 Description of Work.

- .3 Description of site-specific hazards:
 - .1 Physical
 - .2 Chemical
 - .3 Environmental

- .4 Protective Equipment:
 - .1 Respiratory
 - .2 Contact

- .5 Decontamination Procedures:
 - .1 Personal protective equipment (PPE)
 - .2 Equipment

- .6 Medical Monitoring:
 - .1 Workers medical profile and suitability to work at the site

- .7 Air-Monitoring Procedures:
 - .1 Action levels
 - .2 Site Monitoring
 - .3 Perimeter Monitoring

- .8 Emergency Procedures:
 - .1 Emergency Equipment
 - .2 Contingency Plans:
 - .1 Spill Control
 - .2 Fire
 - .3 Ventilation
 - .4 Medical Emergency

14.0 HEALTH AND SAFETY PLAN (CONT'D)

.9 General Safety:

- .1 Designation of site-safety officer
- .2 Safety log
- .3 Trenching, digging, excavations
- .4 Storage of flammables, compressed gases
- .5 Safety Inspections

.10 Site Training

- .1 Initial hazard
- .2 Daily safety
- .3 SDS & worker training

- .2 All workers shall be trained and be familiar with the health and Safety Plan and the use of personal protective equipment.

15.0 TESTING AND MONITORING

- .1 Test and monitor for hazardous conditions, as required to demonstrate compliance with provincial regulations.
- .2 If multiple locations are being worked simultaneously, provide monitoring at all locations where work is being carried out, including providing additional monitoring instruments.

16.0 SITE SAFETY OFFICER

- .1 Appoint a responsible member of the work force as Site Safety Officer (SSO). The selection of the SSO will be subject to the approval of the Consultant and the Owner, and changes shall be made as requested. The SSO shall be responsible for ensuring that all provisions of the Health and Safety Plan and relevant legislation are implemented. The SSO shall ensure that all monitoring and testing, as specified, are conducted. The SSO shall maintain records of all readings that are taken by the Contractor and copy any abnormal or dangerous situations to the Consultant, after having implemented emergency measures, as required, and work shall not continue or proceed until the situation has been rectified.
- .2 The SSO shall be authorized to act on behalf of the Contractor on all matters related to Health and Safety.
- .3 The SSO will meet weekly with the Project Manager and Owner during renovation projects (in cases of new construction, these meetings will commence during joint occupancy or as soon as personnel begin start up procedures) to discuss safety issues/concerns from Owner perspective and recommendation for improvement.

17.0 PERSONAL PROTECTIVE EQUIPMENT

- .1 Use personal protection equipment or devices as prescribed by any manufacturers, provincial acts or safety regulation.
- .2 Training of workers in the proper use, fitting inspections and storage of personal protective equipment shall be done prior to use of the equipment.

18.0 SANITATION / DECONTAMINATION PRACTICES

- .1 After each use, all disposable protective equipment shall be collected in a dedicated container for disposal.
- .2 All respiratory equipment shall be decontaminated daily after use.
- .3 All tools, pumps and equipment used during cleanup should be dedicated to the handling of contaminants and labelled as such and thoroughly decontaminated at the completion of the project.
- .4 Contaminated work clothing shall not be worn outside of regulated areas.
- .5 Workers shall wash their hands and exposed skin before eating, drinking, smoking or using toilet facilities during the work shift, and at the completion of a work shift.
- .6 Food, drink and tobacco products shall only be permitted in regulated areas.

19.0 WORK PRACTICES AND ENGINEERING CONTROLS

- .1 Regulated Areas:
 - .1 Access to work areas shall be regulated and limited to authorized persons. A daily roster shall be kept of persons entering such areas.
- .2 Handling Contaminants and General Work Practices:
 - .1 Transportation and handling of contaminants applicable local, provincial and federal regulations.
 - .2 Emergency respiratory equipment shall be located in readily accessible locations which will remain minimally contaminated with contaminants in an emergency.
 - .3 Containers and systems shall be handled and opened with care. Approved protective clothing shall be worn by all employees engaged in regulated areas.
 - .4 All wastes and residues containing contaminants shall be collected in appropriate containers.

19.0 WORK PRACTICES AND ENGINEERING CONTROLS (CONT'D)

.3 Confined or Enclosed Spaces:

- .1** Entry into confined or enclosed spaces, where there is limited egress, shall be controlled by a permit system. Permits shall be signed by an authorized representative of the employer and shall certify that appropriate measures have been taken to prevent adverse effects on the worker's health as a result of his or her entry into such space.
- .2** Confined or enclosed spaces which have contained contaminants shall be thoroughly ventilated to assure an adequate supply of oxygen, tested for contaminants, and inspected for compliance with these requirements prior to each entry. Adequate ventilation shall be maintained while workers are in such spaces. Each individual entering such confined or enclosed space shall be furnished with appropriate personal protective equipment and clothing and be connected by a lifeline harness to a standby workers stations outside of the space. The standby worker shall also be equipped for entry with approved personal protective equipment and clothing and have contact with a third person. The standby person shall maintain communication (visual, voice, signal line, telephone, radio, or other suitable means) with the employee inside the confined or enclosed space.
- .3** Workers entering confined spaces and standby workers shall be trained at a recognized confined space training program.
- .4** Ensure all safety guidelines re: safety fences at perimeter construction of this project.

20.0 RECORD KEEPING

- .1** All activities associated with Health and Safety shall be recorded daily in a bound notebook. Include as a minimum: activity date, time, location of occurrence, mitigation action taken and Results. Records shall be provided to the Owner and Consultant when requested.

21.0 OPEN FLAMES, SPARKS, EXPLOSION PROTECTION

- .1** Keep open flames and sparks to a minimum. When flames or sparks are required, follow proper procedure to prevent fire or explosion.

22.0 VENTILATION OF WORKING AREAS

- .1** There will be potential for accumulation of hazardous chemical agents in the working area. Vent to atmosphere, or otherwise control, in accordance with environmental regulations, the vapours in building to avoid nuisance, health, safety or other hazards to the satisfaction of provincial regulatory requirements.

22.0 **VENTILATION OF WORKING AREAS (CONT'D)**

- .2 The Contractor shall include in his Emergency Plan for ventilation and provisions of ventilation equipment. If requested, submit plan of ventilation to the Consultant for review and concurrence.

23.0 **SITE SAFETY MEETINGS**

- .1 An orientation meeting will be held with all workers at the start-up of the work, with the presence of the Owner's Project Manager to review the Health and Safety aspects of the work.
- .2 An orientation meeting will be held for each new worker on the site following the initial orientation meeting.

24.0 **SUSPENSION OF ACTIVITIES**

- .1 Exposure to contaminants shall be controlled so that no worker is exposed to contaminants at a concentration greater than the Time Weighted Average (TWA) concentration for the contaminant, for up to a 10-hour workday, 40 hour work week.
- .2 The Contractor will halt activities immediately during unsafe conditions. All costs relating to suspension of work for Contractor's failure to maintain Health and Safety procedures shall be borne by the Contractor.

25.0 **SITE SECURITY**

- .1 The Contractor must secure the site during all phases of the construction period. **The Contractor must use Construction Safety and Industrial Safety Regulations approved fences and barriers around perimeter of construction works at all times.**

26.0 **JOB CLEANINGS AND HOUSEKEEPING**

- .1 Comply with all daily cleaning requirements contained within the specification as they pertain to construction areas and occupied areas of the building during Construction.
- .2 Coordinate, monitor and enforce these procedures as they directly relate to the health and safety plan.
- .3 Review these procedures at weekly safety meeting with S.S.O., the Owner's Project Manager.

27.0 **3RD PARTY HEALTH AND SAFETY INSPECTIONS**

- .1 Provide 3rd party monthly inspections of site and building for Health & Safety.

27.0

3RD PARTY HEALTH AND SAFETY INSPECTIONS (CONT'D)

- .2 Inspections to be performed by a Certified Company qualified to perform these inspections and to the approval of the Owner.
- .3 Keep reports on site and available for review by Owner & Consultants.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 REGULATORY REQUIREMENTS

- .1 Conform to the Ontario Building Code and Subsequent Revisions, Canadian Electrical Code (CEC), CSA B75-1977 and W59-1977 as applicable. Conform to The Occupational Health and Safety Act as applicable to the place of work and Subsequent Revisions and to the applicable Province Fire Code, and the City of Hamilton and all other applicable Codes and building By-Laws, hereinafter referred to as Codes. Conform to the requirements of the authorities having jurisdiction, including public utilities. Where required under The Occupational Health and Safety Act, engage a Professional Engineer to design formwork and false work for concrete.
- .2 Nothing contained in the Drawings or Specifications shall be so construed as to be in conflict with any law, by-law or regulation of the municipal, provincial or other authorities having jurisdiction. Work shall be performed in conformity with all such laws, by-laws and regulations.
- .3 Contract forms, codes, specifications, standards, manuals, and installation, application and maintenance instructions, referred to in these specifications are to be the latest published editions at the date of signing the Contract.
- .4 Provide copies of Standards referred to in the Specification for joint use of Contractor and Architect on Site - when so requested by the Consultant.

3.0 FIRE SAFETY FEATURES

- .1 The Contractor shall ensure that all fire safety features called for in the Contract Documents are supplied and installed to meet fire safety standards established by the authorities having jurisdiction. The Contractor shall ensure that the Work of Subcontractors is properly co-ordinated to achieve the intent of the Specification.

4.0 FIRE PREVENTION AND SAFETY

- .1 Enforce fire protection methods, good housekeeping, and adherence to local and underwriter's fire regulations.
- .2 Fires will not be permitted on the site. Remove combustible and non-combustible waste at regular intervals and/or when directed. Precautions shall be taken to avoid fire by spontaneous combustion. Smoking shall be prohibited, post "No Smoking" signs.

4.0 FIRE PREVENTION AND SAFETY (CONT'D)

- .3 Provide ULC approved fire extinguishers, and other fire fighting services and equipment except where more explicit requirements are specified as the responsibility of individual Sections.
- .4 Provide and maintain in good working order at least one (1) or as many as required, 2A 10BC fire extinguishers which shall be prominently placed and on the job from commencement of work until completion.
- .5 Maintain clear emergency exit paths for personnel at all times.
- .6 Use only fire-resistant tarpaulins and similar protective covering on site.

5.0 EXISTING FACILITIES

- .1 The Contractor must maintain exit facilities and access to thoroughfares during the construction contract. Co-operate at all times with the inspection staff of the City of Hamilton Building Department.

6.0 PERMITS

- .1 Where permits, licenses and inspection fees are required by either General Conditions or Local Authorities having jurisdiction for special trade functions, they shall be obtained and paid for by particular sub-trade responsible for that work.
- .2 Building Permit will be obtained and paid for by the Owner.
- .3 Determine detailed requirements of authorities having jurisdiction; give and post all notices and comply with laws, ordinances, rules and regulations bearing on conduct of work. If any work is performed with knowledge that it is contrary to such laws and ordinances, and without such notices to the Architect, bear costs arising out of this action.

7.0 DAMAGE DEPOSIT

- .1 The Contractor shall pay any required damage deposits to the municipality for damage to curbs, sidewalks, roads etc.
- .2 It will be the contractor's responsibility to submit a written request for the return of any unexpended amount of the deposit upon completion of the project.

8.0 REFERENCE STANDARDS

- .1 Where edition date is not specified, consider that references to manufacturer's and published codes, standards and specifications are made to the latest edition, revision approved by the issuing organization current the date of this Specification.

8.0 REFERENCE STANDARDS (CONT'D)

- .2 Reference standards and specifications are quoted in this Section to establish minimum standards. Work which in quality exceeds shall be considered to conform.
- .3 Should the Contract Documents conflict with specified reference standards or specifications the General Conditions of the Contract shall govern.
- .4 Where reference is made to manufacturer's directions, instructions or specifications they shall include full information on storing, handling, preparing, mixing, installing, erecting, applying or other matters concerning the materials pertinent to their use and their relationship to materials with which they are incorporated.
- .5 Have a copy of each code, standard and specification and manufacturer's directions, instructions and specifications to which reference is made in this Specification, always available at construction site.
- .6 Standards, specifications, associations and regulatory bodies are generally referred to throughout the specifications by their abbreviated designations. These are:

AA	The Aluminium Association
AABC	Associated Air Balance Council
AAMC	Architectural Aluminum Manufacturer's Association
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
AHC	American Institute of Hardware Consultants
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Air Control Association
ANSI	American National Standards Institute
APEO	Association of Professional Engineers of Ontario
ARI	Air Conditioning & Refrigeration Institute
ASME	American Society of Mechanical Engineering
ASTM	American Society of Testing and Materials
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers, Inc.
AWCC	Association of the Wall and Ceiling Contractors
AWI	Architectural Woodwork Institute
AWMAC	Architectural Woodwork Manufacturers Association of Canada
BHMA	Builders Hardware Manufacturing Association
CAN	National Standard of Canada
CCA	Canadian Construction Association
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturer's Association
CGA	Canadian Gas Association
CGSB	Canadian General Standard Board
CISCA	Ceiling and Interior Systems Construction Association
CICS	Canadian Institute of Steel Construction
CLA	Canadian Lumber's Association

8.0 REFERENCE STANDARDS (CONT'D)

CPCA	Canadian Painting Contractor's Association
CPMA	Canadian Paint Manufacturers Association
CSA	Canadian Standards Association
CSSBI	Canadian Sheet Steel Building Institute
FM	Factory Mutual Engineering Corporation
HRAI	Heating, Refrigeration and Air Conditioning Institute of Canada
IAO	Insurers Advisory Organization
IEEE	Institute of Electrical and Electronic Engineers
IGMAC	Insulating Glass Manufactures Association of Canada
IPCEA	Insulating Power Cable Engineers Association
LIB	Lumber Inspection Bureau
MFMA	Maple Flooring Manufacturers Association
MIC	Masonry Institute of Canada
MPI	Master Painters Institute
NAAMM	The National Association of Architectural Metal Manufacturers
NBC	National Building Code
NEMA	National Electrical Manufacturers Association
NFCA	National Flooring Covering Association
NFPA	National Fire Protection Association
NLFA	National Lumber Grading Authority
NRC	National Research Council, Canada
OAA	Ontario Association of Architects
OBC	Ontario Building Code
RCAC	Roofing Contractors Association of Canada
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal & Air Conditioning Contractors National Association
TTMAC	Terrazzo, Tile & Marble Association of Canada
ULC	Underwriters Laboratories of Canada
ULI	Underwriters Laboratories Incorporated
USAS	United States of America Standards

9.0 FIRE RATINGS, ASSEMBLIES AND SEPARATIONS

- .1 Where a material, component, assembly, or separation is required to be fire rated, the fire rating shall be as determined or listed by one of the following testing authorities acceptable to the authorities having jurisdiction:

.1	Underwriters' Laboratories of Canada
.2	Underwriters' Laboratories Inc.
.3	Factory Mutual Laboratories
.4	The National Research Council of Canada
.5	The National Board of Fire Underwriters
.6	Intertek Testing Services.

9.0 FIRE RATINGS, ASSEMBLIES AND SEPARATIONS (CONT'D)

- .2 Where reference is made to only one testing authority an equivalent fire rating as determined or listed by another of the aforementioned testing authorities is acceptable if approved by Authorities Having Jurisdiction. Obtain and submit such approval of authorities, in writing when requesting acceptance of a proposed equivalent rating or test design.
- .3 Fire rated door assemblies shall include doors, frame, anchors, and hardware and shall bear label of fire rating authority showing opening classification and rating.
- .4 Material having a fire hazard classification shall be applied or installed in accordance with fire rating authorities printed instructions.
- .5 Fire rated assemblies shall be constructed in accordance with applicable fire test report information issued by fire rating authority. Deviation from fire test report will not be allowed.
- .6 Construct fire separations as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from floor to underside of structural deck above.
- .7 Fire separations may be pierced by openings for electrical and similar service outlets provided such boxes are non-combustible and are tightly fitted and sealed with a ULC approved sealant for the assembly being sealed.
- .8 Construction that abuts on or is supported by a non-combustible fire separation shall be constructed so that its collapse under fire conditions will not cause the collapse of the fire separation.
- .9 Do not use combustible members, fastenings, attachments and similar items to anchor electrical, mechanical or other fixtures to fire separations.
- .10 At penetrations through fire rated walls, ceilings or floors, completely seal voids with ULC approved fire stopping materials, full thickness of the construction element. In locations that require a smoke seal, provide appropriate ULC.

END OF SECTION

DIVISION 1 - GENERAL REQUIREMENTS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 QUALITY CONTROL

- .1 Provide a system of quality control to ensure that the minimum standards specified herein are attained.
- .2 Bring to the attention of the Architect any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and state his recommendations in writing.
- .3 The Architect's general review during construction and inspection by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve him of contractual responsibility.

3.0 NOTIFICATION

- .1 Give the Architect advance notice of shop fabrication, field erection and other phases of the work so as to afford him reasonable opportunity to inspect the work for compliance with contract requirements. Failure to meet this requirement may be cause for the Architect to classify the work as defective.

4.0 DEFECTIVE MATERIALS AND WORKMANSHIP

- .1 Where factual evidence exists that defective workmanship has occurred or that work has been carried out incorporating defective materials, the Architect may have tests, concrete cores, inspections or surveys performed, analytical calculation of structural strength made and the like in order to help determine whether the work must be replaced. Test inspections or surveys carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Architect's opinion, the work may be acceptable.
- .2 All testing shall be conducted in accordance with the requirements of the Ontario Building Code except where this would, in the Architect's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Architect.

4.0 DEFECTIVE MATERIALS AND WORKMANSHIP (CONT'D)

- .3 Materials and/or workmanship which fail to meet specified requirements or in the opinion of the Architect fail to meet an acceptable level within the standards in the construction industry may be rejected by the Architect whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work incorporating defective materials or workmanship shall be promptly removed and replaced or repaired to the satisfaction of the architect, at no expense to the Owner.

5.0 INSPECTION AND TESTING

- .1 The Owner will hire and pay for an independent inspection service; however, any additional inspection and testing due to non conformance to the Contract Documents shall be at the Contractors expense.
- .2 It is the contractor's responsibility to notify the inspection consultant and the Architect 48 hrs. before the work is to be inspected.
- .3 The contractor is to provide access for inspection and testing personnel to work in progress, provide samples of the materials to be tested in required quantities at locations testing is performed. Provide labour and facilities for assistance to facilitate inspections and tests, storing of concrete specimens at required temperature and free from vibration in conformance with the reference standards.
- .4 Inspection and testing performed by firms engaged for source and field quality control shall not relieve the contractor from his responsibility of performing his work in accordance with the Contract Drawings.
- .5 The following is a partial list of typical inspections and tests which would normally be performed; but may not specifically include all required inspection services for this project.
- .1 Backfilling/ Placement of footing, floor slabs
 - .2 Concrete strength in footings, retaining walls, foundation walls, piers, columns, slabs on grade, sidewalks, curbs.
 - .3 Mortar strength cube tests/ Masonry ties.
 - .4 Rebar sizing, spacing and placement.
 - .5 Membrane Waterproofing.
 - .6 Steel Framing, Lintels, Structural Steel, Connections & Welding.
 - .7 Joint Protection
 - .8 Finish Hardware/ installation/ Operation/ Automatic door openers.

5.0 INSPECTION AND TESTING (CONT'D)

- .9 Air and moisture barrier installation and tie-ins.
- .10 Structural steel stud installation.
- .11 Reinforced and grouted joints in Precast Panels

6.0 QUALIFICATIONS OF INSPECTION AND TESTING COMPANIES

- .1 Inspection and testing companies to be certified by the Standards Council of Canada.
- .2 Companies engaged for inspection and testing shall provide equipment, methods of recording and evaluations, and knowledgeable personnel to conduct tests precisely as specified in reference standards.
- .3 If requested, submit affidavits and copies of certificates of calibration made by an accredited calibrator to verify that testing equipment was calibrated, and its accuracy ensured within the previous twelve months.

7.0 RESPONSIBILITY OF INSPECTION AND TESTING COMPANIES

- .1 Determine from specifications and Drawings the extent of inspections and testing required for Work of the Contract. Subcontractors shall notify Consultant of any omissions or discrepancies in the work inspected and/or testing.
- .2 Perform applicable inspection and testing described in the Specifications and as may be additionally directed.
- .3 Provide competent inspection and testing personnel when notified by the Contractor that applicable work is proceeding. Inspection personnel shall cooperate with the Consultant and Contractor to expedite the Work.
- .4 Subcontractors shall notify the Consultant and Contractor of deficiencies and irregularities in the Work immediately when they are observed in the course of inspection and testing.
- .5 Inspection and testing companies shall not perform or supervise any of the Contractor's work, and shall not authorize:
 - .1 Performance of work that is not in strict accordance with the Contract Documents.
 - .2 Approval or acceptance of any part of the Work.

8.0 INSPECTION AND TESTING PROCEDURES

- .1 Perform specified inspection and testing only in accordance with specified reference standards, or as otherwise approved.

8.0 INSPECTION AND TESTING PROCEDURES (CONT'D)

- .2 Observe and report on compliance of the Work to requirements of Contract Documents.
- .3 Ensure that inspectors are on site or at fabricator's operations for full duration of critical operations, and as otherwise required to determine that the Work is being performed in accordance with the Contract Documents.
- .4 Identify samples and sources of materials.
- .5 Review and report on progress of the work. Report on count of units fabricated and inspected at fabricator's operations.
- .6 Observe and report on conditions of significance to work on progress at time of inspection or at fabricator's operations. Include where applicable and if critical to the work in progress:
 - .1 Time and date of inspection.
 - .2 Temperature of air, materials, and adjacent surfaces.
 - .3 Humidity of air, and moisture content of materials and adjacent materials.
 - .4 Presence of sunlight, wind, rain, snow and other weather conditions.
- .7 Include in reports all information critical to inspection and testing.
- .8 Ensure that only materials from the work and intended for use therein are tested.
- .9 Determine locations for work to be tested.

9.0 TOLERANCES FOR INSTALLATION OF WORK

- .1 Unless acceptable tolerances are otherwise specified in a Section or are otherwise required for proper functioning of equipment, site services, and mechanical and electrical systems:
 - .1 "Plumb and level" shall mean plumb or level within 1mm in 1m.
 - .2 "Square" shall mean not in excess of 10 seconds lesser or greater than 90 degrees.
 - .3 "Straight" shall mean within 1mm under a 1m long straightedge.
- .2 Allowable tolerances shall not be cumulative.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1- GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 RELATED WORK SPECIFIED ELSEWHERE

- .1 Special Project Procedures Section 01 35 13

3.0 GENERAL

- .1 Accept responsibilities for all temporary structures and comply with applicable rules and regulations. Pay all taxes.
- .2 The expression "provide" shall be deemed to include the provision, installation and finishing, maintenance, servicing and removal of the work described. All work damaged by temporary installations shall be repaired and made good at no extra cost to the Owner.
- .3 Keep site clean and orderly during construction to the satisfaction of the Architect.

4.0 TRAFFIC CONTROL AND SECURITY

- .1 Provide necessary traffic control and security personnel as required for the safe performance of the Contract and security of the premises and the site.
- .2 Conform to the requirements of the local authority.
- .3 Conform to requirements of insurance companies providing coverage for this contract.
- .4 Security must be maintained at all times during construction to the satisfaction of the Owners Project Manager. The Contractor must have security present when working during all "OFF HOURS" when the Facility is closed. Security may be outsourced Security guards. All costs to be at Contractor's expenses.

5.0 CONTRACTOR'S SITE OFFICE

- .1 General Contractor shall provide a site office trailer, heated and air conditioned to 70°C, lighted to 750 Lux, smoke free and wall ventilated to be of sufficient size and furnished to accommodate site meetings. Keep in clean condition. Unless an alternate, suitable location can be accommodated on site in compliance with the Owner and Consultant.
- .2 Provide telephone and facsimile machine in Contractor's area. Pay telephone is not acceptable.

5.0 CONTRACTOR'S SITE OFFICE (CONT'D)

- .3 Maintain in contractors assigned area at all times, one bound set of Drawings and Specifications, all Addenda, Proposed Changes, Change Orders, Change Directives, Supplemental Instructions, Shop Drawings, Progress Reports, Meeting Diary, Hardware Schedule, Meeting Minutes, all applicable Standards & Regulations, etc.
- .4 Contractor to supply all necessary furniture and equipment for his project superintendent and manager to administer the job and safely store all contract documents.
- .5 Use only the area designated for Worker's Parking, as directed on site.

6.0 SANITARY FACILITIES

- .1 Provide adequate sanitary facilities for work force in accordance with the Municipal Regulations and Ordinances.
- .2 Post Notices and take precautions as required by local Health Authorities. Keep area and premises in sanitary condition. Have toilets maintained in sanitary conditions under contract. Clean and disinfect Site of the toilets on removal.
- .3 Do not permit construction personnel to use new or existing washroom and toilet facilities.

7.0 TEMPORARY ENCLOSURES

- .1 Provide temporary partitions and enclosures as required to protect the work and guard against burglary or malicious damage. See Barriers in item 1.11.
- .2 Provide heated, ventilated, weather tight enclosures complete with protective hoarding, gates and lighting to facilitate the demolition, construction and completion of all exterior building work as required to maintain temperature for working, surface and curing conditions required by all specified materials.

8.0 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and Site free from standing water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems without prior removal of contaminants.

9.0 WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

9.0 WATER SUPPLY (CONT'D)

- .3 Pay for utility charges at prevailing rates.

10.0 TEMPORARY SERVICES

- .1 Provide, install, maintain and locate where directed the facilities for the Work and for all trades except where specified otherwise and remove them upon completion of the work. These facilities shall be considered minimal and shall be increased as necessary. Pay all charges and billings in connection therewith.
- .2 Install lighting for emergency evacuation, safety and security throughout the Project as required by jurisdictional authorities. Light to be evenly distributed, and at intensities to ensure that proper installations and applications are achieved.
- .3 Provide telephone service for Owner, Architect and Consultants use and all trades and pay all charges.
- .4 Provide water of potable quality for all construction purposes, at locations approved by the Architect.
- .5 Maintain all fire protection as required by the authorities having jurisdiction.
- .6 Include cost of all services used by Owner forces and equipment until Substantial Performance, in Contract price.
- .7 Ensure date of warranties for new heating and ventilation system do not commence until Substantial Performance.

11.0 TEMPORARY HEATING

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Provide temporary heating fuel, if not already available on site, until such time as a permanent natural gas line is installed. All fuel costs shall be borne by the Contractor. The Contractor shall provide all connections and piping between the permanent fuel source and the heating appliance(s).
- .3 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders not permitted.
- .4 Maintain temperatures of minimum:
 - .1 10 degrees C in areas where construction is in progress, until takeover by Owner. Contractor to ensure temporary enclosures remain sealed and penetrations are repaired or closed in a timely fashion.

11.0 TEMPORARY HEATING (CONT'D)

- .2 16 degrees C in areas where finishes are in progress.
- .3 16 degrees C in building once it is enclosed.
- .4 Refer to other Sections for intermittent heating requirements up to 21 degrees C.
- .5 Provide insulated tarp enclosures for openings as required to enclose the building after completion of main building shell components and roof.
- .5 The permanent heating system of the building, or portions thereof, may be used when available subject to the following conditions:
 - .1 Be responsible for damage to systems and equipment.
 - .2 Warranty period for equipment and systems put into use prior to date of substantial completion will commence from date of substantial completion as per certificate of substantial completion issued by Consultant.
 - .3 Where manufacturers equipment warranty periods are commenced prior to substantial completion, Contractor will provide extended warranty under same terms and conditions.
 - .4 Only with Approval from Owner.
- .6 On completion of work for which permanent heating system is used, replace filters, and clean.
- .7 Be responsible for damage to work due to failure in providing adequate heat and protection during construction.

12.0 TEMPORARY POWER AND LIGHT

- .1 Contractor will provide as sources for, and pay the costs of temporary power during construction for temporary lighting and operating of power systems until such time as permanent sources are available.
- .2 Provide at least one temporary panel on each floor with service capacity suitable for construction requirements and to authorities and utilities approval.
- .3 Provide and maintain temporary lighting throughout project. Level of illumination shall not be less than 15-foot candles, 162 Lx.
- .4 Supply electric power for all construction purposes. Make connections available to any part of the work within distance of 90'-0" extension. Provide power at temporary storage sheds and field office.

12.0 TEMPORARY POWER AND LIGHT (CONT'D)

- .5 Install lighting for emergency evacuation, safety and security throughout the Project as required by jurisdictional authorities. Light to be evenly distributed, and at intensities to ensure that proper installations and applications are achieved.

13.0 CONSTRUCTION EQUIPMENT

- .1 Select, operate and maintain hoisting equipment and cranes as may be required. Operate such equipment only by qualified hoist or crane operators. Make hoist available for Work of each Section.
- .2 Erect scaffolding, independent of walls. Use scaffolding so as to interfere as little as possible with the work. When not in use, move scaffolding as necessary to permit other work. Construct and maintain scaffolding in rigid, secure and safe manner. Remove scaffolding in rigid, secure and safe manner. Scaffolding shall permit convenient access to all levels for all workmen and inspection staff.

14.0 GENERAL PROTECTION

- .1 Without limiting the Contractor's responsibility to provide all necessary protection, the Contractor shall:
 - .1 Provide necessary methods, materials and construction to ensure that no damage or harm to work, materials, property and persons results from the work of this Contract.
 - .2 Remove snow and ice as may be required for the protection and/or execution of the Work. Do not use salt under any circumstances.
 - .3 Wet all areas to prevent dust rising and power hose daily to remove dirt. During cold weather, ensure that mud is scraped off areas outside hoarding as well as in.
 - .4 Provide as required to permit Work to continue without interruption, tarpaulins, polyethylene, plastic or wood coverings to close in building prior to installation of windows and doors.
 - .5 Protect materials and equipment delivered to the Site in the Owner's name for installation in the Work.
 - .6 Do not apply markings to surfaces exposed to view in finished state or that receive transparent finishes.
- .2 Any work damaged by failure to provide protection as required or damaged as a result of lack of adequate temporary heat shall be removed and replaced with new, at no additional cost to the Owner.

14.0 GENERAL PROTECTION (CONT'D)

- .3 Each Trade shall avoid damaging the Work of other Trades. Conduct the Work and provide protective covering as necessary to meet this requirement. Make good at own expense any damage resulting from failure to meet this requirement. Protective measures shall be to Consultant's approval.
- .4 If it is necessary to work on roof after installation of roof coverings, protect membrane with plywood sheets or similar materials.
- .5 Provide all necessary shoring and bracing as required for safety and execution of the Work.
- .6 Protection of Off-Site Public Property:
 - .1 Protect surrounding private and public property from damage during performance of work.
 - .2 Be responsible for damage incurred.
- .7 Protection of Building Finishes and Equipment
 - .1 Provide protection for finished and partially finished building finishes and equipment during performance of work.

15.0 SIGNS AND NOTICES

- .1 Construction Banners:
 - .1 Install construction banners where directed on site by the Owner.
 - .2 Banners will be supplied by the Owner.
- .2 Safety Sign:
 - .1 Erect signs relating to Safety of the Work, or mandatory regulation notices.
 - .2 Prior to commencement of Work wherein hazardous or volatile cements, coatings, or substances are used, barricade entire area and post adequate number of "NO SMOKING" signs, as directed by authorities having jurisdiction.
 - .3 Do not display any other signs, posters or advertising matter on Site without approval of Architect.
- .3 Site Project Sign:
 - .1 Supply and install "Site Project Sign" as detailed on Drawings.
 - .2 Obtain electronic images of Client and Consultants logos and artwork.

15.0 **SIGNS AND NOTICES (CONT'D)**

- .4 Other Signs & Announcements:
 - .1 No signs, public announcements or publications concerning any aspect of this project will be allowed without the prior approval of the Owner.

16.0 **BARRIERS**

- .1 General:
 - .1 Some phases of construction may be divided into sub-phases to accommodate time constraints with opening and maintenance of some existing and/or finished areas.
 - .2 Barriers may need to be partially removed and/or temporarily relocated prior to opening up the entire area to accommodate; early opening of sub-phase areas, installation of finishes, and access to washrooms and exits, etc.
 - .3 Coordinate these moves with the Owner's Project Manager.
- .2 Provide barriers to the satisfaction of the Owner, Architect and local authorities for the protection of the Public, Project Workmen, including but not limited to:
 - .1 Isolation of construction area.
 - .2 Separation from excavated areas.
 - .3 Protection from falling/flying debris.
 - .4 Separation from pits, shafts, walls.
 - .5 Protection from odours, noise and dust.
- .3 Types of Barriers
 - .1 Visual
 - Horizontal Obstruction
 - Solid – easily moved
 - Continuous
 - .2 Semi Solid
 - Physical Obstruction
 - Resist day to day abuse
 - .3 Solid Barrier
 - Resist heavy impact
 - Constructed of framing lumber and plywood to with stand expected forces.
 - Provided with hinged access complete with locking devices.

16.0

BARRIERS (CONT'D)

- .4 Marking on barriers shall be provided by way of signs, reflectors or flashing devices to indicate degree of hazard.
- .5 Protect existing landscaping adjacent to site work as required to avoid physical contact or disrupted of natural site conditions.
- .6 Barriers are to be painted white and maintained in a clean and neat manner.
- .7 When barriers are solid to an elevation of 8'-0" from the finished floor and required to extend to the underside of the roof deck, a continuous sheet of 6 mil. polyethylene is to be used to seal from the top of the barrier to the underside of the structure above. All joints and edges are to be secured in place and sealed. Pay specific attention when the poly membrane is penetrated with mechanical or electrical services. Infill the gap generated at the underside of the metal deck and top plate with batt insulation. Refer to details and sections on the drawings.
- .8 Solid barriers required in or adjacent to public corridors shall be adequately constructed with a painted gypsum board finish in strict compliance with the Owner's requirements.
 - .1 It is the contractor's responsibility to obtain & confirm all design requirements for this hoarding prior to installation.
- .9 When barriers are constructed to separate new construction from occupied areas, the hoarding is to be solid and full height.

END OF SECTION

DIVISION 1 - GENERAL REQUIREMENTS

PART 1- GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 PRODUCT AND MATERIAL QUALITY

- .1 Products, materials, equipment and articles (referred to as Products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective Products 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 expenses caused by rejection.
- .3 Should any dispute arise as to quality of fitness of Products, decision rests strictly with the Architect based upon requirements of Contract Documents.

3.0 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products on site or in storage area in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store products subject to damage from weather in weatherproof enclosures.
- .3 Store packaged materials in original undamaged containers with manufacturers label and seals intact.
- .4 Store steel, lumber, precast concrete, sand/masonry units and manufactured items off ground on approved supports and provide weatherproof covering. Stack to permit air circulation and prevent damage to units.

4.0 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect Products in accordance with manufacturer's instruction. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify Architect in writing, of conflicts between specifications and manufacturer's instruction, so that Architect may establish course of action.

4.0 MANUFACTURER'S INSTRUCTIONS (CONT'D)

- .3 Improper installation of erection of Products, due to failure in complying with these requirements, authorizes the Architect to require removal and reinstallation at no increase in Contract Price.
- .4 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the 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.

5.0 WORKMANSHIP

- .1 Workmanship shall be best quality executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Architect if required Work is such as to make it impractical to produce required results.
- .2 Do not employ any unfit person or anyone unskilled in their required duties.
- .3 Decisions as to quality or fitness of workmanship in cases of dispute rest solely with the Architect whose decision is final.

6.0 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Architect if there is a contradictory situation. Install as directed by Architect.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 GENERAL

- .1 Conduct cleaning and disposal operations to comply with local ordinances, anti-pollution laws, and recommendations of Construction Safety Association.
- .2 Store volatile wastes in covered metal containers and remove from premises daily.
- .3 Prevent accumulation of wastes which create hazardous conditions.
- .4 Provide adequate ventilation during use of volatile or noxious substances.
- .5 Provide instructions designating proper methods and materials to be used in final cleaning of Work.

3.0 MATERIALS

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

4.0 PROGRESSIVE CLEANING

- .1 Maintain project areas, public sidewalks and municipal roadways free from accumulations of waste materials and rubbish. Do not allow rubbish to accumulate in work under construction or on low roofs.
- .2 Schedule cleaning operations so that dust or other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- .3 Cleaning operations shall include those areas used for temporary site access or used on a temporary basis to facilitate the Work.
- .4 Ensure splatters, over applications, droppings, soil, labels and debris are removed from surfaces to receive new finishes, before they set-up. Leave work and adjacent finished work in new condition.
- .5 Maintain premises "Broom Clean" at all times. Vacuum clean interior areas immediately before finish painting commences.

4.0 **PROGRESSIVE CLEANING (CONT'D)**

- .6 The Contractor is to take every effort necessary to control the movement of dust from the construction area into the completed areas during ceiling spray painting, and construction.
- .7 The General Contractor will be responsible for all cleaning and garbage box rentals for use of all trades. Maintain a clean, orderly site, on a daily basis, to the satisfaction of the Owner. Garbage box location and its time allowed must be approved by the Landlord/ Owner.
- *.8 **All cleaning is to be done to the satisfaction of the Owner's Project Manager. If in the opinion of the Project Manager the contractor is failing to comply with these cleaning requirements, the Owner at their discretion will engage an independent third party cleaning company to complete this work. All associated costs to perform this work will be deducted from the General Contractors Contract Price.**

5.0 **FINAL CLEANING (AS APPLICABLE TO TRADE-SUBSECTIONS)**

- .1 In addition to the progressive removal of rubbish from the entire building and Site, and leaving the buildings broom clean, the Contractor shall perform the following work before final acceptance.
- .2 Clean and polish glass both sides, mirrors, wall tile and plastic laminate and replace broken glass.
- .3 Remove dust, stains, paint, soil, grease, spots, marks, accumulations of construction materials and dirt from decorated work, electrical and mechanical fixtures, millwork and the like. Remove protective materials.
- .4 Clean hardware, aluminium, stainless steel and the like.
- .5 Cleaning all the exterior windows. Peeling plastic covering from all stainless steel.
- .6 Remove paint spots and smears from all surfaces.
- .7 Vacuum clean all building interiors behind grilles, louvres and screens affected in construction operations.
- .8 Pressures wash all exterior asphalt areas and sidewalks to remove stains, fines and dust. Broom clean and scrub all areas unable to be cleaned with the pressure wash.
- .9 Broom clean and remove debris and materials from roof areas, gutters, areaways and sunken wells.
- .10 Replace heating, ventilating and air conditioning filters if units were operated during construction.

5.0 FINAL CLEANING (AS APPLICABLE TO TRADE-SUBSECTIONS) (CONT'D)

- .11 Leave premises ready for immediate occupation without further cleaning, all to the Architect's approval.
- .12 Wax, seal, shampoo, or prepare floor finishes as recommended by manufacturer. A complete strip wax of all floor area flooring is to be completed and covered with the installation of Five (5) additional coats of wax.
- .13 Inspect finishes, fitments and equipment, and ensure specified workmanship and operation.
- .14 Wash all exterior windows and frames (inside and out).
- .15 Remove temporary fasteners, dirt, construction graffiti and other disfigurements from exterior surfaces.
- .16 Lubricate operative equipment to manufacturer's requirements, using recommended SAE lubricants only. Drain and flush lubricant reservoirs.
- .17 Upon completion of final cleaning close rooms and areas to all but authorized persons.
- .18 Clean roof areas and drainage systems.

6.0 FINAL CLEANING

- .1 Include all labour and materials, tools, equipment, transport, taxes and insurances necessary to complete the FINAL CLEANING work, in accordance with drawings and specifications.

7.0 CLEAN-UP PRIOR TO APPLYING FOR SUBSTANTIAL PERFORMANCE

- .1 Before applying for Substantial Performance of the Work as provided in GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK, the Contractor shall remove waste products and debris, other than that resulting from the work of the Owner, other Contractors or their employees, and shall leave the Place of Work clean and suitable for use or occupancy by the Owner. The Contractor shall remove products, tools, Construction Equipment, and Temporary Work not required for the performance of the remaining work.

8.0 CLEAN-UP PRIOR TO APPLYING FOR FINAL PAYMENT

- .1 Prior to application for Final Payment, the Contractor shall remove any remaining products, tools and Construction Equipment, Temporary Work, and waste products and debris, other than those resulting from the work of the Owner, other contractors or their employees.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1- GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 GENERAL REQUIREMENTS

- .1 **Note: 1% of Contract value will be held from final payment until all final Deficiencies & Close Out submissions have been complied with.**

3.0 MAINTENANCE MANUALS

- .1 Five (5) days after the Substantial Performance submit to Consultant Hardcopies and Electronic copies of Operations Data, Maintenance Data and Materials made up as follows:
 - .1 Provide Electronic copies of Operations Data and Maintenance Manuals and as-built drawings and one (1) electronic copy of coloured PDF format of all Operation and Maintenance Manuals, As-Built drawings (drawings to be scanned) on CD / DVD or USB Flash device.
 - .2 Provide individual folder by Division for Architectural, Civil, Landscape, Structural, Mechanical and Electrical.
 - .3 Bind data in vinyl hard covered, three "D" ring loose leaf binders of the same colour, for 8-1/2" x 11" size paper.
 - .4 Enclose title sheet, labelled "Operation Data and Maintenance Manual", project name, date, a list of contents, list of specification section and drawings.
 - .5 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .2 **Sample Format (to be provided as directories on the close out drives and hardcopies):**
 - .1 Architectural Closeout:
 - .1 Shop Drawings
 - .2 Warranties
 - .3 Maintenance & Operation Manuals
 - .4 As-Built Drawings
 - .5 Designated substances / hazardous materials audit report.
 - .6 Survey Certificate

- 3.0 **MAINTENANCE MANUALS (CONT'D)**
- .2 Structural Closeout:
 - .1 Shop Drawings
 - .2 Warranties
 - .3 Maintenance & Operation Manuals
 - .4 As-Built Drawings
 - .3 Mechanical Closeout:
 - .1 Shop Drawings
 - .2 Warranties
 - .3 Maintenance & Operation Manuals
 - .4 As-Built Drawings
 - .4 Electrical Closeout:
 - .1 Shop Drawings
 - .2 Warranties
 - .3 Maintenance & Operation Manuals
 - .4 As-Built Drawings
 - .5 Project Changes:
 - .1 Proposed Changes
 - .2 Site Instruction
 - .3 Change Directives
 - .4 Change Orders
 - .6 Conformance & Permit:
 - .1 Items Required for Permit Sign Off
 - .2 Building Permit & Permit Drawings
 - .3 Building Inspection Reports
 - .3 Include the following information plus data specified.
 - .1 Maintenance instruction for finished surface and materials.
 - .2 Copy of hardware and paint schedules.
 - .3 Description, start-up and shutdown procedures, operation service and maintenance instructions for equipment and system, including complete list of equipment and parts list. Indicate nameplate information such as make, model no., size, capacity, flow rates, belt size, type and lengths, serial number.

3.0 **MAINTENANCE MANUALS (CONT'D)**

- .4 Names, addresses and phone numbers of Subcontractors and suppliers who can affect repair maintenance on equipment.
- .5 Guarantees, warranties and bonds showing:
 - .1 Name and address of Project.
 - .2 Guarantee commencement data (date of Certificate of Substantial Completion).
 - .3 Duration of warranty.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and seal of Contractor and Subcontractor.
- .6 Additional material used in project listed under various sections showing name of manufacturer and source of supply.
- .7 Neatly type lists and notes. Use clean drawings, diagrams or manufacturer's literature.
- .8 Include one complete set of final approved Shop Drawings (bound separately) indicating corrections and changes made during fabrication and installation.
- .9 Include a complete list of lubricants with lubricating instructions for all moving parts, recommended spare parts for operating equipment, cleaning, overhaul and adjustment schedules and similar maintenance information.

4.0 **MAINTENANCE MATERIALS**

- .1 Where supply of maintenance materials is specified, deliver to the Owner as follows:
 - .1 Materials in unbroken cartons, or if not supplied in cartons, they shall be strongly packaged.
 - .2 Clearly mark as to content.
 - .3 If applicable give colour, room number of area where material used.
 - .4 Provide written letter confirming quantities and location of materials left on site.
- .2 Where not specifically noted in each Specification Section: Supply 2% or minimum 2 cases of all materials.

5.0 **AS-BUILT DRAWINGS**

- .1 Provide Colour PDF Format As-Built Drawings. (Record Drawings).
- .2 Obtain 2 complete sets of Contract Documents from Architect and record all changes and revisions neatly and mechanically in red ink for all trades.
- .3 Submit to Architect at completion of the Contract for review and sign off.
- .4 Submit as-built drawings for Mechanical and Electrical trades as specified in their respective specification sections.
- .5 Submit as-built site and building drawing complete with building area calculations.

6.0 **CLOSE OUT CERTIFICATES AND DOCUMENTS**

- .1 Required Close Out documents after the issuance of Certificate of Substantial Performance.
 - .1 Provide all necessary documents and certificates for Close Out procedure.
 - .2 Provide copy of all field reports issued by Consultants.
 - .3 Provide copy of all field inspection reports issued by Authorities Having Jurisdiction.
 - .4 Provide copy of the General Conformance letters including all reports and certificates submitted to the Consultants.
 - .5 Provide a copy of the Certificate of Substantial Performance as well as its publication.
 - .6 Refer to "Appendix D" in "Section 01 31 00 "Project Management and Coordination" for complete list of Project Close Out documents.

7.0 **SUBMISSIONS AND HOLD BACK RELEASE**

- .1 All final submissions are to be made in a timely manner.
- .2 All deficiencies are to be completed to the satisfaction of the Architect and Owner.
- .3 The release of Holdback Monies will be contingent on completing all submission requirements.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1- GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 GENERAL

- .1 All Warranties including standard one-year warranty, shall start at date of substantial Performance of the Total Contract, or when work of an area is substantially completed, accepted and taken over for use by the Owner. Ensure that all warranties comply with this stipulation prior to submission of same.
- .2 The Owner shall give prompt notice in writing to the Consultant of any defects noted during the warranty periods(s) and the Architect will notify the Contractor promptly requesting him to remedy such defects.
- .3 The Contractor shall correct promptly, at the Contractors expense, defects or deficiencies in the Work which appear prior to and during the one (1) year Warranty period.
- .4 The Contractor shall correct and pay for damages resulting from corrections made under the requirements of paragraph 2.3.
- .5 During the month prior to the end of the standard one-year warranty period, the Owner, the Architect and the Contractor, shall conduct an inspection of the project, the Contractor shall promptly remedy any defects due to faulty materials or workmanship.
- .6 Use of permanent heating system for temporary heat shall not affect requirement that all warranties start at date of issue of Architect's Certificate of Substantial Completion. However, if portions of the system are accepted and taken over of use by the Owner, then the warranty shall start at date of acceptance on those portions of the work.
- .7 At the expiry of the standard one-year warranty period the Contractor shall formally assign to the Owner all extended warranties given by Subcontractors for their work on the project and such Subcontractors for their work on the project and such Subcontractors shall be formally advised of the assignment.

3.0 LIST OF EXTENDED WARRANTIES

- .1 The following warranties specified elsewhere in the Specification are hereunder listed for convenience only. All warranties called for in the individual Specification Sections shall be supplied, whether so listed or not.

3.0 LIST OF EXTENDED WARRANTIES (CONT'D)

Section 04 20 00 – Unit Masonry	2 years
Section 06 20 00 - Finish Carpentry	2 years
Section 08 11 13 – Hollow Metal Doors & Frames	2 years
Section 08 71 00 - Door Hardware	5 years
Section 08 71 13 – Power Door Operators	3 years
Section 08 80 00 - Glazing	5 years

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1- GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 PROTECTION OF WORK, PROPERTY AND PERSONS

- .1 Enforce fire prevention methods on site. Do not permit bonfires, open flame heating devices or accumulation of debris. Use flammable materials only if proper safety precautions are taken, both in use and storage.
- .2 Do not store flammable materials in the building. Take necessary measures to prevent spontaneous combustion. Place cloths and other disposable materials that are a fire hazard in closed metal containers and remove them from the building every night.
- .3 Where flammable materials are being applied, ensure that adequate ventilation is provided, spark-proof equipment is used, and smoking and open flames are prohibited.
- .4 Ensure that volatile fluid wastes are not disposed of in storm or sanitary sewers or in open drain courses.

3.0 FIRES

- .1 Fires and burning of rubbish on Site is **not** permitted.

4.0 DISPOSAL OF WASTES

- .1 Burying of rubbish and waste materials on Site is **not** permitted.
- .2 Disposal of waste or volatile materials, such as mineral spirits oil or paint thinner into storm or sanitary sewers is prohibited.
- .3 Provide on-site disposal service for rubbish accumulated by all trades work.

5.0 POLLUTION CONTROL

- .1 Prevent extraneous materials from contaminating air beyond application areas, by providing temporary enclosures.
- .2 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

6.0

DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and Site free from water.
- .2 Dispose of water containing silt in suspension in accordance with local authority requirements.
- .3 Take full responsibility for maintenance of existing drainage, above ground and underground, adjacent to the Work or affected by the Work.
- .4 Before commencing any Work likely to affect the drainage of water from the existing building or Site, provide necessary alternative drainage systems to ensure that water will be conducted to alternative outlets. Do not block or impede any drain, roof outlet or rainwater leader such safety precautions have been made.

END OF SECTION

DIVISION 01 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

2.0 QUALITY ASSURANCE

- .1 Provide testing organization services under the provisions specified in Section 01 45 00 "Quality Control". and as required by the individual specification Sections.
- .2 Testing organization: current member in good standing of AABC, certified to perform specified services.
- .3 Comply with applicable procedures and standards of the certification sponsoring association.
- .4 Perform services under the direction of a supervisor qualified under the certification requirements of the sponsoring association.
- .5 The General Contractor is to hire one Commissioning agent who is to be responsible for the coordination, start up and verification of all systems under all Divisions. A final report to be issued confirming that all specification requirements for M&E have been met, balanced, set points, interlocks, timers etc. have been set, are functional and are coordinated with other systems. The cost of such agent is considered part of the contractors' general conditions and is not paid out of testing and inspection allowances.

3.0 REFERENCES

- .1 Associated Air Balance Council (AABC): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems.

4.0 SUBMITTALS

- .1 Prior to start of Work, submit the name of the organization proposed to perform services. Designate who has managerial responsibilities for coordination of the entire testing, adjusting and balancing.
- .2 Submit documentation to confirm the organization's compliance with quality assurance provisions.
- .3 Submit 3 preliminary specimen copies of each of the report forms proposed for use.
- .4 Fifteen days prior to Substantial Performance, submit 3 copies of the final reports on the applicable forms.

4.0 SUBMITTALS (CONT'D)

- .5 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond the Contractor's control, promptly after execution of those services.

5.0 PROCEDURES - GENERAL

- .1 Comply with the procedural standards of the certifying association under whose standard the services will be performed.
- .2 Notify the Consultant 3 days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report to the Consultant any deficiencies or defects noted during the performance of the services.

6.0 FINAL REPORTS

- .1 The Organization having managerial responsibility shall make the reports.
- .2 Ensure each form bears the signature of the recorder, and that of the supervisor of the reporting organization.
- .3 Identify each instrument used, and the latest date of calibration of each.

7.0 CONTRACTOR RESPONSIBILITIES

- .1 Prepare each system for testing and balancing.
- .2 Cooperate with the testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify the testing organization and Commissioning agent 7 days prior to the time the project will be ready for testing, adjusting, and balancing.

8.0 PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing operations.
- .2 Make instruments available to the Consultant to facilitate spot checks during testing.
- .3 Retain possession of the instruments and remove at the completion of services.
- .4 Verify that the systems installation is complete and in continuous operation.

8.0 PREPARATION (CONT'D)

.5 Verify that lighting is turned on when lighting is included in the cooling load.

.6 Verify equipment such as computers, laboratory and electronic equipment are in full operation.

9.0 EXECUTION

.1 Test equipment; balance distribution systems; and adjust devices for HVAC systems.

.2 Test hydronic systems adjust and record liquid flow at each piece of equipment.

10.0 SCHEDULE OF SYSTEMS REQUIRING TESTING, ADJUSTING, AND BALANCING SERVICE

.1 See the Mechanical and Electrical drawings for requirements

END OF SECTION

DIVISION 02 - EXISTING CONDITIONS

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Special Project Procedures Section 01 35 13
- .2 Health, Safety and Emergency Procedures Section 01 35 29
- .3 Temporary Facilities & Controls Section 01 50 00
- .4 Facility Performance Requirements Section 01 81 00

1.2 WORK INCLUDED

- .1 All Work of this Section shall be done in strict accordance with Section 01 35 13 of the Specification, as shown on the Architectural Drawings and as noted in the Demolition Structural Assessment.
- .2 This Section includes the demolition, removal and disposal of components of the existing building. Include all labour, equipment and material required for a complete work.

1.3 QUALIFICATIONS

- .1 Work under this Section shall be performed by a Contractor specializing in this type of work. Furnish evidence of qualifications upon request of the Architect.
- .2 Use only skilled tradesman for Work under this Section.

1.4 MATERIALS FROM DEMOLITION

- .1 The owner will have first right of refusal for all materials and equipment scheduled for demolition or removal from the building.
- .2 All materials resulting from demolition work will become the property of the Contractor, with the exception of those materials shown on the Drawings to be relocated, removed, re-used or turned over to the Owner.

1.5 SUBMITTALS

- .1 Prior to the commencement of Work, submit a schedule and a summary of the methods of demolition and type of equipment intended to be used.
- .2 Submit detailed shop drawings of all shoring, underpinning and scaffolding to be used in the demolition and removal of beams, lintels, columns and masonry walls.
- .3 Submit in accordance to Section 01 33 00.

1.6 PROTECTION

- .1 Provide, erect and maintain required hoarding, sidewalk sheds, catch platforms, lights and other protection around Site before commencing Work. Maintain such areas free of snow, ice, mud, water and debris. Lighting levels shall be equal to that prior to erection.
- .2 Protect existing areas against damage, dust, odours, and noise which might occur from falling debris during the demolition process or other cause. Do not interfere with use of existing areas and maintain free, safe passage to and from same.
- .3 Provide flagmen where necessary or appropriate to provide effective and safe access to Site to vehicular traffic and protection to pedestrian traffic.
- .4 Protect adjacent structures and property against damage which might occur from falling debris or other causes. Repair or replace damage caused from Work of this Section to acceptance of Consultant.
- .5 Do not interfere with use of adjacent structures and Work areas. Maintain free, safe passage to and from adjacent structures and Work areas.
- .6 If movement or settlement occurs, install additional bracing and shoring as necessary and make good damage to acceptance of Consultant.
- .7 Hang tarpaulins where debris and other materials are lowered. Build in around openings with wood and plywood at locations used for removal of debris and materials.
- .8 Prevent debris from blocking surface drainage system, elevators, mechanical, and electrical systems which are required to remain in operation.
- .9 Pay particular attention to prevention of fire and elimination of fire hazards which would endanger Work or adjacent structures and premises.
- .10 Supply, install and maintain legal and necessary barricades, guards, railings, lights, warning signs, security personnel and other safety measures, and fully protect persons and property.

1.6 **PROTECTION (CONT'D)**

- .11 Precautions shall be taken to prevent movement of existing areas, settlement or damage of adjacent structures, services, walks and pavement. This Contractor shall be responsible for safety and support of existing areas and be liable for any movement, any damage or injury caused thereby, or resulting therefrom.
- .12 If at any time, during the course of Demolition Work, the safety of the existing areas appear to be endangered, cease operations and notify the Consultant; and do not proceed with Demolition Work until permission has been granted to do so.
- .13 If movement is caused by negligence or default of the Contractor, he shall be completely responsible to rectify the situation, at no extra cost to the Owner.
- .14 Provide special protection for sensitive finishes being retained, removed and re-installed.
- .15 Do not temporarily fasten hoarding or dust closures to the finished floor, ceiling and /or wall finishes.

PART 2 - PRODUCTS

- 2.1 Not Applicable.

PART 3 - EXECUTION

3.1 **PREPARATION**

- .1 All Bidders shall visit the Site and **thoroughly examine existing conditions** in order to familiarize themselves with the extent of demolition and removal work required to properly execute this portion of the Contract. **(Non Mandatory)**
- .2 Disconnect electrical and telephone service lines entering areas to be demolished as per rules and regulations of authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other areas during demolition.
- .3 Disconnect and cap mechanical services in accordance with requirements of local authority having jurisdiction.
 - .1 Natural gas supply lines to be removed by gas company.
 - .2 Remove sewer and water lines and cap to prevent leakage.
 - .3 Remove and cap or dispose other existing underground services.
- .4 Do not disrupt active or energized utilities traversing premises.

3.2 DEMOLITION

- .1 Do not start demolition without the approval of the Architect.
- .2 Do not operate heavy equipment such as front end loader on the floor slab without the approval of the Architect.
- .3 The use of explosives will not be permitted.
- .4 The burning of materials on Site is not permitted.
- .5 In addition to following the requirements of the Ontario Building Code, carry out demolition in accordance with the requirements of local and Municipal Authorities and the Canadian Construction Safety Code.
- .6 Furnish all labour, materials, tools, plant, scaffolding, chutes and services required or incidental to the completion to the full extent of the Work and to the full intent of the Drawings and Specifications, for the execution of all demolition and protection work specified herein.
- .7 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces and replace same as work progresses.
- .8 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts not to be demolished from exterior elements at all times.
- .9 Demolish in a manner to minimize dusting. Keep dusty materials wetted.
- .10 Demolish masonry and concrete walls in small sections. Carefully remove and lower structural framing and other heavy or large objects.
- .11 Selling or burning materials on site is not permitted.
- .12 Remove contaminated or dangerous materials from site and dispose of in safe manner to minimize danger at site or at any time during disposal.
- .13 Removal of floor covering material includes adhesives, mortars and grout. Slab to be left ready for installation of new flooring. Grind floor smooth to remove as required. Remove floor covering where new finishes are called for.
- .14 Employ rodent and vermin exterminators to comply with health regulations.
- .15 Perform demolition with extreme care. Confine effects of demolition to those parts which are to be demolished.

3.2 DEMOLITION (CONT'D)

- .16 Perform Work and prevent inconvenience to persons outside those parts which are to be demolished.
- .17 Carry out demolition in accordance with the requirements of CSA S350-M.
- .18 Demolish parts of structure to permit remedial Work as indicated on drawings.
- .19 Do not overload floor or wall with accumulations of material or debris or by other loads.
- .20 At end of day's Work, leave Work in safe condition with no part in danger of toppling or falling.

3.3 REMOVALS

- .1 Carefully remove, store and protect all equipment and materials which are to be salvaged, relocated and re-used from the building using qualified tradesmen.

3.4 CLEANUP AND DISPOSAL

- .1 Clean up the work areas daily to the satisfaction of the Architect.
- .2 Dispose of concrete, steel masonry and debris and other unsalvageable materials off site except where noted otherwise.
- .3 Clear the entire site of all debris at completion of this Contract.

END OF SECTION

DIVISION 3 - CONCRETE

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 GENERAL REQUIREMENTS

- .1 In the event of any discrepancy between this section and the structural specifications as stated on Structural drawings, Construction Notes & Schedules” as prepared by the Structural Engineer and the structural specification will take precedence.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Concrete Finishing Section 03 35 00

1.3 REFERENCE STANDARDS

- .1 Refer to general notes on structural drawings.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions and addenda.
- .3 Conform with the applicable regional Building Code standard.
- .4 Related Standards
 - .1 CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA A23.3 Design of concrete structures
 - .3 CAN/CSA A3000 Cementitious Materials Compendium.
 - .4 CAN/CSA W186 Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .5 ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
 - .6 ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete

1.4 INSPECTION AND TESTING

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Consultant.
- .2 Tests will be carried out under the appropriate CSA standards and as directed by the Consultant.
- .3 The Contractor shall supply all necessary samples to the Testing Laboratory for testing. Supply additional labour required to assist the Testing Laboratory in making such tests. The cost of this material and labour shall be borne by this section.
- .4 Inspection company reports of tests will be forwarded to the Consultant and to the Contractor with an opinion or reason for any abnormalities noted thereon.
- .5 Cooperate with and assist Inspection Company's personnel during inspection and tests.
- .6 Remove defective materials and completed work, which fail tests and replace as directed by Consultant, at no cost to Owner. The Contractor as a result of materials and work that failed original tests shall pay for further inspection and testing required.

1.5 SUBMITTALS

- .1 Submit manufacturers' product data, performance criteria and other documentation for each material specified in this section that is proposed for use including, but not limited to the following:
 - .1 Admixtures
 - .2 Curing Compounds
 - .3 Sealing Compounds
 - .4 Surface Hardeners
 - .5 Joint Filler
- .2 Submit Shop Drawings and product literature in accordance with Section 01 33 00.
- .3 Provide design mix for review.
- .4 Also submit the following:
 - .1 Proposed placement equipment.
 - .2 Schedule of events and casting plan regarding placement operations, and records of concrete pours.
 - .3 In addition to that specified above, provide submittals to the Consultant as defined in the referenced CSA standards, which are applicable to work of this Section.

1.5 QUALITY ASSURANCE

- .1 It is the intent of this Section to establish a single component source to be responsible for providing complete, durable concrete floors as specified herein. Including provisions of formwork, reinforcing, concrete and finishing complete as specified herein.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Store materials on Site in a manner to prevent damage. Protect materials from inclement weather, comply with CAN/CSA – A23.2.
- .2 Protect materials and work of this Section from damage. Protect other work from damage resulting from work of this section. Replace damaged work, which cannot be satisfactory repaired at no cost to the Owner.

1.7 JOB CONDITIONS

- .1 Environmental requirements: The minimum temperature of the sub grade at the time of placement of the concrete shall be 12 ° C when measured by a temperature embedded 25 mm (1") into the granular material.
- .2 During cold weather, provide temporary heating and enclosures as required. Mix, place and protect concrete in accordance with CAN/CSA-A23.1.

1.8 TOLERANCES

- .1 Place concrete level and true to linear building lines.
- .2 Maximum variation of concrete slab shall not exceed 3 mm in 6 m x 6m (1/8" in x 20'-0" x 20'-0") area and shall be sufficiently even to make contact with a 3000 mm (10'-0") long straightedge with a tolerance of 3 mm (1/8").
- .3 A permitted variation in any part of the construction or in any Section of the Specification shall not be construed as permitting violation of more stringent requirements for any other part of the construction or any Specification Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Portland Cement: to CAN/CSA-A3001 Type GU.
- .2 Water, fine aggregates, normal weight course aggregates: to CAN/CSA A-23.1.
- .3 Air entraining admixture: to ASTM C 260.
- .4 Chemical admixtures: to ASTM C 494.

2.1 MATERIALS (CONT'D)

- .5 Pozzolanic mineral admixtures: to CAN/CSA-A3001.
- .6 Ready-mixed concrete: to CAN/CSA A-23.1 and the requirements of these Specifications.
- .7 Non-shrink grout: pre-mixed compound consisting of metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 50 MPa at 28 days.
- .8 Joint filler for sawn control joints: Refer to section 03 35 00 (Concrete Finishing).
- .9 Super plasticizer by concrete supplier, to be added on site. To be used for the slab on grade only.

2.2 CONCRETE MIXES

- .1 All concrete exposed to foot traffic in its final condition shall have a cement content of not less than 290 kg/cu.m. without water-reducing admixtures or not less than 262 kg/cu.m. with water-reducing admixtures.
- .2 All concrete floors, stairs and platforms which will not be exposed to foot traffic in its final condition shall have a cement content of not less than 262 kg/cu.m without water-reducing admixtures or not less than 240 kg/cu.m. with water-reducing admixtures.
- .3 Size of course aggregate shall be not more than 20 mm and not less than 10 mm, except for concrete on steel deck where size of aggregates shall not be more than 10 mm.
- .4 Water/cement ratio shall not exceed the values indicated in Table 2 for Class C exposure of CAN/CSA A23.1. Water/cement ratio for exterior slabs on grade shall not exceed **0.55**.
- .5 Water/cement ratio for interior slabs on grade shall not exceed **0.45**.
- .6 Concrete shall be designed to prevent segregation and excessive bleeding. Submit mix designs for approval. Provide any necessary evidence that the mix designs will provide the desired properties.
- .7 Determine concrete strengths from standard cylinders, sampled, cured and tested at 28 days in accordance with CAN/CSA-A23.1.
- .8 Refer to drawings, structural general notes or elsewhere in the Specification for strength of concrete required for various locations, but in all cases, the minimum 28-day strength shall not be less than the following:
 - .1 Skim slab, concrete for backfilling purposes 15 MPa
 - .2 Raft Slab 35 MPa

2.2 **CONCRETE MIXES (CONT'D)**

.3	Foundations, Retaining walls, Pile caps and Piers	25 MPa	
.4	Interior slabs on grade, steel deck or insulation	25 MPa	
.5	All exterior concrete slabs and columns	32-35 MPa	
.6	All other concrete	25 MPa	
.9	Concrete is to have the following slumps <u>at the point of placing</u> :	Maximum	Minimum
.1	Footings, Pile caps, Piers	110 mm	50 mm
.2	Foundation walls, reinforced concrete walls, beams & slabs (except as otherwise provided herein):	110 mm	50 mm
.3	Raft slabs, structural slabs, slabs on grade and deck after the addition of super plasticizer.	110 mm	50mm
.4	Toppings	50 mm	25 mm
.10	Obtain specified slumps with the aid of specified water reducing agent.		
.11	The use of slag or fly ash is <u>NOT ALLOWED IN THE MIX FOR SLABS ON GRADE.</u>		
.12	The interior slab on grade is <u>NOT TO HAVE AIR ENTRAINMENT,</u> and a maximum of 2% to 3% entrapped air.		
.13	The super plasticizer shall be provided for slabs on grade to ensure a workable product.		

2.2 **ADMIXTURES**

- .1 Admixture will be permitted only to correct a definite deficiency in mixture or to make correct placement requirements as recommended by the Testing Laboratory and approved by the Consultant.
- .2 Approval for the use of the admixture will be withdrawn if during the course of the work, concrete performance appears unsatisfactory.
- .3 Accelerating admixtures may be used subject to approval in cold weather. If approved, the use of admixture will not relax the cold weather placement requirements of CAN/CSA A23.1-04. **The use of calcium chloride is not permitted.**
- .4 Set-retarding admixtures may be used subject to approval during hot weather to allow for proper finishing of concrete.

2.3 **ADMIXTURES (CONT'D)**

- .5 For all concrete exposed to weather provide 6% to 9% air entrainment as per the requirements of CAN/CSA A23.1, Tables 2 and 4.

PART 3 - EXECUTION

3.1 **PRE- CONCRETE SLAB POUR CONFERENCE**

- .1 At least fifteen (15) days prior to start of the concrete construction schedule, a pre-concrete conference MUST be held. The mix design shall be reviewed, and the required methods and procedures to achieve the required concrete shall be discussed. The Contractor shall send a pre concrete conference agenda to all the attendees' ten (10) days prior to scheduled date of the conference.
- .2 The contractor shall require responsible representatives of all parties concerned with the concrete work to attend the conference, including but not limited to the following: the contractor's super, a representative from the laboratory responsible for the concrete mix design, the laboratory responsible for field quality control, the concrete sub contractor, the ready mix concrete producer, the admixture manufacturer (s), the hardener supplier, and the concrete pumping contractor.
- .3 Minutes of meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within five (5) days of the meeting. One (1) copy of the minutes shall also be transmitted to the following for information purposes: the Owner's representatives, the Architect, and the Consultant engineer.
- .4 The Consultant engineer will be present at the conference. The Contractor shall notify the Consultant engineer at least ten (10) days prior to the schedule date of the conference.

3.2 **RECORDS**

- .1 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and test samples taken.

3.3 **PREPARATION FOR PLACING CONCRETE**

- .1 Prior to pouring Concrete, Contractor to provide legal survey of the building location on the site. Survey to be taken to the concrete work for the foundation wall. Review the survey and architect approval must be received prior to pouring of concrete for the foundation wall.
- .2 Ensure that footing excavations and skim slabs are free of frost or water before placing concrete. If a sump is required for pumping water from the excavation, locate it outside the area for footings. Remove any wet or disturbed soil just prior to placing concrete.

3.3 PREPARATION FOR PLACING CONCRETE (CONT'D)

- .3 Before placing concrete, check that all forms are rigid and structurally safe, and that all reinforcing steel, formwork, sleeves, anchor bolts and other items are installed in accordance with the Drawings and Specifications. Ensure that all trades have checked the security and location of all components required in the concrete by those trades.

3.4 SLABS-ON-GRADE

- .1 Install adjustable screed supports after reinforcing is placed.
- .2 Immediately prior to placing concrete, moisten base material to reduce absorption of moisture from the concrete.
- .3 Prior to slab pour place concrete around drains, cleanouts interceptors, trenches etc. by hand to allow an early set-up to ensure proper levels, alignment and setting.
- .4 Place concrete and screed level to indicated elevations.
- .5 Unless otherwise detailed, use building paper or polyethylene to separate slab-on-grade from vertical surfaces.
- .6 Provide saw-cut or formed control joints in slabs-on-grade inside the building at maximum spacing of 3.8M (12'-6"). Locate control joints in consultation with the Consultant. Construct joints in accordance with Clause 3.6 and 3.7.
- .7 Level of finished concrete floors under finished floor application shall be within 6 mm of established elevations in any 6 meter x 6 meter square area, and shall be sufficiently even to contact a 3 meter long straight- edge with a tolerance of 6 mm under ceramic/ VCT finish levels and shall not vary more than 1.5 mm in any running foot (Coordinate with structural engineer).
- .8 In case of any deviation from these noted. It will be the sole responsibility of the Contractor to repair the slab to the satisfaction of BJC architects ins. Using the "ADREX" self-levelling compound as specified below.
- .9 Provide "ADREX" compound for the entire space, where the concrete floor surface is not level with the allowable tolerance as indicated above, install a self-levelling Cementitious underlayment, high strength, non-shrink, self-levelling Cementitious underlayment having a minimum of 4,100 PSI 28 days compressive strength, "ADREX – K15" by ARDEX INC.

3.5 CO-OPERATION WITH OTHER SECTIONS

- .1 Set sleeves, ties, anchor bolts, pipe hangers and other inserts, openings and sleeves in concrete work, as required by other Sections. Sleeves, openings, etc., greater than 100 mm square in diameter not indicated on the structural drawings must be approved by the Consultant.

3.5 **CO-OPERATION WITH OTHER SECTIONS (CONT'D)**

- .2 Ensure that all sleeves, insets, anchors and other fasteners required to be installed by other trades are installed before placing concrete.
- .3 Set all frames in concrete.

3.6 **CONTROL JOINTS**

- .1 In floors, form control joints as detailed. Where diamond- shaped or other isolation joints are shown to be constructed around columns or piers, place after the floor has been concreted and saw cuts have been made.
- .2 Saw-cut joints shall extend into the slab one-third of the slab thickness. Take care that control joints are sawn within 24 hours after finishing the concrete and ensure that the sawing will not tear or damage the concrete surface or use Soft cut method immediately after finishing.
- .3 Fill ALL control joints with joint filler in accordance with manufacturer's directions.
 - .1 Remove dirt, debris, laitance and other foreign material from joint.
 - .2 Fill joint full depth with Joint Filler. Refer to Section 03 35 00 (Concrete finishing).
 - .3 Fill slightly crowned and shave flush within 3-12 hours or sooner if allowed.
 - .4 Wait as long as possible to fill joints. If separation does occur in joints repair using a low viscosity epoxy or similar material as originally installed.

3.7 **CONSTRUCTION JOINTS**

- .1 Where construction joints are required in locations not shown on drawings, locate in consultation with the Consultant.
- .2 Provide shear keys in all construction joints, unless agreed otherwise for specific locations by the Consultant. Normally form keys from 50 mm x 100 mm material. Depth of keys shall total approximately 1/3 of the depth of the member. In deep members, use two or more keys.
- .3 Unless otherwise detailed on the structural drawings, provide reinforcement continuous along construction joints. Install (400 mm) 16" long, 10 M rebar's at 16" o.c. (400 mm) along entire length of joint with 1/2 the bar length in each slab.

3.8 **TEMPERATURE OF CONCRETE**

- .1 In cold weather, concrete shall be delivered to the work having a temperature of not less than 18 deg. C. and not more than 27 deg. C.

3.8 TEMPERATURE OF CONCRETE (CONT'D)

- .2 In hot weather, concrete shall be delivered to the work having a temperature of not less than 10 deg. C. and not more than 27 deg. C.
- .3 Hot and cold weather concreting shall comply with all requirements of CAN/CSA A-23-1 unless noted otherwise.

3.9 SLUMP OF CONCRETE

- .1 Slump tests shall be taken in conjunction with sampling of concrete for cylinder tests (see Article 3.16). If the inspector from the Testing Laboratory reports to the Contractor's representative that the slump is excessive, the Contractor shall remove the balance of the concrete from the site without further instructions. Refer to Notes on Structural Drawings.
- .2 If the Consultant suspects that the slump of concrete is excessive and so instructs the Contractor, the latter shall carry out additional slump tests in the presence of the Consultant. No further concrete shall be placed until the test is carried out. Concrete with excessive slump shall be removed from the site. Provide slump testing equipment on site, readily available for this testing.
- .3 Slump tests shall be carried out following the requirements of CSA Method of Test A23.2.5C.
- .4 It is not permitted to add water to concrete on site unless approved by the Consultant.

3.10 DEPOSITING

- .1 Notify the Consultant at least 24 hours before each day's operation of placing concrete.
- .2 Unless otherwise agreed by the Consultant, consolidate all concrete in place by means of internal vibrators. Use the largest vibrator consistent with the type and location of concrete being placed. Vibrators shall be in accordance with CSA A23.1, Clause 5.4 Table 19.
- .3 Apply vibrators systematically and at such spacing that the zones of influence overlap. Do not over-vibrate.
- .4 Keep one spare vibrator for every three vibrators in use in case of breakdown.
- .5 Concrete and pump must be ordered through Contractor
- .6 It is the responsibility of the Subcontractor to obtain the location from Contractor of where concrete trucks shall enter to prevent damage to existing site conditions.
- .7 Truck clean-outs to be as per Contractor instructions.

3.11 CURING

- .1 Protect and cure concrete in accordance with CAN/CSA A23.1 Table 20 and Clause 7.4.1 in such a manner as to prevent evaporation of moisture from the concrete and damage to the surface.

3.12 TREATMENT OF FORMED SURFACES

- .1 Repair honeycomb areas of "as-formed" concrete not exposed in the finished work. No additional treatment is required. Do all work in accordance with CAN/CSA A23.1.

3.13 DEFECTIVE CONCRETE

- .1 Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.
- .2 Patch, repair and make good concrete at rod holes or snap ties and sleeves, ready for damp proofing.

3.14 PATCHING

- .1 Unless instructed otherwise by the Architect, patch imperfections when concrete is green as follows:
 - .1 Chip down edges perpendicular to the surface.
 - .2 Wet the area and brush on 1:1 cement-sand grout.
 - .3 Patch with 1:2 cement-sand mortar with 10% hydrated lime.

3.15 GROUTING

- .1 Grout between column base plates and/or beam bearing plates and bearing surface of concrete piers and foundations and/or masonry walls. Use a premixed non-shrink grout in accordance with manufacturer's directions.

3.16 FLOOR SLOPES

- .1 In areas with drains provide positive slope to drain/trench such that there is no standing or ponded water remaining on the floor after a flood wash.
- .2 Perform a flood test in presence of the Owner's Project Manager to ensure compliance.
- .3 Failure to provide adequate slope to drain / trenches will require removal of slab area and replacement at contractors cost.

3.17 SLAB DEPRESSIONS

- .1 Depress concrete slabs for special floor finishes.
- .2 Refer to Drawings finish schedule for specified areas and confirm depth to suit.
- .3 Ensure edges are consistent in depth at perimeter and parallel to wall faces and fixtures.

3.18 OPENINGS IN SLAB

- .1 Provide formed openings and pits through concrete floor slabs to accommodate service risers, equipment, ductwork and the like, refer to details.

3.19 SIDEWALKS

- .1 Unless otherwise noted all sidewalks shall comply with the following:
 - .1 Minimum slab thickness 125mm (5").
 - .2 Surfaces shall be tamped, screened and wood floated.
 - .3 Finish edge with 1/4 round radius tool.
 - .4 Install saw cut control joints at 1.5m (5'-0") maximum intervals in both directions.
 - .5 Bond break joints are to be installed with 6 mil poly. Continuous abutting buildings, columns or other vertical obstructions (not at doorways).
 - .6 All sawcut control joints are to be sealed. (See specification Section 07 90 00)
 - .7 All sidewalks to be on minimum 300mm (12") of compacted granular "A" base to 98% S.P.M.D.D. with suitable subbase as prescribed in soils report or by Soil consultant.
 - .8 Sidewalk finish to be broomed in the direction of slope.
 - .9 Slope sidewalks away from building @ 1% per foot unless otherwise noted.
 - .10 Keep top of sidewalk 25mm (1") minimum below wall flashings at building perimeter, unless otherwise noted.
 - .11 At the main entrance, the sidewalk is to be dowelled to the foundation wall and set on 100mm (4") of rigid SM HI-40 insulation by Dow Chemical, or Approved Alternate.
 - .12 The slope of the sidewalk at the Main Entrance is to be no more than 0.5% away from the building and marry flush with the adjacent asphalt surface. Refer to wall sections and details.

3.19

SIDEWALKS (CONT'D)

- .13 Refer to drawings for locations where insulation is to be installed under sidewalks for standard details.
- .14 Install 15m 36" x 18" L re-bars at 16" o.c. embedded 18" into the foundation wall and extend into the sidewalk at all entrances. Refer to details on drawings.
- .15 Water test all sidewalks adjacent to the building to confirm proper drainage away from the building. Test in the presence of the Architect and Owners Representative.

END OF SECTION

DIVISION 03 - CONCRETE

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Cast-In-Place Concrete Section 03 30 00
- .2 Painting (Application of Paint, Urethane and Epoxy Floor Finishes) Section 09 91 00

1.3 QUALITY ASSURANCE

Requirements of Regulatory Agencies

- .1 Applicable Codes and Standards governing the work of this Section.
- .2 Related Standards:
 - .1 CAN/CSA A23.1 Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA A23.2 Methods of Tests for Concrete.
 - .3 ASTM C 260 Air Entraining Admixtures for Concrete.
 - .4 ASTM C 494 Chemical Admixtures for Concrete.
- .3 Except as otherwise specified, placing, finishing, curing, joint cutting, and forming and temperature control of concrete slabs on which surface hardeners are to be applied, shall be in accordance with 1.2.1. and 1.2.2. clauses-2.1 and 2.2.
- .4 Work shall be done by a Firm and by Mechanics with at least five years experience in this type of work and who are members of the Concrete Floor Construction Association.

1.4 SUBMITTALS

- .1 Submit manufacturers' product data, performance criteria and other documentation for each material specified in this section that is proposed for use including, but not limited to following:
 - .1 Admixtures
 - .2 Curing Compounds

- 1.4 **SUBMITTALS (CONT'D)**
- .3 Sealing Compounds
 - .4 Surface Hardeners
 - .5 Joint Filler

PART 2 - PRODUCTS

2.1 **MATERIALS**

- .1 General: use materials specified herein or approved equal as defined in General Requirements.
- .2 **Note:** Refer to Floor Finishes Plan and Schedules for locations of specific applications listed here in.
- .3 Non-Metallic Hardener Manufacturer (Natural Colour):
 - .1 “Sika Emericrete SH” by Sika Canada.
 - .2 Surflex by Euclid Canada.
 - .3 Mastercron FF by BASF.
- .4 Non-Metallic Hardener Manufacturer (Coloured Hardener):
 - .1 “Surflex” Colored by Euclid Canada.
 - .2 Mastercron Colored by Master Builders.
 - .3 Sika Colorplete by Sika Canada.
- .5 Curing, Sealing and Densifier Compound:
 - .1 “Diamond Clear 350” by Euclid Canada.
 - .2 “Kure-N-Seal 25” by BASF.
 - .3 “Sikafloor 3S” by Sika Canada.
- .6 Joint filler for sawn control joints (Interior Application):
 - .1 “Euco 700” or “Euco Quickjoint UVR” by Euclid Canada.
 - .2 “Load Flex” by Sika Canada.

2.1 **MATERIALS (CONT'D)**

- .3 Other approved manufacturer.
- .4 Colour of Joint filler to be grey or as selected by the Architect.
- .7 For Concrete Control & Expansion Joints (Exterior application):
 - .1 "Eucolastic 1SL (Self Levelling) by "Euclid Canada.
 - .2 "Eucolastic 2NS" for vertical application by "Euclid Canada".
- .8 Concrete densifier for New and Existing Concrete Floor:
 - .1 "Euco Diamond Hard" by "Euclid Canada".
 - .2 Liqui Hard Ultra" by WR Meadows.
- .9 For Heal and Seal concrete and penetrating shrinkage cracks:
 - .1 "Dural 50" by "Euclid Canada" or "Euco Quick Stitch".
- .10 For Transition Strip for floor (Ramp):
 - .1 "Duraflex Fastpatch", low modulus repair epoxy repair kit by "Euclid Canada".

PART 3 - EXECUTION

3.1 **PREPARATION**

- .1 Examination
 - .1 Before work commences ensure that all preceding work has been completed in accordance with the specifications. Report any deficiencies to the Architects before proceeding with the work.

3.2 **INSTALLATIONS**

.1 **GENERAL**

- .1 **Note:** Refer to Floor Finishes Plan and Schedules for locations of specific applications listed here in.
- .2 Follow manufacturer's instruction for surface preparation, direction for use and precautions/ limitations.

3.2 **INSTALLATIONS (CONT'D)**

- .3 Unless otherwise specified or directed, all floors concrete within the building shall be finished with a power float and power trowel to finish the surface to a smooth, even finish.

- .2 Floor Finishes: Coordinate compatibility of Concrete Sealer application with paint finishing of Paint, Urethane or Epoxy floor finishes.

- .3 Conform to the requirements of CAN/CSA A23.1&2 Finishing and/or as hereinafter specified.

- .4 Employ a minimum amount of hand trowelling to remove any machine marks after the power trowelling.

- .5 Provide a non-slip, spin trowel finish where directed.

- .6 Secure the Architects approval of finished surfaces before leaving any area.

- .7 Cure and protect the surface of finished floors and roofs in accordance with CAN/CSA A23.1.

- .8 Keep traffic, which would affect and/or otherwise disturb the curing procedures, off the finished surface for a period of seven (7) days minimum.

- .9 Protect exposed concrete finishes against damage until the building is accepted by the Architect.

- .10 Protect floors which are to receive an Architectural finish against contamination by oil, paint or other deleterious materials.

- .11 Floors in rooms with an exposed concrete floor finish noted to receive a non-metallic hardener and curing & sealing compound, shall be applied strictly in accordance with the manufacturer's directions at the rate of 3.9kg/m² - 5.0kg/m² (80 lbs. to 100 lbs. per 100 sq.ft) of surface.

- .12 The selected mineral aggregate for the dry shake shall be applied immediately before power floating begins. As soon as concrete is firm enough to support the weight of workmen and their equipment and NO surface water is present, apply the first shake of material. Treat areas adjacent to walls and columns first. Spread the material evenly by sprinkling at right angles in two passes close to floor level. Do NOT broadcast from the stationary position. Approximately two-thirds of the material shall be broadcast uniformly over the surface. Power floating shall begin immediately after application of the dry shake. Work wall, column and door areas first. After this material is adequately embedded or blended into the surface by power floating, the remaining one-third of the material shall be applied to the surface at right angles to the previous application. During the second application, care should be exercised to apply sufficient material to all areas to secure uniform coverage.

3.2 INSTALLATIONS (CONT'D)

- .13 For Non-Hardened concrete floors, cure finished concrete surfaces with curing and sealing compound which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Ensure that the curing compound will be compatible with the Architectural finishes, or adhesives for Architectural finishes to be applied later. Apply the compound in strict accordance with the manufacturer's instructions.
- .14 Protect surfaces which will be exposed to direct sunlight during the curing period, with a light coloured, laminated waterproof paper immediately after the curing and sealing compound has hardened sufficiently for the paper to be placed without damage to the sealed surface. Lap the paper a minimum of 4 inches and seal the laps. Leave the paper in place for at least seven (7) days.
- .15 Floors in all rooms with an exposed concrete floor finish that are noted to receive a clear urethane coating:
 - .1 Apply in a continuous film by a cold low-pressure sprayer only after slab has cured 28 days minimum.
 - .2 If slab is porous apply a second coat where first coating is inconsistent, with a light sanding between coats.
 - .3 Allow 3-4 hrs. minimum for drying between coats.
 - .4 Apply 2 finish coats "of topcoat" with a light sanding between coats.
 - .5 Allow final application to dry for 48 hrs. prior to the application of heavy traffic.
 - .6 Read and follow the product literature and application instructions.

3.3 FINISHING OF FORMED CONCRETE SURFACE

- .1 Conform to the requirements of Cast-In-Place Concrete: Section 03 30 00, except as hereinafter specified.

END OF SECTION

DIVISION 04 - MASONRY

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 REFERENCE STANDARDS

- .1 ASTM A123/A123M, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A580/A580M, Stainless Steel Wire.
- .3 ASTM A653/A653M, Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
- .4 ASTM D2240, Test Method for Rubber Property Durometer Hardness.
- .5 CAN/CSA A179, Mortar and Grout for Unit Masonry.
- .6 CAN/CSA A370, Connectors for Masonry.
- .7 CAN/CSA A371, Masonry Construction for Buildings.
- .8 CAN/CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .9 CAN/CSA G30.3-M, Cold-Drawn Steel Wire for Concrete Reinforcement.
- .10 CAN/CSA G40.18-M, Billet-Steel Bars for Concrete Reinforcement.
- .11 CAN/CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Steel/Structural Quality Steel.
- .12 CAN/CSA S304.1, Design of Masonry Structures.
- .13 CAN/CSA-A165 SERIES-04 - CSA Standards on Concrete Masonry Units
- .14 CAN/CSA-A82-14 - Fired masonry brick made from clay or shale

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Installations of Hollow Metal Door and Window Frames. Section 06 10 00
- .2 Sealing of Control and Expansion Joints Section 07 90 00
- .3 Supply Only of Hollow Metal Door and Window Frames. Section 08 11 13

1.3 SUPERVISION

- .1 Work of this Section shall be executed under the continuous supervision and direction of a competent foreman for each class of work.
- .2 One thoroughly experienced, reliable and competent man shall be in charge of mortar mixing.

1.4 SHOP DRAWINGS

- .1 Consult the approved Shop Drawings to determine the exact location of items to be built into masonry.

1.5 SAMPLES & SUBMISSIONS

- .1 Submit for approval clearly labelled samples of masonry units, reinforcement and accessories to be used in the work. Submit for approval of samples of alternative materials if requested by the Architect.
- .2 All submittals to be in accordance to section 01 33 00.
- .3 Approved sample panel shall establish standard for acceptance or rejection of actual work.
- .4 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specifications requirements.

1.6 JOB MOCK-UP

- .1 Construct mock-up panel where directed by Architect.
- .2 Construct mock-up panel of exterior masonry wall construction 4'-0" x 6'-0" min. in size, showing masonry colours, textures, pilasters, recesses, panelling, use of reinforcement, ties, through wall flashing, weep holes, ventilators, jointing, coursing, mortar, sills and workmanship.
- .3 Clean one half of mock-up wall in accordance with cleaning requirements here-in and leave remainder for comparison.
- .4 Receive acceptance of Mock-Up by Architect before proceeding with masonry installation.

1.6 JOB MOCK-UP (CONT'D)

- .5 Mock-up may remain as part of the work if acceptable to the Architect.
- .5 The approved mock-up panel shall establish the standard for acceptance or rejection of actual work.

1.7 DEFECTS DEFINED

- .1 In addition to non-compliance with specified requirements or other contract requirements, the following will be considered defect:
 - .1 Shrinkage in individual units and erected.
 - .2 Spalling.
 - .3 Poor colour or texture blending of units.
 - .4 Surface deterioration dusting.
 - .5 Discolouration, crumbling and similar deterioration of mortar.
 - .6 Failure of built in items to remain anchored.
 - .7 Excessive cracking of mortar joints on brick faces.
 - .8 Over cuts at service entries, boxes, etc..

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Store cementitious material in accordance with CAN3.A5. Store aggregates in accordance with CAN A.23. Stack masonry units to avoid chipping. Manufacturers seals and labels shall be intact.
- .2 Protect concrete block from rain and inclement weather to ensure that blocks are dry when delivered to site, while stored on site and when used.

1.9 FIRE SAFETY FEATURES

- .1 Masonry units used in partitions designed to provide fire separation shall be of material specified and in the case of hollow units shall have the percentage of solid material necessary to provide the rating called for and or required by authorities having jurisdiction.
- .2 Concrete block and similar hollow units shall be identified as to percentage of solid material and tested for fire separation value in each thickness. Delivery slips shall state tested status of the units and the skids shall be marked to facilitate identification of the units at Site.

1.10 **WARRANTY/GUARANTEE**

- .1 Provide guarantee for 2-year period. Warranty to cover both labour and materials. Warranty shall start from the date of substantial performance.

PART 2 - PRODUCTS

2.1 **MATERIALS**

.1 **Concrete Block:**

- .1 Standard concrete masonry units Type 1: to CAN/CSA-A165 Series (CAN/CSA-A165.1).
 - .1 Classification: H/15/A/M. (Unless noted otherwise on Structural Dwgs. & Spec.)
 - .2 Size: metric modular.
 - .3 Curing: Autoclaving to CAN/CSA-A165 Series-M85 (CAN/CSA-A165.4) or bubble cure system, TCG Material Ltd or Boehmers.
 - .4 Use header and other special shape blocks for backups to blockwork forming piers, reveals, control and expansion joints and the like.
- .2 H/15/A/M, filled solid for top two courses of load bearing walls, for all locations where structural members bear on concrete block, and where shown on Drawings.
- .3 Strength of load bearing masonry units shall be: 7.5 MPa minimum for hollow units; 12.5 MPa minimum for 75% solid units based on gross area.
- .4 Provide special shales and sizes as shown or specified such as halves, jambs, lintels, solids, corners, bullnoses and double bullnoses, semi-solids and the like as shown.
- .5 Where concrete block walls are required to act as fire separations or barriers, they shall conform to Ontario Building Code with respect to equivalent thickness and type of concrete.
- .6 Exposed block shall be uniform in colour, shade and texture, and made by one manufacturer.

2.2 **MASONRY REINFORCEMENT FOR NON-CAVITY WALLS**

- .1 Approved manufacturer:
 - .1 DW 100 by Dur-O-Wal Ltd., (Hohman & Bernard)
 - .2 Ladur by Dur-O-Wal Ltd., (Hohman & Bernard)

2.3 **MASONRY REINFORCEMENT FOR NON-CAVITY WALLS (CONT'D)**

- .3 Blok-Lok or Blok-Truss by Blok-Lok Ltd.
- .2 3.8 mm diameter (No. 9 Steel ga) deformed wire for single block wythes, 4.8 mm diameter (3/16") for two or more wythes; mill galvanized for interior wall locations; for exterior wall locations, hot dipped galvanized after fabrication, ASTM A153, Class B-2, minimum of 457 g/m² (1.5 oz/sf) zinc coating; sized 50 mm (2") narrower than wall or partition.
- .3 Provide shop fabricated corners and intersections where required hot dipped galvanized for exterior walls and mill galvanized for interior walls. In curved configuration provide shop fabricated reinforcement fully galvanized as specified herein.

2.3 **ANCHORAGE AND REINFORCEMENT**

- .1 Steel Wire: CAN/CSA G30.3.
- .2 Steel Sections and Plates: CAN/CSA G40.20/G40.21, Grade 350W.
- .3 Stainless Steel Wire: ASTM A580, Type 304 or 316.
- .4 Conform to Ontario Building Code.

2.4 **FLASHINGS**

- .1 Flexible Membrane Flashing: 1.0 mm thick, self adhering SBS rubberized asphalt membrane with a cross laminated HPDE top surface, sheet width to suit application;
 - .1 Bakor Blueskin TWF by Henry Company Canada.

MORTAR AND GROUT

- .1 Cementitious Material: CAN/CSA A179.
- .2 Portland Cement: CAN/CSA A3001, Type GU, grey colour.
- .3 Mortar Aggregate: CAN/CSA A179, fine aggregate.
- .4 Grout Aggregate: CAN/CSA-A179, fine aggregate.
- .5 Hydrated Lime: ASTM C207-79; Type "N".
- .6 Aggregate: CAN/CSA A82.56, except that the maximum allowable percentage passing 600 um (No. 30) sieve shall be 80% and maximum passing 300 um (No. 50) sieve shall be 50%.

2.5 MORTAR AND GROUT (CONT'D)

- .7 Mortar Colouring Compounds: Pure, synthetic, inorganic pigments manufactured by Northern Pigment Company in proportions recommended by manufacturer, but not exceeding 10% of weight of cementitious material.
- .8 Proprietary Mortar Mixes (in lieu of above) St. Lawrence Cement Company, Canada Cement, St. Marys Cement or Lake Ontario Cement Ltd.; conforming to mix requirements specified.
- .9 Ready Mixed Lime Mortar: Redi-Mix Mortar Ltd.
- .10 Water: Clean and potable. Exempt of ice, oils, acid, alkalis, organic material, sediments or other harmful matter.
- .11 Colour: Refer to colour schedule on Drawings.

2.6 JOINT FILLER

- .1 Compressible Joint Filler - Rodofam per type by Sternson Ltd.
- .2 Pre-moulded Joint Filler: For Fire Rated walls "Fire-Bloc" mineral fibre, as distributed by M.W. McGill & Associates Ltd., or other approved U.L.C. labelled materials.

2.7 WATER PROOFING ADMIXTURES

- .1 Add integral water proofing to mortar at exposed areas (except Mortar Mortars) acceptable types: Sterad 300 by Sternsons Ltd., or Rheo-mix 235 by Master Builders unless otherwise noted. Dry-Block by WR Grace.

2.8 MORTAR MIXES

- .1 Mortar for Above Grade:
 - .1 Load bearing Walls: CAN/CSA A179, Type S using the Proportion specifications.
 - .2 Non-Load bearing Walls: CAN/CSA A179, Type N using Proportion specifications
- .2 Stain Resistant Pointing Mortar: CAN/CSA-A179, non-staining masonry cement for cementitious portion of specified mortar type.
- .3 For all load bearing concrete block wall masonry units in exterior cavity walls, interior bearing walls and partitions. Use Type 'S' cement mortar having a 28 day strength min 8.5 MPa and max 120 MPa.

2.8 MORTAR MIXING

- .1 Mixing: Prepare and mix mortar materials under strict supervision, in an onsite batching plant. Use and mix proprietary mortar in strict accordance with manufacturer's instructions to produce the following mortar types, CAN/CSA A179-M1976. Do not use re-tempered mortars.
- .2 For Bedding Steel Bearing Plates, Lintels, for Laying Bearing Courses Under Concentrated Loads and for Laying Masonry Below Grade: Use Type 'M' cement mortar, having a compressive strength of 17.5 MPa (2,500 psi) minimum.
- .3 Except as provided in 2.2.2 for Laying; Brick or Brick Facing only of double withe walls whether backup is load bearing or otherwise: Use Type "N" masonry mortar, having a compressive strength of 5.0 MPa (750 psi) minimum.
Or proprietary or ready-mixed type "N" masonry mortar mixes specified, mixed in accordance with manufacturer's instructions.
- *.4 Use same manufactures product for the entire project to ensure uniformity of mix and coloration.

2.9 NON-SHRINK GROUT

- .1 "Masterflow 713" manufacturer by Master Builders Ltd. Or "M-Bed Standard" manufactured by Sika Canada Inc or 'CPD Non-Shrink Group' by CPD Construction Products.

2.13 PACKING INSULATION

- .1 Loose glass fibre insulation, 16kg/m2 (1lb/c.f.) density or mineral wool.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 General Workmanship
 - .1 Confirm required size of masonry openings for all doors, windows and equipment with supplier or manufacturer prior to installation of masonry units.
 - .2 Install Brick, Architectural Stone and architectural trim products in accordance with manufacturer's installation instructions.
 - .3 Architect is to be notified 36 hours in advance of laying first course of masonry to review installation of flashing, weep-vents, control joints and block positioning on wall. Failure to do so will result in removal for inspection.
 - .4 Employ properly qualified masons for laying up masonry units.

3.1 **INSTALLATION (CONT'D)**

- .5 Distribute exposed masonry units of varying colours, tones and textures evenly over wall surface to avoid patches and streaks and to produce a pleasing appearance.
- .6 Gaining to meet spandrels, etc., leaving courses uneven or with visibly thicker mortar joints is not acceptable. Any such work must be removed and rebuilt to approval of Architect.
- .7 Construct masonry evenly in maximum lifts of 5'-0" (1500mm) per working day. Rake back ends of unfinished walls; do not tooth and bond new masonry.
- .8 Maintain dimensions, lines and levels.
- .9 Keep exposed faces free from stains, chips and cracks. Keep tolerance in plane 3 mm (1/8") in 2,400 mm (8'-0"). Do not use chipped, cracked or deformed units in exposed work.
- .10 Buttering corners of units, throwing mortar droppings in joints, deep or excessive furrowing of bed joints will not be permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply.
- .11 When mortar is "thumb-print" hard, tool joints slightly concave for exposed work, elsewhere, strike joints flush. Use sufficient force to press mortar tight against masonry units on both sides of joints. Remove excess material or burrs left after jointing. Use trowel or rub with burlap bag.
- .12 Lay all joints approximately 10 mm (3/8") thick unless otherwise specified or otherwise shown on Drawings. All joints shall be full of mortar except where specifically designated to be left open.
- .13 Build in all door frames, window frames, wood louvres, anchor bolts, sleeves, inserts, loose steel, etc.
- .14 Complete all door and windowsills, quoins, soldier courses, dovetail designs as per plans.
- .15 All outside 45-degree brick walls are to be completed with mitered corners.
- .16 "Load bearing" means supporting a load other than itself and any unit masonry wall which supports floor loads, roof loads, landing loads, staircase loads, or any other such loads whether directly or indirectly, or which is shown on Drawings as load bearing or which is shown on Structural Drawings, shall be considered to be a load bearing wall. Brick or stone veneer, whether cavity or otherwise, is not load bearing.

3.1 **INSTALLATION (CONT'D)**

- .17 "Exposed" means unpainted, painted and special plastic coated block that are exposed to view in completed work.
 - .18 Partition means a non load bearing interior wall.
 - .19 Construct masonry evenly in maximum lifts of 5' – 0" (1500 mm) per working day. Rake back ends of un-finished walls; do not tooth and bond new masonry.
 - .20 Chases must be built – not cut.
 - .21 Build-in hollow metal door frames previously set in place by Section 06 20 00 by building in lugs and fill voids with mortar. Refer to Section 08 10 00 for number of lugs per jamb. Keep frames free of mortar stains until planned.
 - .22 Use bullnose and double bullnose block at all external corners where block is left exposed including all door and window jambs.
- .2 Cold Weather Requirements
- .1 When laying masonry in ambient temperature below 4 degrees C, (40 degrees F), use heat and maintain temperature of masonry materials and protect completed work from freezing to Satisfaction of Architect. Heat and maintain temperature of masonry materials to at least 4 degrees C (40 degrees F) on both sides of masonry for a period of at least 72 hours.
 - .2 Do not use scorched sand. Do not use salts, admixtures or anti-freezes. Use approved smokeless heaters.
 - .3 In general conform to "Recommended and Guide Specifications for cold weather masonry construction" by O.M.C.A.
- .3 Hot Weather Requirements
- .1 Protect freshly laid masonry from drying too rapidly by means of waterproof, non-staining coverings.
 - .2 When the ambient air temperature exceeds 38°C, or 33°C with a wind velocity greater than 8 mph, execute the following:
 - .1 Store masonry units out of direct sunlight.
 - .2 Do not spread mortar beds more than 4' - 0" ahead of masonry.
 - .3 Set masonry units within one (1) minute of spreading mortar.

3.1 **INSTALLATION (CONT'D)**

.4 Blockwork:

- .1 Lay block to align plumb over each other with thick ends of webs up. Leave no cells open in exposed work. Reinforce all blockwork as hereinafter specified.
- .2 Minimize cutting block. Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel where cutting is required and for flush mounted electrical outlets, grilles, pipes, conduit, leaving 3 mm (1/8") maximum clearance.
- .3 Do not wet concrete masonry before or during laying in wall.
- .4 Locate corners accurately.
- .5 Use full bed of mortar for first course. For remaining courses bed face shells and cross and end webs and vertical end joints fully in mortar. Compress end joint mortar.
- .6 Stagger end joints in every course. Align joints plumb over each other in every other course.
- .7 Do not break bond of corridor walls or other walls of exposed units where partitions intersect and if bonding will show through on exposed face of walls. Bond these partitions to walls that intersect with prefabricated intersection masonry reinforcement in each course.

.5 Partitions:

- .1 Carry the following partitions up through ceiling to structure above, unless shown or specified otherwise: corridor partitions, demising partitions, partitions in areas without suspended ceilings and other partitions so shown on Drawings. Terminate such partitions 19 mm (3/4") below structure and fill space between top of masonry and structure with compressed packing insulation.
- .2 Co-ordinate bracing to provide lateral support for tops of partitions required to extend to within 19 mm (3/4") of underside of structure where they occur under steel joists and beams, slabs and other structural elements with section 05 51 00, Metal Fabrication.
- .3 Where walls and partitions are pierced by structural members, ducts, pipes, fill voids with mortar to within 19 mm (3/4") of such items flush with wall finish.
- .4 Fill spaces between partitions and structure, ducts and pipes with compressed packing insulation completely from one side of wall to other.

.6 Load Bearing Walls:

- .1 Wedge and grout load bearing walls to underside of structure.

3.1 **INSTALLATION (CONT'D)**

.7 Protection

- .1 Protect laid masonry from damage by weather. At end of each day or shutdown period, cover exposed tops of masonry with canvas or strong waterproof membrane securely clamped down and overhanging on each side of wall at least 600 mm (2'-0"). Use wire spring clamps which extend 200 mm (8") down each side of wall, spaced 2,400 mm (8'-0") maximum or other approved method.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Subcontractor is responsible to protect glass, sliding patio doors and other building components (including concrete terraces) from mortar droppings, and will supply poly for same.
- .4 Protect and leave broom-clean all surfaces, where masonry work carried out over or above.
- .5 Wind bracing of all masonry walls during construction until the structure provides sufficient lateral support is a mandatory requirement.
- .6 Comply with the Occupational Health & Safety Act & Regulations For Construction Project.

.8 Reinforcement, Reinforcing Ties and Stud Shear Connectors

- .1 Install anchors and ties in accordance with CAN/CSA A370 and CAN/CSA A371.
- .2 Space wall ties in accordance with CAN/CSA A370. Increase wall ties where recommended by masonry unit manufacturer.
- .3 Reinforce all masonry walls with continuous masonry wall reinforcement in every second block or every 6th brick course. Reinforcing shall be continuous.
- .4 Adjustable masonry reinforcement not permitted to correct poorly laid masonry. Bending of masonry reinforcement or ties not permitted.
- .5 At openings provide extra masonry/cavity wall reinforcement, so that first and second courses above and below openings are reinforced. Extend extra reinforcement 600 mm (2'-0") beyond opening in each direction.
- .6 Do not bridge expansion or control joints.
- .7 Lap reinforcement 6" (150 mm) minimum.

3.1 **INSTALLATION (CONT'D)**

- .8 Where steel columns occur in masonry walls embed steel bar anchors fully with mortar, including bent ends.
 - .9 In areas where exterior signage is indicated on the drawings, spacing of masonry ties are to be increased to 16" o.c.
 - .10 Install Stud Shear connectors for brick veneer masonry in strict compliance with the manufacturer's instructions and the General notes on the Structural Drawings.
 - .11 Refer to the General Notes on the Structural Drawings that are applicable to and govern the work of this section, notwithstanding whatever may be specified herein to the contrary.
 - .12 Masonry Reinforcement for Earthquake: CAN/CSA 3-S304-M, refer to notes on Structural Engineers drawings.
- .9 Built-ins
- .1 Confirm all built in items are available before proceeding.
 - .2 Build in items occurring in masonry provided by other Sections including: steel door frames; anchor bolts; sleeves; inserts; loose steel lintels; shelf angles; access panels; masonry flashings not in direct connection with roofing and other such items. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.
 - .3 Brace/plumb/square all built ins and maintain same until rigidly set.
 - .4 Fill voids between masonry and metal frames with masonry mortar or insulation, as shown.
- .10 Damp Course and Membrane Flashing
- .1 Install damp courses and flashings in accordance with the Manufacturers written Instructions and as shown on Drawings. If not fully shown on drawings, install in locations as follows and as specified hereafter.
 - .1 Over exterior lintels and shelf angles.
 - .2 Below first masonry course of inner wythe at floors on grade. Extend damp course through full thickness of inner wythe.
 - .3 Below second exterior block masonry course and the fourth exterior brick course above new grade line.

3.1 **INSTALLATION (CONT'D)**

- .4 Jointed masonry under windowsills.
- .5 Wherever roofs or other exterior, horizontal surfaces intersect masonry walls, immediately above roof flashing or horizontal surface flashing and seal to roof or other flashing or vapour barrier.
- .2 Apply primer to all substrate areas where dampproof course/thru-wall flashings are to be applied. Apply primer using lamb's wool roller at rate 100 sq.ft to 300 sq.ft/gallon depending on porosity of substrates. Allow primer to 'tack-up' for approximately 30 minutes prior to application of dampproof course/thru-wall flashings. Primed surfaces not covered within 24 hours shall be completely re-primed.
- .3 In non-cavity wall install flashing through full thickness of wall as shown. Lap joints at least 150 mm (6") and seal with sealant recommended by flashing manufacturer or heat weld P.V.C.
- .4 Install all flashings and damp proofing courses to provide continuous waterproofing flashing in wall except where such courses occur over openings in walls extend them past opening a minimum of 200 mm (8") and turn up minimum 150 mm (6") at each end to create a waterproof dam to prevent water draining into cavity.
- .5 Install membrane flashings onto Bent metal drip flashings and behind vertical wall air barrier membrane with primer. Keep membrane flashing back ½" from outer edge of masonry. Refer to Blow up Details in drawings.
- .6 Inspect flashings for punctures, tears, misaligned seams and the like, apply additional layer of flashing membrane, extending minimum of 6" around damaged area in all directions.
- .11 Lintels
 - .1 Bridge openings not exceeding 1'-6" in width with 1/4" mild galvanized steel plate lintels bearing 100 mm on each side of opening. Width of plate shall be wall thickness less 1".
 - .2 Set loose lintels for bridging openings in masonry.
 - .3 Bearing surface for lintels shall be full width of wall or partition extending 8" (200 mm) each side of opening for openings up to 5'-0" (1500 mm) in width with 1/2" (13 mm) increments each side for each additional 1'-0" (300 mm) of span or part thereof.

3.1 **INSTALLATION (CONT'D)**

.12 Lateral Supports

- .1 Lateral Supports - Where non load bearing unit masonry partitions meet structural elements at top of partitions, provide lateral supports as required by National Building Code. In areas where ceilings are scheduled, use (6") 150 mm lengths of steel angle located each side of partition at 1200 mm and staggered. Where no ceilings are scheduled, use continuous length of steel angle on each side of partition. Use angle of sufficient size to accommodate where required due to fire rated walls.

.13 Reglets

- .1 Provide reglets in masonry as required by the roofing and sheet metal trade, for installation of flashings. Reglets shall be full height of the joint and 1" deep.

.14 Control Joints for masonry

- .1 Provide continuous vertical control joints at the following locations and maximum at every 20'-0" on centre for clay masonry and 25'-0" for concrete masonry.
 - .1 Interior and exterior of masonry panels.
 - .2 In line with the end of all lintels over doors, windows and other openings.
 - .3 Changes in wall directions.
 - .4 Changes in building wall height.
 - .5 Major changes in wall thickness.
 - .6 Abutting of new structure to existing structure.
 - .7 4'-0" from exterior corners. (one side)
 - .8 At movement joints in foundations, floors and roof.
- .2 Control Joints are to extend full height of the wall and be free of mortar.
- .3 All locations to be reviewed on site with the Architect and the Project Manager prior to placement.
- .4 Install control joints as detailed on the drawings.

.15 Scaffolding:

- .1 Supply, erect and dismantle scaffolding that may be required.
- .2 Scaffolding must meet Ministry of Labour standards.

3.1 **INSTALLATION (CONT'D)**

.16 Repointing or Tuckpointing:

- .1 Repoint defective joints as follows: cut back joints ½", taking care not to damage units. Remove dust and loose materials by brushing or by water jet. If water jet is used, allow excess water to drain before repointing. Repoint with same mix as original. Pack mortar tightly in these layers, and tool joints or strike flush as required.

3.2 **CLEANING**

- .1 Obtain and follow masonry manufacturer's written instructions for cleaning. Test sample area, 10 square metres (100 sq ft), to judge effectiveness of cleaning procedures and obtain Architect's approval.
- .2 Keep wall clean and free of mortar stains during laying. Allow mortar droppings which adhere to wall to dry out but not to set. Then rub with small piece of masonry followed by brushing to remove all traces. On completion of masonry, after mortar is thoroughly set and cured, clean masonry thoroughly.
- .3 Remove all mortar fins, stains, discolouration and efflorescence to satisfaction of Architect.
- .4 Remove mortar with wood paddles and scrapers before wetting. Saturate masonry with clean water and flush off loose mortar and dirt. Clean brickwork using water, scrubbing brushes and wood paddles only.
- .5 Clean masonry to be left exposed, using procedures as outlined herein and, where this is inadequate, try following recommendations outlined in Technical Notes on Brick and Tile No. 20, revised May 1964, published by the Canadian-Structural Clay Association. Should these methods prove inadequate consult masonry manufacturer before undertaking unusual cleaning procedures and obtain Architect's prior consent.
- .6 Repoint all defective joints.
- .7 Masonry work to be cleaned at the end of each working day and immediately after removal of scaffolding.

END OF SECTION

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 DESCRIPTION

- .1 Work included:

To complete all carpentry required as shown or specified and which is not specifically called for in "work included" portions of other specifications divisions.

- .2 Work installed but furnished by other sections:

- .1 Door hardware Section 08 71 00

- .3 Related work specified in other sections:

- .1 Glass & Glazing Section 08 80 00

- .2 Back Priming & Finish Painting Section 09 91 00

1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
- .2 CAN/CSA B111, Wire Nails, Spikes and Staples.
- .3 CAN/CSA O115, Hardwood and Decorative Plywood.
- .4 CAN/CSA O151-M, Canadian Softwood Plywood.
- .5 CAN/CSA O153-M, Poplar Plywood.
- .6 CAN/CSA O141, Softwood Lumber.
- .7 CAN/CSA O153, Canadian Softwood Plywood.
- .8 National Lumber Grades Authority (NLGA), Standard Grading Rules for Canadian Lumber.

1.3 QUALITY ASSURANCE

- .1 Requirements of regulatory agencies:
 - .1 Mark each piece of wood that is pressure treated to meet fire retardant requirements of jurisdictional authorities, or underwriters, or both, with ULC Fire Hazard Classification label.
- .2 Reference standards:
 - .1 Conform to CAN/CSA Standard 0141 for dressed dimensions of wood members.
 - .2 Fabricate the listed Work to Custom Quality Standard of: AWMAC Specification, Quality Standards of the Architectural Woodwork Manufacturers Association of Canada.

1.4 QUALIFICATION

- .1 Contractor to have 5 years of experience in the Work of this Section.

1.5 SUBMITTALS

- .1 Samples:
 - .1 Submit 1-12"x12" sample of each specified finish wood species, and in each cut. As per Section 01 33 00 "Submittals Procedures".
- .2 Shop Drawings:
 - .1 Submit shop drawings for manufactured items to Section 01 33 00 "Submittals Procedures".

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Environmental Requirements:
 - .1 Ensure that relative humidity in areas where Work is stored and installed does not exceed 55%.
- .2 Protection:
 - .1 Ensure that Work of this Section is protected from damaged and deterioration during installation, and otherwise until Project completion.
 - .2 Take particular care that wood made fire retardant by pressure treatment is exposed to no dampness.

1.7 **WARRANTY**

- .1 Warrant work of this Section against de-lamination of plastic laminate work and warpage of millwork for a period of 2 years from date Work is certified as substantially performed in accordance with General Conditions of the Contract and as amended by Supplementary General conditions. Promptly make good defects and deficiencies which become apparent within warranty period including making good any work damaged by this work, satisfactory to the architect and at no expense to Owner.

PART 2 - PRODUCTS

2.1 **MATERIALS**

- .1 Miscellaneous Hardware
- .1 Drawers slides, locks, hinges, pulls, chains, stops, adjustable legs, magnetic latches, shelving standards, brackets, corner guards, rubber bumpers, piano hinges, castors, brackets. Standard of quality to be for heavy duty use to suit use and finish to match Hardware as listed and described in the Colour, Material & Finish Schedules on the drawings.
- .2 Hollow wall anchors
- .1 Star Wall grip; Rawplug Rawlys; or Red Head WA series.
- .3 Provide all rough or builders hardware such as nails, spikes, ground, bolts, iron works, washers, anchors, etc., herein specified or as may be required for proper completion of the work.
- .4 Fastenings for exterior use to have a rust-inhibitive coating; screws for securing of galvanized anchors, etc., to be galvanized.
- .5 Dimensional Lumber: To Section 06 10 00; sanded to remove grade marks, selected for knot-free appearance.

2.2 **FABRICATION**

- .1 **GENERAL WORKMANSHIP**
- .1 Fabricate and install work in accordance with Architectural Woodwork Manufacturers Association of Canada Custom Grade Standards by skilled craftsmen of companies specializing in work specified and to requirements of other trades. Each item shall be as shown on Drawings and as detailed on shop drawings.
- .2 Assemble work in shop and deliver to Work ready for installation, as far as practicable. Leave ample allowance for fitting and scribing on job.

2.2

FABRICATION (CONT'D)

- .3 Take care to prevent opening up of glue lines in finished work.
- .4 Design construction methods for expansion and contraction of material.
- .5 Conceal joints and connections wherever possible. Locate prominent joints where directed by Architect. Intermediate joints between supports not permitted.
- .6 Joints made on the job shall be equal in quality & workmanship to joints made in shop.
- .7 Erect work plumb, level, square and to required lines.
- .8 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by work of other trades.
- .9 Take field dimensions and fabricate work to suit field dimensions.
- .10 Fasten wood nailers, blocking, framing and strapping solidly to adjacent materials in true planes.
- .11 Do not permit delivery of this work to Site until area is sufficiently dry so that woodwork will not be damaged by excessive changes in moisture content.
- .12 Check access clearance at Site before assembling large units or components in factory for shipment to work.
- .13 Provide all blocking coming in direct contact with millwork in accordance with applicable provision set forth herein.
- .14 Counter tops shall be of Quartz & plastic laminate where shown. Form splash backs as indicated.
- .15 Glues shall be waterproof and of a type suitable for work to be joined.
- .16 Moisture content of interior woodwork shall be not less than 4% nor more than 8%.
- .17 Comply with glue manufacturer's recommendations for lumber moisture content, glue shelf life, pot life, working life, mixing, spreading assembly time, time under pressure and ambient temperature.
- .18 Subcontractor to site measure after plumbing, electrical, HVAC and carpentry rough ins are complete allowing for drywall finish as necessary. At the time of measuring, identify any discrepancies between the approved layouts, work orders and the actual on-site dimensions, and review the differences and proposed final layouts with Contractor on site prior to releasing for production.

2.2 FABRICATION (CONT'D)

- .19 All holes required in cabinetry for plumbing to be drilled, not cut.

2.3 MILLWORK SCHEDULE

- .1 Hardwood board benches in Change Rooms.
.2 Refer to plans for locations and blow-up sections for details.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Before commencing installation, ensure that grounds, strapping, and other constructions and surfaces to which Work is installed are satisfactory for fitting and adequate for securing of Work.

3.2 INSTALLATION

- .1 Take site measurements of construction to which Work of this Section must conform, and through which access must be made, before Work is delivered to site, to ensure that adaptation is not required which would result in construction delay.

.2 Installation of Doors:

- .1 Install wood doors supplied under Work of Section 08 14 00 & 08 16 73 after finishing of walls.
.2 Fit wood doors with 24 mm (3/32") clearance at jambs and heads and 3/8" over finished flooring.
.3 Trim hinge side of wood doors to fit, and bevel latch edges as required.
.4 Ensure that top and bottom edges of wood doors are primed under Work of Section 09 91 00 after they are cut to fit.
.5 Install grilles in wood doors, supplied as specified in other Sections.
.6 Undercut (non-fire rated)wood doors where indicated on Door Schedule.

.3 Installation of Washroom Accessories:

- .1 Install all washroom accessories supplied under work of Section 10 28 00 and supplied by Owner.

3.2 INSTALLATION (CONT'D)

- .4 Installation of Finishing Hardware:
 - .1 Accept delivery of all finishing hardware, and be responsible for safe storage, issuing and ultimate installation under this or other Sections.
 - .2 Make cuts in wood doors neatly.
 - .3 Accurately located and adjust hardware to meet manufacturer's instructions. Use special tools and jigs as recommended.
 - .4 Install hardware in wood doors at same locations as for hollow metalwork installed in Project.
 - .5 Locate top hinges with top 5" below door top, bottom hinges with bottom 10" from floor, and intermediate hinges equidistant between top and bottom hinges.
 - .6 Locate door stops to contact doors 3" from latch edge.
 - .7 Install hardware and trim square and plumb to doors.
 - .8 Replace missing hardware to ensure specified installation at time of building completion.
 - .9 Safeguard keys to keep them out of unauthorized hands, tag them with opening number, and deliver them to person designated by Architect at building completion.

3.3 ADJUSTMENT AND CLEANING

- .1 Adjust hinged doors to swing freely and easily, to remain stationary at any point of swing, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force. Adjust sliding doors to operate smoothly without binding, and to close evenly and tightly against jambs.
- .2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by supplier's instructions.
- .3 Clean hardware after installation in accordance with supplier's instructions.
- .4 Sand and clean woodwork to leave free from finish defects in any exposed part.

END OF SECTION

DIVISION 07 - OPENINGS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 SUMMARY OF WORK

- .1 Work Included: The work of this Section includes the provision of all labour, materials, equipment and services required to install firestopping and smoke seal materials, as indicated on the drawings, as specified herein and as required for a complete project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Rough Carpentry. Section 06 10 00
- .2 Gypsum Board Assemblies. Section 09 21 16
- .3 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) Division 21 and 26 respectively.

1.3 REFERENCE STANDARDS

- .1 Underwriters' Laboratories Canada (ULC):
 - .1 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.

1.4 REGULATORY REQUIREMENTS

- .1 The work of this Section shall conform to the requirements of the applicable building code, to ULC design requirements for each assembly and to all other applicable codes and regulations, to the satisfaction of the authorities having jurisdiction.

1.5 SUBMITTALS

- .1 General: Submit each item in this Article according to the Conditions of the Contract and the applicable Division 01 Specification Sections.

1.6 SUBMITTALS

- .2 Test Reports: Submit test reports certifying that materials have been tested and approved as part of a firestop system by Underwriters Laboratories of Canada (ULC) or Underwriters Laboratories (UL) or Factory Mutual (FM).
- .3 Product Data:
 - .1 Include installation instructions for each material.
 - .2 Include manufacturer's material safety data sheets for the safe handling of the specified materials and products, in accordance with Workplace Hazardous Materials Information Service (WHMIS) requirements.

1.7 DELIVERY, STORAGE & HANDLING

- .1 Deliver products in original unopened packaging with legible manufacturer's identification.
- .2 Store materials in strict accordance with the manufacturer's recommendations, off the ground, under cover and away from moisture.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain minimum ambient temperature above 15°C. for 24 hours before, during, and 72 hours after application.
- .2 Maintain relative humidity within manufacturer's recommended limits to allow proper drying.
- .3 Maintain adequate ventilation in areas of application during and for 24 hours after completion.

PART 2- PRODUCTS

2.1 MANUFACTURERS

- .1 Acceptable Manufacturers:
 - .1 3M Company Canada
 - .2 AD Fire Protection
 - .3 Hilti Canada
 - .4 Tremco

2.2 MATERIALS

- .1 Use products by only one manufacturer throughout Work of this Section.
- .2 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115, asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended.
- .3 Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 and listed in ULC Guide No. 40 U19.
- .4 Service penetration firestop components: certified by ULC in accordance with CAN/ULC-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.
- .5 Firestop Sealant: non-slump, one-part silicone type; capable of stopping travel of heat and ignition of combustible materials.
- .6 Firestop Insulation: Mineral/ceramic fibre type to ULC Guide No. 40 U18.7.
- .7 Firestop Mortar: Self-levelling, self-curing, cementitious matrix. Density as recommended by manufacturer to suit application and fire resistance rating.
- .8 Fire- resistance rating of installed fire stopping assembly shall not be less than the fire-resistance rating of the surrounding floor and wall assembly.
- .9 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .10 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .11 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .12 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .13 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine areas and conditions under which work is to be performed and notify the Consultant in writing of conditions detrimental to the proper and timely completion of the work.

3.1 EXAMINATION (CONT'D)

- .2 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .3 Do not proceed with the work until unsatisfactory conditions have been corrected to the satisfaction of the installer.
- .4 Commencement of the installation will be construed as acceptance of the site conditions and, thereafter, the Contractor shall be fully responsible for satisfactory work as specified herein.

3.2 PREPARATION

- .1 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .2 Ensure all surfaces are dry and clean before beginning application of firestop materials.
- .3 Clean bonding surfaces of dust, rust, oil, grease and other foreign materials that may impair application and adhesion.
- .4 Do not apply firestop materials to surfaces that have been painted or treated with other coatings, unless tests have been performed to ensure compatibility of materials. Remove paint and other coatings as required.
- .5 Prepare and prime surfaces as recommended by firestop material manufacturer.
- .6 Mask adjacent surfaces as required to protect from damage due to application of firestop materials.
- .7 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seals at service penetrations through fire resistive construction and at all locations where the continuity of fire resistive construction is interrupted, as indicated on the drawings, as specified herein and as required for a complete project.
- .2 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

3.3 INSTALLATION (CONT'D)

- .4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .5 Tool or trowel exposed surfaces to a neat finish. Remove excess compound promptly as work progresses and upon completion.

3.4 REVIEW

- .1 Notify the Consultant when ready for review and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.5 SCHEDULE

- .1 Unless specified otherwise apply the following:
 - .1 Firestop mortar where surrounding surfaces are concrete or masonry.
 - .2 Sealant and insulation where surrounding surfaces are gypsum board.
- .2 Apply firestop materials to the following locations:
 - .1 Around pipes, conduits, ductwork and other mechanical or electrical components that penetrate through fire rated walls, ceilings and other assemblies.
 - .2 Along tops of fire rated walls and assemblies that extend to underside of floor and roof construction. Use firestop sealant and insulation, apply sealant to both sides of walls.
 - .3 Around supporting steel structures that penetrate fire rated walls and assemblies. Use firestop sealant and insulation, apply sealant to both sides of walls.
 - .4 Along tops of fire rated walls that extend to gypsum board assemblies applied around supporting steel structures. Use firestop sealant and insulation, apply sealant to both sides of walls.
 - .5 Around pipes conduits, ductwork and other mechanical or electrical components that penetrate through fire rated floor assemblies.

3.6 CLEANING

- .1 As work progresses, remove excess materials and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.
- .3 Upon completion of the work of this Section:

3.6 CLEANING (CONT'D)

- .1 Remove masking and temporary protection from adjacent surfaces.
- .2 Remove stains on adjacent surfaces and make good damage to adjacent surfaces caused by the work of this Section.
- .3 Remove from the premises all surplus material, dirt and debris caused by the work of this Section and leave the installation clean.
- .4 Remove temporary dams after initial set of fire stopping and smoke seals.

END OF SECTION

DIVISION 07 - THERMAL & MOISTURE PROTECTION

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 INTENT

- .1 To provide all sealing not specified under other Sections but required to make building tightly sealed from exterior and interior to withstand the action of the elements and to complete the building vapour barrier.

1.2 REFERENCES

- .1 American Society for Testing and materials (ASTM)
 - .1 ASTM C661- Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of Durometer.
 - .2 ASTM C679- Standard Test Method for Tack-Free Time of Elastomeric Sealants.
 - .3 ASTM C719- Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - .4 ASTM C920, Specification for Elastomeric Joint Sealants.
 - .5 ASTM C1135 Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.
 - .6 ASTM C1248 - Standard Test Method for Staining Porous Substrate by Joint Sealants.
 - .7 ASTM C1330 - Cylindrical Sealant backing for Use with Cold Liquid Applied Sealants.
 - .8 ASTM D412 - Standard Test Method for Vulcanized Rubber and thermoplastic Rubbers and thermoplastic Elastomers – tension.
 - .9 ASTM D 2202 - Standard Test Method for Slump of Sealants.
 - .10 ASTM E119 9UL 263) – Standard Test Method for Fire Tests of Building Construction and Materials.

1.3 SUBMITTALS

- .1 Provide in accordance with Section 01 33 00 "Submittal Procedures":
 - .1 Product data for silicon sealant, primer, joint backing, and other accessories. Include safety data sheets (SDSs) and certifications showing compliance with specified standards.
 - .2 Shop drawings detailing sealant joints and indicating joint dimensions, materials, sealant profile, and size limitations.
 - .3 Manufacturer's colour chart for selection by Architect, or custom colour where noted.
 - .4 Manufacturer's instructions for installation and field quality control testing.
 - .5 Copy of warranties specified in paragraph 1.8 for review by Architect.

1.4 PROJECT CONDITIONS

- .1 Do not install silicone sealant during inclement or windy weather when such conditions are expected. Allow wet surfaces to dry.
- .2 Do not install sealant when temperature is less than 5 degrees Fahrenheit (3° C) below dew point. Silicones approved for -29C.

1.5 QUALIFICATIONS

- .1 Perform the Work by recognized established sealant contractor having a minimum of five (5) years experience and skilled mechanics thoroughly trained and competent in the use of sealant equipment and specified materials.

1.6 FIELD QUALITY CONTROL

- .1 Arrange with sealant manufacturer for a technical representative to visit the work prior to beginning sealant installation to discuss procedures to be adopted, analyze site conditions, inspect surfaces to be sealed and make recommendations should adverse conditions exist.
- .2 The following items should be discussed:
 - .1 Weather conditions under which work to be done.
 - .2 Anticipated frequency and extent of joint movement.
 - .3 Joint Design.
 - .4 Suitability of durometer hardness and other properties of material in relation to Items 1 and 3 above.
 - .5 Primers to be used.

1.7 WARRANTY

- .1 Provide under provision of Section 01 78 00 – Closeout Submittals.
 - .1 Installer's (5) five years workmanship warranty.

1.8 **WARRANTY (CONT'D)**

- .2 Manufacturer's 20- year material warranty for properly installed silicon sealant.

PART 2 - PRODUCTS

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Dow Corning Corporation. P.O. Box 994, Midland, MI 486886- 0994; (800) 248-2481; www.dowcorning.com/construction.
- .2 Approved Alternate: Tremco Commercial Sealants.
- .3 Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 00 21 00, article 2.6 Specified Manufacturer.

2.2 **SEALANT**

- .1 Type: One-component, ultra-low modulus, neutral-cure silicone rubber sealant; Dow Corning® 790 Silicone Building Sealant, as manufactured by Dow Corning Corporation.
- .2 Compliance: Sealant shall meet or exceed requirements of these standards:
 - .1 ASTM C920, Type S, Grade NS, Class 100/50, Use T, NT, G, M, A, and O.
 - .2 GSA CID A-A-272A.
 - .3 GSA CID A-A-1556.
- .3 Colour: Refer to Manufacturer's standard colours. Custom colour as noted by Architect on Drawings.
- .4 Shelf life: 12 months.
- .5 Application temperature range: Minus 20 to plus 120 degrees F. (Minus 29 to plus 50 degrees C.)
- .6 Tack-free time: 1 hour at 50 percent relative humidity, tested in accordance with ASTM C679.
- .7 Working time: 10 to 20 minutes.
- .8 Curing time at 3/8-inch (10-mm) depth: 7 to 14 days at 77 degrees F. (25 degrees C) and 50 percent relative humidity.
- .9 Flow, sag, or slump in [3 inches] [76 mm] wide joint: None, when tested in accordance with ASTM D2202.
- .10 Volatile organic compound (VOC) content: 43 grams/liter maximum.

2.2 SEALANT (CONT'D)

- .11 Cured sealant properties after 21 days at [77 degrees F] [25 degrees C] and 50 percent relative humidity:
 - .1 Joint movement capability: Plus, 100 percent extension and 50 percent compression, tested in accordance with ASTM C719.
 - .2 Hardness: 15-durometer hardness, Shore A, tested in accordance with ASTM C661.
 - .3 Properties tested in accordance with ASTM D412.
 - .4 Minimum peel strength: [15 ppi] [2.67 kg/cm], tested in accordance with ASTM C794.
 - .5 Properties tested in accordance with ASTM C1135.
 - .6 Weathering after 22,400 hours, tested in accordance with ASTM C1135 using QUV Weatherometer.
 - .7 Staining after 14 days at 50 percent compression, 158 degrees F (70 degrees C): None on concrete, granite, limestone, and brick, when tested in accordance with ASTM C1248.
- .12 Low Dirt Pick-up, Non-Staining, Medium-modulus, one-component, pre-pigmented, neutral-cure elastomeric silicone sealant; Compliance: Sealant shall meet or exceed requirements of ASTM C920, Type S, Grade NS, Class 50, Use NT, G, M, A, and O. *Dow Corning® 756 SMS Silicone Building Sealant*, as manufactured by Dow Corning Corporation.
- .13 **Exterior Concrete Sidewalk Sealants:** One part silicone – Dow Corning Parking Structure SL or Dow Corning Contractors Concrete Sealant or approved Alternate.
- .14 **Interior Building Sealants:** Acrylic emulsion compound fast setting, low odour and paintable equal to professional grade acrylic latex caulk by Tremco. Note: Use sealants from Item 7 where mildew resistance is required.
- .15 Joint Backing: Round, closed cell foamed polyethylene; closed cell urethane foam; rubber; rubber tubing; non-migrating plasticised vinyl having Shore 'A' hardness of 20 and tensile strength of 20 - 30 psi, type of which is compatible with sealant type, and as recommended by manufacturer.
- .16 Joint Filler - white non-absorbent closed cell foam polyethylene rope "Ethafoam", Dow Chemical of Canada Limited or approved alternative.
- .17 **Exterior Building Sealants:** One-part silicone Construction sealants series 790, 795, and 888 SL and mildew resistant where specified, by Dow Corning to Canadian Standard CAN2-19-13 or ASTM C920.

2.3 ACCESSORIES

- .1 Substrate primer: As recommended for project conditions and provided by silicone sealant manufacturer.
- .2 Sealant backing: Provide backing complying with ASTM C1330 (Type B non-absorbent, bi-cellular material with surface skin.) (Type O open-cell polyurethane.), as recommended by sealant manufacturer.
 - 1. Size: Greater than joint opening by 25 percent minimum.
- .3 Bond breaker tape: Provide tape to prevent adhesion to joint fillers or joint surfaces at back of joint and allow sealant movement.
 - 1. Type: Polyethylene or other plastic tape recommended by sealant manufacturer.
- .4 Masking tape: Non-staining, non-absorbent type compatible with silicone sealant and adjacent surfaces.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Prepare substrates and apply silicone sealant in accordance with manufacturer's instructions.
- .2 Handle, store, and apply materials in compliance with applicable regulations and safety data sheets (SDSs).
- .3 Do not use silicone sealant for:
 - .1 Below-grade applications.
 - .2 Surfaces to be immersed in water for prolonged time.
 - .3 Brass and copper surfaces.
 - .4 Materials bleeding oils, plasticizers, and solvents.
 - .5 Structural glazing and adhesive.
 - .6 Surfaces to be painted.
 - .7 Surfaces in direct contact with food.
 - .8 Medical and pharmaceutical applications.
- .4 Do not apply in totally confined spaces without ventilation for curing.

3.2 **PREPARATION**

- .1 Inspect new substrates to receive silicon sealant. Ensure surfaces are clean, dry, and free of frost, dust, dirt, grease, oil, curing compounds, form release agents, laitance, efflorescence, mildew, and previous films and coatings.
- .2 Clean substrates to receive silicone sealant.
 - .1 Porous surfaces: Abrasive-clean followed by blasting with oil-free compressed air.
 - .2 Nonporous surfaces: Use two-cloth solvent wipe in accordance with ASTM C1193.
 - .3 High-pressure water cleaning: Exercise care that water does not enter through failed joints.
- .3 Aluminum and other nonporous surfaces except glass require use of primer. Concrete, stone, masonry, and other nonporous surfaces typically do not require primer. Comply with Manufacturer's primer recommendations.
- .4 Adhesion test: Apply silicone sealant to small area and perform adhesion test in accordance with ASTM C1193, Method A, to determine if primer is required to achieve adequate adhesion. If necessary, apply primer at rate and in accordance with manufacturer's instructions. Allow primer to dry.
- .5 Masking: Apply masking tape as required to protect adjacent surfaces and to ensure straight bead line and facilitate cleaning.
- .6 Clean joints and spaces which are to be sealed and ensure that they are dry and free of dust, loose mortar, oil, grease and other foreign materials, which may damage or destroy bond of sealant. Thoroughly clean sides of joints and spaces to establish good bond between sealant and adjacent materials.
- .7 Clean ferrous metals free of all rust, mill scale and foreign materials by wire brush, grinding or sandblasting.
- .8 Do not install materials when ambient air temperature is less than 5⁰ C, when recesses are wet or damp, or to manufacturer's recommendations.
- .9 Do not install materials on Building Exterior if windy conditions exist and present possibility of wind-borne dust adhering to sealant materials.
- .10 Wipe all metal surfaces to be sealed, except painted metal, with cellulose sponges or clean rags soaked with ethyl alcohol, xylol and wipe dry with clean cloth. Clean painted metal with solutions or compounds which will not injure paint, and which are compatible with the primer and sealant.

3.2 PREPARATION (CONT'D)

- .11 Where joints are 12 mm or deeper, insert backing material in continuous 30% compression with set-back from finished face of adjoining materials equal to required depth of caulking (width/depth ratio) as recommended by manufacturer of sealant, but not less than a distance which leaves minimum 6 mm thickness of sealant.
- .12 On horizontal traffic surfaces, support joint filler against vertical movement which might result from loads, including foot traffic.
- .13 Prime surfaces of joints with primer to which adhesion is required, unless otherwise instructed by manufacturer.
- .14 Seal joints in surfaces to be painted before surfaces are painted. Where surfaces to be sealed are primed in shop before sealing, check to make sure prime paint and sealant are compatible. If they are incompatible inform Architect and change sealant to compatible type approved by Architect.
- .15 Prime sides of joints with primer where required. In any case, prime all metal surfaces to be sealed, including pre-coated metals.

3.3 APPLICATION

- .1 Sealant backing: Install without gaps, twisting, stretching, or puncturing backing material. Use gage to ensure uniform depth to achieve correct profile, coverage, and performance.
- .2 Bond breaker: Install on backside of joint where backing is not feasible.
- .3 Sealant:
 - .1 Use sealant-dispensing equipment to push sealant bead into opening. Fill joint opening to full and proper configuration. Apply in continuous operation.
 - .2 Before skinning or curing begins, tool sealant with metal spatula. Provide concave, smooth, uniform, sealant finish. Eliminate air pockets and ensure complete contact on both sides of joint opening. Tool joints in one continuous stroke.
- .4 Complete horizontal joints prior to vertical joints. Lap vertical sealant over horizontal joints.
- .5 Cleaning: Remove masking tape and excess sealant.
- .6 Apply joint filler to proper, uniform depth to give sealant bead of optimum size and shape for joint condition and expected movement condition.
- .7 Apply sealant using guns fitted with suitable nozzles and equipment approved by sealant manufacturer. Apply in strict accordance with manufacturer's directions and recommendations.

3.3 **APPLICATION (CONT'D)**

- .8 Apply sealants under pressure in such manner as to assure good adhesion to sides and to completely fill all voids in the joint.
- .9 Form surfaces of sealant smooth, concave, free from ridges, wrinkles, sags, air pockets and embedded foreign matter.
- .10 Apply fire stop sealants in strict conformance with manufactures directions to ensure compliance with U.L.C. rating of fire stop systems.
- .11 Upon completion, remove masking tape and sealant smears and droppings from adjacent and other surfaces.
- .12 Tool all joints smooth, minimum thickness of sealant over backing (1/4").
- .13 Ensure all wood shims and projections are cut back to ensure a full continuous bead of sealant.
- .14 All Exterior Precast Panel Joints are a three stage joint system, Exterior, Mid Panel & Interior. (except horizontal bearing joints). Mid joint is to vent/drain through to exterior. Horizontal bearing joint is a dual stage joint system within a 2" raked mortar joint. Refer to blow up details on drawings.
- .15 Around Curtain Wall System and components note: **Seal inside and outside of frame**, not at exterior location of pressure cap plate. A third line of sealant may be required behind the pressure plate to prevent water entry to the cavity wall if the curtain wall framing sits on a knee wall. Refer to Details on Drawings.

3.4 **LOCATIONS (AS APPLICABLE)**

- .1 Seal the junction of the following **Interior Materials**:
 - .1 Joint between full height masonry partitions and structure above.
 - .2 Hollow Metal Frames with adjacent materials - both sides.
 - .3 Provide silicone sealant at splash juncture of vanity and wall and at juncture of mirror and wall and at juncture of other counters and walls.
 - .4 All chair rails and wall tiles
 - .5 At base of toilets and floor.
 - .6 At perimeter of shower and tub enclosure and wall finish.
 - .7 Concrete floor slab control joints.
 - .8 Around all window frames.

3.4

LOCATIONS (CONT'D)

- .9 All wall/floor penetrations fire stopped where required.
- .10 Joints between pre-cast concrete slabs and perimeter.
- .2 Seal the junction of the following **Exterior Materials**:
 - .1 Exterior pressed steel frames with adjacent materials.
 - .2 Seal all junctures between structural members and adjacent materials where space is less than 1" (25 mm).
 - .3 Sidewalk control joints.
 - .4 Masonry control joints.
 - .5 All doors, windows, patio door frames and sills.
 - .6 Under thresholds.
 - .7 All wall penetrations.
 - .8 Saw cut control joints in exterior concrete slabs.
 - .9 At junction of concrete slabs/walks to building foundation.
 - .10 Roof flashings, penetrations and joints.
 - .11 Where wood (including capped framing) and brick meet.
 - .12 Where wood (including capped framing) and concrete meet.
 - .13 Where aluminum and brick meet.
 - .14 Recessed mortar joint in stone sills (one joint when window over 1.2 m wide).
 - .15 To underside of balcony slab where concrete meets masonry wall.
 - .16 Perimeter of all mechanical vents and louvers, electrical outlets, fixtures, hose bibs and exterior wall penetrations (including all PTAC sleeves).
 - .17 All Exterior Precast Panel Joints. **Note:** Application is a three stage joint system, Exterior, Mid Panel & Interior and a two stage joint system for grouted panel bearing joints.

3.4 **LOCATIONS (CONT'D)**

.18 Around Curtain Wall System and components note: **Seal inside and outside of frame**, not at exterior location of pressure cap plate. A third line of sealant may be required behind the pressure plate to prevent water entry to the cavity wall if the curtain wall framing sits on a knee wall. Refer to Details on Drawings.

.3 Provide sealant elsewhere as noted in drawings as caulking and/or sealant and not specifically noted to be provided by other Sections.

3.5 **TESTING AND CLEANUP**

.1 Test all exterior joints with hose in presence of Architect if so requested. Clean adjacent and affected surfaces.

END OF SECTION

DIVISION 08 - OPENINGS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 GENERAL REQUIREMENTS

- .1 Conform to Canadian Manufacturing Specifications for Steel Doors and Frames published by Canadian Steel Door and Frame Manufacturers Association, except as specified therein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Installation of Hollow Metal Doors Section 06 10 00
- .2 Door Hardware Section 08 71 00
- .3 Power Door Operators Section 08 71 13
- .4 Glass and Glazing Section 08 80 00
- .5 Gypsum Board Assemblies Section 09 21 16
- .6 Painting Section 09 91 00

1.3 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 01 33 00 "Submittals Procedures".
- .2 Clearly indicate each type of door, frame, material, gauge, mortises, reinforcements and anchors.
- .3 Do not fabricate until Shop Drawings have been reviewed by the Consultant.

1.4 MEASUREMENTS

- .1 Where work is to be built into existing openings, measurements shall be taken on site at the actual location of the work. Fabricate the work to job measurements.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel Sheet - Commercial grade hot rolled steel to ASTM-A526-71 with "wiped coated" zinc finish to ASTM-A525-71, 0.25 oz. per sq.ft.

2.1 **MATERIALS (CONT'D)**

- .2 Reinforcing Steel - To CAN/CSA-G40.21 Type 33W hot dip galvanized with minimum zinc coating G90 to CAN/CSA G.164.
- .3 Insulation - Loose fibreglass, minimum density 1.5 lbs./cu.ft. (24 kg per cu. m.).
- .4 Door Bumpers - black neoprene.
- .5 Primer - Zinc rich to CGSB-1-GP.
- .6 Core Material - Resin impregnated, rot resistant kraft honeycomb for interior doors, rigid polyurethane board stock foam insulation for exterior doors to CGSB-41-GP-14a. Fire rated doors to conform to U.L.C. requirements.
- .7 Fabricate doors, frames and all internal reinforcements of hot dip galvanized steel to ASTN -97, minimum coating designation ZF 75 (A25).

2.2 **METAL THICKNESS**

.1	Building Doors	Gauge	Inches	mm
.1	Frames and Framing	16	.060	1.5
.2	Doors			
	§ Surface Sheets	18	.048	1.2
	§ Top and Bottom end channels	18	.048	1.2
.3	Accessories			
	§ Lock and strike reinforcement	16	.060	1.5
	§ Hinge reinforcement	10	.135	3.4
	§ Flush bolt reinforcement	16	.060	1.5
	§ Reinforcement for surface applied hardware	12	.105	2.7
	§ Mortar guard boxes	22	.030	0.76
	§ Jamb floor anchors	16	.060	1.5
	§ Jamb spreaders	18	.048	1.2
.4	Anchors			
	§ "T" - Strap Type	16	.060	1.5
	§ "L" - Strap Type	18	.048	1.2
	§ Stud Type	18	.048	1.2
.5	Glazing Stops	20	.040	1.0

PART 3 - EXECUTION

3.1 FABRICATION OF WELDED FRAMES

- .1 Construct framing in accordance with details and reviewed shop drawings.
- .2 Mortise, reinforce, drill and tap frames and reinforcement to receive hardware using templates provided.
- .3 Install 3 bumpers on strike jamb of frame for each single door and two bumpers at head of double door frames.
- .4 Protect strike, hinge and overhead concealed door closer reinforcement completely by guard boxes welded to frame.
- .5 Weld in 2 channel spreaders per frame, to ensure proper frame alignment.
- .6 Where frames terminate at finished floor, provide floor plates for anchorage to structural slab.
- .7 Cut mitre accurately and weld continuously on inside of frame profile.
- .8 Grind welded corners to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

NOTE: Neatly mitred and reinforced corners may be accepted subject to Architect's approval of sample prior to installation.

- .9 Fill surface depressions and butted joints with metallic paste and sand to a uniform smooth finish.
- .10 Provide 3 T strap adjustable jamb anchors per jamb for frames up to 2133 mm (7'-0") high to be installed in masonry walls. Provide additional anchor for each 600 mm (24") over 2133 mm (7'-0") high.
- .11 Provide steel anchors of suitable design for frames to be installed in stud partitions and for frames adjacent to pre-cast concrete. Securely wedge or weld anchor inside each jamb as follows:
 - .1 Frames up to 2133 mm (7'-0") high - 4 anchors per jamb.
- .12 Exterior Hollow Metal Frames for Door (Thermal Broken Frame) to be 1.5 mm (16 ga) heavy galvanized, secured together by an extruded poly vinyl chloride thermal break without the use of any fastening devices by S.W Fleming or approved equal. Thermal frame shall be complete with anchors and accessories as specified for frames and framing members. Exterior hollow metal frames to be packed with injected foam insulation. Fabricate frames with sufficient rigidity to effectively receive the forced entry. Provide minimum 2.7 mm (12 ga) continuous hinge reinforcement.
- .13 Insulate frames for exterior doors with fibreglass for full height and depth.

3.1 FABRICATION OF WELDED FRAMES (CONT'D)

- .14 All exterior window and door frames are to be thermally broken.
- .15 Guard box to accept 25 mm (1") throw or deadbolt.

3.3 FABRICATION OF DOORS

- .1 Construct doors in accordance with details and approved shop drawings, fully welded construction with no visible seams or joints on faces or vertical edges.
- .2 Assemble doors with full sheets laminated under pressure to honeycomb core.
- .3 Reinforce and frame openings required for glazing. Provide glazing stops with countersunk flat head screws.
- .4 Mortise, reinforce, tap and drill doors and reinforcement to receive hardware using templates provided by hardware supplier. Refer to Finishing Hardware Schedule for mounting heights.
- .5 Provide sound deadening and thermal insulation material to fill all voids in doors.
- .6 Assemble components by means of spot or arc welding.
- .7 Fit exterior doors and all interior stair doors with flush steel channel caps at top of door and seal against moisture penetration.
- .8 Provide condensate weep holes at bottom of exterior doors.
- .9 Interior Hollow Metal Doors: D20 Series. Each face formed from one sheet 0.9mm (20 ga) steel. Lock seam and seal longitudinal joints. Core to be honeycomb laminated under pressure to face sheets and to fill core space completely. Close top and bottom with 1.2 mm (18 ga) channels, spot welded.
- .10 Exterior Hollow Metal Doors: D18 Series. Each face formed from one sheet 1.2 mm (18 ga) steel. Lock seam and seal longitudinal joints, tack weld lock seams 15 mm o.c., fill flush, grind smooth. Core to be polyisocyanurate RSI 2.1 (R12) board, laminated under pressure to face sheets and to fill core space completely. Provide minimum 2.7 mm (12 ga) continuous hinge reinforcement. Close top and bottom with 1.2 mm (18 ga) channels, spot welded. Close top of out swing doors with sealed watertight cap.

3.4 SHOP PAINTING

- .1 Wipe coated steel frame: touch up areas where wipe coating has been removed using zinc rich paint.
- .2 Wipe coated steel doors: touch up areas where wipe coating has been removed, using zinc rich paint, and apply one full coat of rust inhibitive primer to CGSB-1-GP-105M.

3.4 **SHOP PAINTING (CONT'D)**

- .3 Uncoated Steel - Apply one rust inhibitive primer conforming to GCSB-1-GP-105M.

3.5 **INSTALLATION**

- .1 Supply hollow metal frames to masonry or drywall Trades in good time for building in so that building program is not delayed.
- .2 Co-operate with all Trades as required for the execution of the complete work.

3.6 **FIRE DOORS AND FRAMES**

- .1 Supply fire doors and frames assemblies to meet fire resistance time rating called for and carry the appropriate U.L.C. Label.
- .2 Fire doors and frames shall be installed as tested and as approved by a nationally recognized agency having a factory inspection service.
- .3 Locate label on frame on jamb midway between top hinge and head of door frame. Provide labels on door edge, hinge side.
- .4 Provide label on hanging edge of door near frame.

END OF SECTION

DIVISION 08 - OPENINGS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Allowances Section 01 21 00
- .2 Rough Carpentry Section 06 10 00
- .3 Hollow Metal Doors and Frames Section 08 11 13
- .4 Wood Doors Section 08 14 00

1.2 WORK INCLUDED

- .1 This section includes the supply of finishing hardware including but not limited to the following:
 - .1 Interior door hardware, Electronic key Fobs, privacy, dummy, passage sets, lock sets, exit devices, stops, closers, kick plates, dead bolts, cane bolts, push, pull plates, hinges etc. (Labelled where required).
 - .2 All other General Building hardware including kick plates and thresholds, weather stripping, stops, electric strikes, Electronic Key Fobs, lockset, exit devices, electromagnetic locks, hinges and closers (labelled where required).

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Delivery - supply hardware as and when required for each opening. Package hardware separately for each opening in a package which contains all the hardware for that opening and bears the number of the opening. Supply hardware to those who are to install it, complete with keys, templates and installation instructions together with all required screws, expansion shields, anchors and other related accessories for satisfactory attaching/installing hardware.
- .2 Hardware supplier to co-ordinate delivery of hardware to the site or to the appropriate parties.
- .3 Prior to delivery to the job site, a dry, secure room is to be provided for storage of finishing hardware.

1.4 **SUBMITTALS**

- .1 Submit product data, shop drawings and samples in compliance with Section 01 33 00.
- .2 Prepare a detailed finishing hardware schedule itemizing each opening.
List all doors by number including size, hard, swing and any and all relevant details affecting the application of finishing hardware.
- .3 Submit catalogue cuts of all proposed hardware.
- .4 Submit samples for approval as required.
- .5 Submit template information to the General Contractor for preparation of product in related sections and installation of finishing hardware.
- .6 Prepare for review a detailed key schedule.
- .7 Submit wiring diagrams and a description of operation for electrified hardware systems specified.
- .8 Upon job completion, submit to the Owners two "Owners Operation and Maintenance Manuals containing the following information:
 - .1 Maintenance instructions for each items of hardware.
 - .2 Final Hardware Schedule.
 - .3 Final Keying Schedule.

1.5 **GENERAL REQUIREMENTS**

- .1 Comply with all applicable ANSI/BHMA standards and requirements of Authorities.
- .2 Grade of hardware to be; "Commercial Grade Standard Duty".
- .3 All door closers shall have back checking features and shall be of proper size to operate door efficiently.
- .4 Confirm all kick plate and threshold sizes before ordering them.
- .5 Use no wall mounted door stops on drywall.
- .6 Exposed screws for installing hardware shall have Phillips or Robertson heads.
- .7 Rim panic device strikes shall be mortise type application. Equip panic devices with sex bolts.

1.5 **GENERAL REQUIREMENTS (CONT'D)**

- .8 Confirm degree of swing for door holders, closers, etc.
- .9 All locksets and passage sets to be lever handles.
- .10 A hardware schedule is to be provided by a certified Hardware Consultant for submission and review.
- .11 *Refer to Hardware Schedule contained in the Schedules on Drawings. This schedule is to be used as a guide to represent the minimum standard and quantity of hardware required. It is in no way to represent the exclusion of any required hardware as part of the contract.

1.6 **KEYING**

- .1 All locks to be keyed using blanks.
- .2 All locks shall be keyed as required to Master Key system as later described by the Owner, for all doors.
- .3 Quantity of keys per keying group to be determined later by Owner.

1.7 **FIELD QUALITY CONTROL**

- .1 Check all hardware when it has been installed and notify Architect of any cases where it has been improperly installed, is defective or is not specified.
- .2 The door closer supplier shall review installation and operation of all door closers on site and issue a written report to the Architect.

1.8 **WARRANTY**

- .1 All hardware is to be guaranteed for an extended period of five (5) years.
- .2 Provide a minimum ten (10) year warranty for door closers.
- .3 Warranty to commence from date of Substantial Completion.

1.9 **MAINTENANCE**

- .1 Provide three wrenches for door closer adjustment.

PART 2 - PRODUCTS

2.1 **MANUFACTURERS**

<u>Item:</u>	<u>Manufacturer:</u>
Hinges	Ives
Exit Devices	Von Duprin
Locksets	Schlage Lock Co.
Cylinders	Schlage Lock Co.
Door Pulls	Standard Metal
Door Closers	LCN Closers
Overhead Stops	Glynn-Johnson
Push, Kick, Armor Plates	Standard Metal
Floor, Wall Stops	Standard Metal
Thresholds, Weatherstrip	KN Crowder
Signage	Frost

.2 Or approved Alternates.

.3 For all cylinders use ASSA. (Owner's Keyway)

PART 3 - EXECUTION

3.1

.1 This section is for supply only.

END OF SECTION

DIVISION 08 - OPENINGS

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 This Section includes the following types of power door operators:
 - 1. Exterior and interior, power door operators, low energy, with visible mounting. Refer to Plans and schedules
 - 2. Automatic door operators shall be configured for doors as follows:
 - 1. Simultaneous pairs, out swing, in swing, or double egress.
 - 2. Simultaneous pairs, with single operator, out swing or in swing.
 - 3. Single doors, out swing or in swing.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Door Hardware Section 08 71 00
- .2 Electrical Specification: electrical connections including conduit and wiring for power door operators & push button controls Division 26

1.4 REFERENCES

- .1 General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- .2 UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- .3 ANSI/BHMA A156.19: Standard for Power Assist and Low Energy Power Operated Doors.

1.4 REFERENCES (CONT'D)

- .4 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .5 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- .6 BHMA A156.10 - Standard for Power Operated Pedestrian Doors.
- .7 NFPA 101 – Life Safety Code.
- .8 NFPA 70 – National Electric Code.
- .9 UBC: Uniform Building Code
- .10 ISO 9001 - Standard for Manufacturing Quality Management Systems
- .11 Metal Finishes Manual for Architectural and Metal Products.
- .12 AAMA 607.1 - Clear Anodic Finishes for Architectural Aluminum.
- .13 AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
- .14 CSA approved in compliance with the O.B.C.

1.5 DEFINITIONS

- .1 Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

1.6 PERFORMANCE REQUIREMENTS

- .1 Provide power door operators capable of withstanding structural loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- .2 Operating Range: Minus 30 deg F (29 deg C) to 130 deg F (54 deg C).
- .3 Opening-Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) applied at 1" (25 mm) from the latch edge of the door.
- .4 Break Away Requirements: Power door operators provided with a breakaway device shall require no more than 50 lbf (222 N) applied at 1" (25 mm) from the latch edge of the door.
- .5 Door Energy: The kinetic energy of a door in motion shall not exceed 1.25 lbd-ft (1.69 Nm).

1.6 PERFORMANCE REQUIREMENTS (CONT'D)

- .6 Closing Time:
 - .1 Doors shall be field adjusted to close from 90 degrees to 10 degrees in 3 seconds or longer.
 - .2 Doors shall be field adjusted to close from 10 degrees to fully close in not less than 1.5 seconds.

1.7 SUBMITTALS

- .1 Submit listed submittals in accordance with Section 01 33 00 submittal procedures.
- .2 Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work. Indicate wiring for electrical supply.
- .3 Color Samples for selection of factory-applied color finishes.
- .4 Closeout Submittals: Provide the following with project close-out documents.
 - .1 Owner's Manual.
 - .2 Warranties.

1.8 QUALITY ASSURANCE

- .1 Installer Qualifications: Manufacturer's authorized representative who is trained for installation and maintenance of units required for this Project.
- .2 Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001 and with company certificate issued by AAADM.
- .3 Certifications: Power door operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - .1 ANSI A156.10.
 - .2 NFPA 101.
 - .3 UL 325 Listed (Fire Door Operator).
 - .4 ICBO (UBC Standard 10-1).
 - .5 CSA approved in compliance with the O.B.C.
- .4 Source Limitations: Obtain power door operators through one source from a single manufacturer.

1.8 QUALITY ASSURANCE (CONT'D)

- .5 Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- .6 Power Operated Door Standard: ANSI/BHMA A156.19.
- .7 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- .8 Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for swinging automatic entrance doors serving as a required means of egress.

1.9 PROJECT CONDITIONS

- .1 Field Measurements: General Contractor shall verify openings to receive power door operators by field measurements before fabrication and indicate measurements on Shop Drawings.
- .2 Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.
- .3 Other trades: General Contractor Advise of any inadequate conditions or equipment.

1.10 COORDINATION

- .1 Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing power door operators to comply with indicated requirements.
- .2 Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies.
- .3 System Integration: Integrate power door operators with other systems as required for a complete working installation.
 - .1 Provide electrical interface control capability for card reader or keypad operation of power door operators on doors with electric locking.
 - .2 Where required for proper operation, provide a time delay relay to signal power door operator to activate only after electric lock system is released.

1.11 WARRANTY

- .1 Power door operators shall be free of defects in material and workmanship for a period of three (3) years from the date of Substantial Performance.
- .2 During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- .3 During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 POWER DOOR OPERATORS

- .1 Manufacturer:
 - .1 Stanley Access Technologies; Heavy Duty, Stanley M-Force Series power door operator.
 - .2 SW100 By "Besam", ASSA ABLOY.
 - .3 Approved Alternate.

2.2 MATERIALS

- .1 Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated. Colour to match door frame.
 - .1 Headers: 6063-T6.
 - .2 Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - .3 Sheet and Plate: ASTM B 209.
- .2 Sealants and Joint Fillers: Refer to Division 07 Section "Joint Sealants".

2.2 COMPONENTS

- .1 Header Case: Header case shall not exceed 6-1/8 inch x 4 inch (156 mm x 102 mm) in rectangular section and shall be fabricated from extruded aluminum with structurally integrated end caps, designed to conceal door operators and controls. The operator shall be sealed against dust, dirt, and corrosion within the header case. Access to the operator and electronic control box shall be provided by a full-length removable cover, edge rabbeted to the header to ensure a flush fit. Removable cover shall be secured to prevent unauthorized access.

2.2 COMPONENTS (CONT'D)

- .2 Door Arms and Linkage Assembly: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.
- .3 Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
- .4 Signage: Provide signage in accordance with ANSI/BHMA A156.19.

2.3 SWINGING DOOR OPERATORS

- .1 Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- .2 Operators: Self-contained units powered by a minimum fractional horsepower, permanent-magnet AC or DC motors.
- .3 Electro-mechanical Operator: Transmit power from operator to door through reduction gear train, splined spindle, door arm, and linkage assembly. Drive train shall have positive constant engagement.
 - .1 Operation: Power opening and spring closing.
 - .2 Mounting: Visible
- .4 Features:
 - .1 Adjustable opening, open check, and closing speeds.
 - .2 Adjustable opening force.
 - .3 Adjustable hold-open time between 0 and 30 seconds.
 - .4 Reverse on obstruction.
- .5 Closing Operation: The operator shall close the door by spring energy employing the motor, as a dynamic brake to provide closing speed control. The closing spring shall be adjustable for positive closing action at a low material stress level for long spring life.
- .6 Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.
- .7 Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 10 amps for doors with operators in pairs, 5 amps for single doors.

2.4 ELECTRICAL CONTROLS

- .1 Electrical Control System: Electrical control system shall include a solid-state controller with quick connect plugs.
- .2 Controller Protection: The controller shall incorporate the following features to ensure trouble free operation:
 - .1 Fuse Protection.
 - .2 Electronic Surge Protection.
 - .3 Internal Power Supply Protection.
- .3 Program Dip Switches: The controller shall have program dip switches to allow selection or change at the following parameters: carpet or timer logic, single or dual door, and activation options.

2.5 ACTIVATION DEVICES

- .1 Push Plates: Provide 5 7/8" (150 mm) round SPDT push plates with UL listed switch. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and "Push To Open":
 - .1 Push Buttons to be installed, so the centre located 1000-1100 mm (39- 3/8" – 43 1/4') from the floor;
 - .2 Incorporate controls that are clearly visible which are at least 150 mm (5-7/8") in diameter;
 - .3 Incorporate the International symbol of Access for Persons with Disabilities.
- .2 Interior and exterior push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.

2.6 ALUMINUM FINISHES

- .1 Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- .2 Class II, Clear Anodic Finish: AA-M10C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.40 mils minimum complying with AAMA 611, and the following:
 - .1 AAMA 607.1

2.6 ALUMINUM FINISHES (CONT'D)

- .2 Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

- .1 Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of swinging automatic entrance doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.
- .2 Mounting: Install power door operators/headers plumb and true in alignment with established lines and grades. Anchor securely in place.
 - .1 Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - .2 Set headers, arms and linkages level and true to location with anchorage for permanent support.
- .3 Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.
- .4 Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants" to provide weather tight installation.

3.3 FIELD QUALITY CONTROL

- .1 Testing Services: Factory Trained Installer shall test and inspect each swinging automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

- .1 Adjust door operators, controls, and hardware for smooth and safe operation, for weather-tight closure, and complying with requirements in ANSI A156 by AAADM Certified Technician.

3.5 CLEANING AND PROTECTION

- .1 Clean surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

END OF SECTION

DIVISION 09 - FINISHES

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 GENERAL REQUIREMENTS

- .1 The Instructions to Bidders and all Sections of Division 01 apply to and form part of this section of the specification.
- .2 Conform to CAN/CSA A-82.27, and CAN/CSA A-82.31 including appendixes.
- .3 Ensure strict compliance with Manufactures Literature.
- .4 ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .5 Ontario Building Code Section 9.24 Sheet Steel Stud Wall Framing.
- .6 Canadian Sheet Steel Building Institute Technical Bulletins and Manuals.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Painting Section 09 91 00

1.3 QUALITY ASSURANCE

- .1 Requirements of Regulatory Agencies:
Install fire separations and fire protection exactly as specified in Underwriters' Laboratories test design specification that validates the specified rating.
- .2 Allowable Tolerances:
Install Work within 1/8" of dimensioned location unless approved otherwise, and flat to a tolerance of 1/8" maximum in 10'-0" and 1/16" maximum in any running 12".

1.4 DELIVERY AND STORAGE

- .1 Handle and store materials carefully to prevent damage.
- .2 Store gypsum board flat in piles with protected edges.
- .3 Obtain approval of proposed locations for stockpiling material.

1.4 DELIVERY AND STORAGE (CONT'D)

- .4 Do not install damaged or deteriorated material but remove from site immediately.
- .5 Provide any necessary temporary covers, skids and the like.
- .6 Materials as delivered shall bear manufacturer's name, brand name of material and where applicable, CSA classification.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply gypsum board or joint filler to surfaces that are damp or contain frost.
- .2 In cold weather and during gypsum panel application and joint finishing, temperatures within work areas shall be within the range of 12 deg. C to 25 deg. C. for 7 days prior to application of joint compound and until cement and adhesives have cured.
- .3 Provide adequate ventilation to carry off excess moisture.

1.6 RELATIONS WITH OTHER TRADES

- .1 Co-ordinate with Mechanical and Electrical Trades to ensure that all services are installed prior to application of wall board.
- .2 Give directions to Section 06 10 00 for supplementary blocking.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 All materials to conform to CAN/CSA A82.27 unless specified otherwise.
- .2 Gypsum Board Types:
 - 1. Gypsum Board- Paper Faced (GB-PF): To ASTM C1396/C1396M, tapered edges, ivory paper faced, thickness as indicated on the drawings.
 - 2. Gypsum Board- Fire-Rated (GB-FR): To ASTM C1396/C1396M, Type C, tapered edges, ivory paper faced, ULC labelled, thickness as indicated on the drawings.
 - 3. Gypsum Board- Shaft-Liner (GB-SL): To ASTM C1658/C1658M, Type X, 25mm thick double bevelled edges, silicone treated gypsum core, with coated glass matt facers both sides.
 - 4. Gypsum Board- Backing Board (GB-BB): To ASTM C1396/C1396M, 12.7mm thick paper faced, square edges.

2.1 MATERIALS (CONT'D)

5. High Impact Resistant Gypsum Board- Ceiling Board (GB-CLG): To ASTM C1396/C1396M, 12.7mm thick, paper faced, eased edges, maximum 6.5kg/m² weight.
 6. Gypsum Board- Tile Backer (GB-TB): To ASTM C1178/C1178M, 12.7mm thick, Coated glass mat-faced gypsum panels, with silicone treated core, glass fibre mesh facers both sides and a co-polymer waterproof coating on the tile-face side, square edges.
 - .7 Gypsum Board – Abuse Resistant Board (G.B.A.R.) to ASTM C1629, 16mm thick, Level 2 for abrasion, indentation and impact resistance paper faced, tapered edges.
- .3 Partition Systems:
- .1 Steel Studs: 20 ga. min. steel, wiped coated, having knurled flanges 1-1/4" wide with edges doubled back at least 3/16", with girts as required, and with service access holes in webs at 18" o.c..
 - .2 Partition Runner Tracks: As specified for studs, Min. 25 ga. electro zinc coated sheet steel with flanges minimum of 1 3/16" high, and to suit width of studs. Oversized to accommodate structural deflection and floor toppings. 2½" "Slotted Deflection" track and 2½" "Deep Track" to accommodate the installation of cementitious skim coat topping.
 - .3 Bracing Channels: 18 ga. 1-1/2" x 3/4" cold rolled steel, wiped coated.
 - .4 Steel Sheet Metal Blocking: 18 ga. 16" wide mtd. to face of studs for mounting of devices, accessories and millwork. Refer to details for mounting heights.
- .4 Corner Bead and Trims: 18 ga. galvanized steel with perforated flanges; one piece per location. Dur-A-Bead 1 ¼" x 1 ¼" metal bead for corners; "J" trim and "L" trim by "CGC" or approved alternate, fill type only. Paper or plastic beads are not acceptable.
- .5 Control Joint: C.G.C. No. 093.
- .6 Thermal Break: Permanent adhesive faced rubberized cork, 1/8" thick by width required.
- .7 Fastenings and Ties:
- .1 Screws: For metal furring. Self-drilling, self-tapping, case-hardened, Phillips head, drywall screws, with corrosion resistant finish. For wood furring: similar wood screws #6 x 1" for single thickness board fastening and #7 x 1-5/8" for double thickness board fastening.
 - .2 Tie Wire: 16 ga. galvanized soft annealed steel wire.

2.1 MATERIALS (CONT'D)

- .3 Furring System: 16 ga. cold rolled steel, prime painted.
 - .1 1-1/2" x 1/2" where supported at centres of 3'-0" maximum.
 - .2 1-1/2" x 3/4" where supported at centres of 4'-0" maximum.
- .4 Furring Channels: 25 ga. cold rolled steel, wiped coated, nominal size of 3/4" deep x 1-1/4" face, hat type with knurled face.
- .8 Joint Treatment Material: (Joint compound, taping compound laminating compound). To ASTM C474 and C475. Use material recommended by board manufacturer for the proposed use.
- .9 Resilient Sponge Tape: self sticking adhesive on one side, closed cell neoprene sponge tape Permastik 122X by Jacobs and Thompson Ltd. Or approved alternate.
- .10 Adhesive: type acceptable to insulation manufacturers to provide vapour barrier of 1/8" thickness.
- .11 Reinforcing Tape: Perf-A-Tape by C.G.C. or approved alternate.
- .12 Ceiling Hanger System:
 - .1 Hanger Anchoring Devices:
 - .1 Phillips Red Head by Phillips Drill Company of Canada Limited.
 - .2 T32, self-drilling for use in concrete deck.
 - .3 WS-3822 wedge anchor with tie wire insert for use in composite concrete and steel deck.
 - .4 SDI-3822 for use in steel deck, with screw eye bolts to suit inserts or as otherwise approved.
 - .5 All anchors to be fastened to lower flute of deck
 - .2 Hangers:
 - .1 Zinc coated annealed steel wire; 12 ga. to support a maximum weight of 150 pounds per hanger.
 - .2 9 ga. to support a maximum weight of 310 pounds per hanger and zinc coated annealed steel rod.

2.1 MATERIALS (CONT'D)

- .3 3/16" dia. to support a maximum weight of 500 pounds per hanger.
- .3 Sound Isolation Hangers: spring hangers of weight capacity required by Vibro Coustics Ltd. or approved alternate.
- .13 Tile Backer Board accessories: 2" wide 10 x 10 coated glass mesh tape, rust resistant fasteners. Mold resistant Drywall Type: Certain Teed Fiba Tape Mold-X10 Mold Resistant Drywall type with M2 Tech or approved alternate.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Before application of drywall commences, ensure that services have been installed, tested, and approved; that conduits, pipes, cables, and outlets are plugged, capped, or covered; and that fastenings and supports installed by others are in place.

3.2 INSTALLATION

- .1 General
 - .1 Coordinate the Work of this Section with that of other Sections.
 - .2 Install framing for support and incorporation of flush mounted and recessed components. Ensure adequacy of supports by consultation and verification of methods with those performing the Work of Divisions 22 to 28.
 - .3 **Do not use through-the-roof deck flange hangers.**
 - .4 Do not install metal framing, trim, casings, or accessories which have been bent, dented, or otherwise deformed.
 - .5 Framing and furring shown on Drawings is indicative but do not regard it as exact or complete.
 - .6 Provide for movement at intersections with structural members to avoid transference of loads to this Work.
 - .7 Make allowances for thermal movements in drywall systems of 1/2" min.
 - .8 Do not support the Work of this Section from, nor make attachment to, ducts, pipes, conduit, or the support framing of the Work of other Sections.
 - .9 Do not apply drywall in close proximity to hot pipes or heating ducts.

3.2 **INSTALLATION (CONT'D)**

- .10 Install materials with the minimum of joints. Tightly butt joints, without force, and neatly align them.
 - .11 Splice, framing members only where continuous lengths are not available from manufacturer.
 - .12 Frame openings on every side with suitable sections. Provide clearances required at mechanical and electrical services, such as grilles, diffusers, access panels, and lighting fixtures only after verification of requirements in each case.
 - .13 Coordinate Work with Section 06 10 00 to ensure that proper wood blocking for support of items secured to Work of this Section is installed and anchored adequately to prevent damage to Work of this Section.
 - .14 Attach to framing adequate steel reinforcing members to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed upon the Work of this Section.
 - .15 Install each grab rail anchorage to withstand a force of 9500 pounds in all directions.
 - .16 Include in Work; fire stopping bulkheads over doors, frames, screens, and changes in ceiling levels; stair soffits; furred beams; and pipe spaces; all as indicated on Drawings and required by the Ontario Building Code.
- .2 Suspended Ceiling Framing and Furring:
- 1. Screw apply hanger anchoring devices to metal deck.
 - 2. Space hangers for runner channels to suit structure, to support ceiling load, at a max. distance of 4'-0" o.c., and at no greater distance than 6" from ends of runner channel.
 - 3. Install runner channels at 3'-0" o.c., generally, and at no greater distance than 6" from terminations of supported cross furring members. Bend rod hangers sharply under bottom flange or runners, and wire securely in place with saddle ties.
 - 4. Splice runner channels by lapping at least 12" with interlocking flanges and wired at each end with two loops. Do not bunch or line up splices.
 - 5. Install cross furring at 16" o.c., generally, and at no greater distance than 6" from walls, openings, breaks in continuity of ceiling, and changes of direction. Space furring in all cases to suit incorporated services, and so as to avoid contact with perimeter walls. Span hat-type furring no greater than 4'-0". Use metal studs for greater spans 1-5/8" deep spanning to 5'-0", 2-1/2" deep to 6'-0", and 3-5/8" deep to 8'-0".

3.2 **INSTALLATION (CONT'D)**

6. Secure cross furring to supports with double wire ties or approved equivalent attachment. Splice by nesting and tying together with 8" overlap.
7. Erect entire hanger and suspension system to adequately support the ceiling assembly, including incorporated services, with a maximum deflection of 1/360 in the span of each component member, and free from horizontal movement.

.3 Metal Stud Partition Framing:

- .1 Secure ceiling and floor runner tracks at floor and tops of partitions for their full length, at 24" o.c. with concrete nails, square cut nails, toggle bolts, or sheet metal screws as suitable for base material. Install runner tracks also at heads and sills of openings. Secure runner tracks at openings by cutting flanges, turning up webs, and screwing to studs.
- .2 Install top runner deflection tracks with slotted oversized flanges at top of non-load bearing partitions to compensate for deflection of structure.
- .3 Install base runner tracks with oversized flanges to compensate for installation of poured in place cementitious floor toppings (min.1" deep).
- .4 Butt, not mitre, runners at wall intersections and corners. At ceilings, lap and screw channels together.
- .5 Space studs at 16" O.C., generally; and at no greater distance than 2" from abutting walls, partitions and corners.
- .6 Secure studs to runners by screws, crimping, or welding, as required by stud type, and in accordance with manufacturer's design specification.
- .7 Install studs of depth indicated on Drawings: but in no case span studs 1-5/8" deep more than 9'-0" between supports; 2-1/2" deep, 12'-0"; and 3-5/8" deep, 16'-0".
- .8 Extend double studs on each side of all openings from floor to ceiling or structure above, whichever is indicated.
- .9 Erect three studs at corner and intermediate intersections of partitions.

3.2 **INSTALLATION (CONT'D)**

- .10 Install bracing channels in partitions, spaced equally in partition height, at no more than 3'-0" O.C. where not otherwise specified; over doors in partitions of greater height than 10'-0", spaced as preceding; and above and below window-type openings, spaced not more than 6" from the top and bottom of the opening. Install two lines of bracing in partitions up to 8'-0" high and three lines in partitions up to 12'-0" high. Install bracing channels in stud cut-outs, wire tied or welded to each stud, and extending horizontally across entire length of each braced partition and across two full stud spaces at each side of door and window openings.
 - .11 Splice studs by nesting, with 8" minimum lap, and fastened with one screw in each flange.
 - .12 Coordinate Work with others installing horizontal runs of service lines so that Work of all is done simultaneously.
 - .13 Screw, or weld, frame anchor clips, of frames supplied under the Work of Section 08 11 13 "Hollow Metal Doors and Frames", to jamb studs, and head and sill runners. Ensure adequate fastening to prevent movement of the frame within the partition. Remove spreaders at floor after frames are anchored.
 - .14 Unless shown otherwise on Drawings, partitions, together with wall board facings, shall extend above ceiling to underside of structure above or be laterally braced.
 - .15 Ensure strict compliance with the limiting height tables for stud size, gauge and allowable deflection, and when used for alternate board products with different weights and performance.
 - .16 Metal studs in walls required to have a fire resistance rating shall be installed so that there is a 1/2" clearance between the top of the stud and the top of the runner to allow for expansion in the event of fire.
- .4 Accessories
- .1 At external corners install corner beads secured to framing at 6" o.c. on alternate flanges.
 - .2 At board edges secure casing beads at 12' o.c. at edges exposed to view, where board butts against other materials with no trim to conceal junction, at control joints, at perimeter of ceiling surfaces, at tops of partitions where otherwise indicated on Drawings.
 - .3 Install control joints in walls, partitions and ceilings at no greater spacing than 25'-0" in each direction, at perimeters of ceilings where they abut walls and other vertical surfaces, or as otherwise indicated. Line up control joints in other construction or with centre lines of mullions, columns, piers, or similar building elements.

3.2 **INSTALLATION (CONT'D)**

.4 Install casings and thermal breaks at junctions of drywall with exterior door, window or screen frames. Apply self-sticking resilient sponge tape where gypsum board abuts, same, to casing bead.

.5 Application of Board

.1 Extend board into door, window, and other opening reveals, and on metal stud partitions to structure above, unless noted otherwise on Drawings.

.2 Apply board with long dimension perpendicular to supports except at stud partitions where they shall be parallel to studs for Fire Rated Assemblies.

.3 Board is to be cut to fit tight into deck flutes, around building structure and other members to maintain Acoustic & Fire Separations and Thermal Barriers to provide a completed finish.

.4 Back all joints with a framing member. Locate joints on opposite sides of partitions on different studs, and at least 12" from opening jambs.

.5 Install board in maximum lengths and widths to minimize joints, and in lengths of 6'-0" minimum. Stagger end joints where they are unavoidable.

.6 Form neat joints at mill ends and at job cut edges of board panels. Cut paper on face with knife. Smooth by sanding and rubbing edges together.

.7 Fasten wallboard to metal support members by sheet metal drywall screws 3/8" minimum and 1/2" maximum from centre of joints. Space screws:

.1 At ceilings of fire rated board at 8" o.c. at edges and in field.

.2 At walls of fire rated board at 8" o.c. at edges and 12" o.c. in field.

.3 Locate screws opposite one another in adjacent panels.

.4 At walls and ceilings where non-fire rated board is used at 12" o.c. at edges and in field.

.5 To both double jamb studs for all openings @ 8" o.c.

.8 Start application on walls at corners of rooms, and on ceilings from centre line of spaces. Do not force adjacent boards into place; allow moderate contact. Install extension clips where required. Drive screws to form a slight depression, but not so paper cover is broken.

.9 Nail board to wood furring as specified in CSA Standard A82.31.

3.2 **INSTALLATION (CONT'D)**

- .10 Ensure gypsum board sits tight to floor surface to provide full support for wall bases.
- .6 Control Joints for Gypsum Board partitions
 - .1 Control joints should be employed in long expanses of partitions at 25-foot intervals, from floor to ceiling. Control joints are recommended at doorjamb, extending from door head to ceiling. Where doorjamb extends from floor to ceiling and are spaced less than 25 feet apart, no control joints are required.
 - .2 Control joints are required in ceilings to limit areas to 2,500 square feet. Additionally, control joints should be installed in ceilings to limit dimensions in either direction to 50 feet. Control joints should be installed where ceiling framing or furring changes direction.
- .7 Finishing of Joints and Depressions:
 - .1 Fill joints, casing beads, corner beads, holes at board fasteners and depressions on board surfaces exposed to view to ensure smooth seamless surfaces and square neat corners. Use jointing compounds and reinforcing tapes in conformance with manufacturer's specification. Ensure that board is tight against framing members, fasteners are properly depressed, and adhesives have sufficiently cured.
 - .2 For joints not exposed to view but are part of an acoustic wall with insulation fill, an STC Rating or a Fire Rating, these are to be fully taped and mudded full height.
 - .3 Fill joints by three-coat method:
 - .1 Embed reinforcing tape in a cover coat of joint filler.
 - .2 Apply skim coat of topping cement when level coat has dried.
 - .3 Feather edges of compounds into surfaces of wallboards. After skim coat has dried for at least 24 hours sand to leave smooth. Do not sandpaper face of wallboard.
 - .4 At bevelled joints: Apply cover coat 7" wide, level coat 10" wide, and skim coat 12" wide.
 - .5 At end joints and butt joints formed at cut edges of wallboard. Apply cover coat 14" wide, level coat 20" wide, and skim coat 24" wide. Camber treatment over end joints to 1/32" thick at most.

3.2 **INSTALLATION (CONT'D)**

- .6 At Internal Corners: First fill gaps between boards with joint filler. Embed creased reinforcing tape in a thin coat of joint filler applied 2" wide at each side of corner. Apply cover coat as specified for bevelled joints) to just one side of joint, and when dry, apply skim coat to other side.
- .7 At External Corners: Fill to nose of corner bead with joint filler and topping cement as specified for bevelled joints.
- .8 At casing beads: As specified for bevelled joints.
- .9 At Board Fasteners: Fill holes and depressions with a two coat application of joint filler.

.8 Caulking

- .1 Caulk between casing beads and other construction where junctions are exposed to view.
- .2 Caulk junctions between drywall fire separations and projections, and other construction to ensure that integrity of fire rating is maintained. Ensure that caulked joints provide a continuous seal and that they are caulked before other Work encloses them.
- .3 Clean joints, prime and install sealants in accordance with the requirements of Section "07 90 00 Joint Protection".

.9 Bracing:

- .1 Non-Full Height walls require lateral bracing every 6'-0" to 8'-0".
- .2 Corner braces and/or angle braces up to roof / floor structure on both sides of walls are required.
- .3 Securing top track only to the underside of an acoustic tile T-bar ceiling is not permitted. Lateral bracing is still required for walls as noted above, however, connection of top track to the framing for a suspended drywall ceiling is permitted.

.10 Openings:

- .1 All openings in fire separations require double studs on both sides.
- .2 Refer to the fire damper installation documents for framing requirements around dampers.

3.2 INSTALLATION (CONT'D)

- .3 In non-fire separations, for all openings, provide double studs on both sides.
- .4 Openings up to 4 feet - Track only lintel is acceptable, except in a fire separation use a double track lintel.

3.3 CONSTRUCTION OF SOUND ATTENUATED PARTITIONS

- .1 Execute as follows for all gypsum board wall construction:
 - .1 Install sound attenuation batts.
 - .2 A 1/8" continuous bead of acoustical sealant around perimeter of wall at web of top and bottom tracks and end studs. Lay gypsum board into position forcing caulking bead to fill space between gypsum board and structure.
 - .3 Seal full perimeter for cut-outs around electrical boxes, pipes and ducts and perimeter convactor pipes with acoustical sealant.

3.4 CONSTRUCTION OF FIRE RATED PARTITIONS AND CEILINGS

- .1 Construct all gypsum board partitions and ceilings identified to require a fire resistance rating in strict conformance with U.L.C. Designs or approved alternate.
- .2 Fit assemblies tightly to enclosing constructions to maintain integrity of the separations.

3.5 TILE BACKER BOARD APPLICATIONS

- .1 Studs and retaining t's are to be spaced at 16" o.c. max. deflection = 1/360 of span.
- .2 Install 1/2" tile backer board in all areas and washrooms to receive ceramic tiling. Install board with the grey face out away from framing. Boards can be set parallel or perpendicular to the wall framing.
- .3 To extend 6'-0" F.F.L. continuous around perimeter in Washrooms, full height in Showers.
- .4 Fasten at 150mm (6") o.c. and a min. of 12.7mm (1/2") from edges. Drive fasteners flush to coated surface of board.
- .5 Joint Treatment: Butt ends and edges snugly and fit tight around all cut-outs and adjacent surfaces. Reinforce all joints with a 50mm (2") wide 10 x 10 coated glass mesh tape embedded in the adhesive to be used by the tile installer.
- .6 Follow the manufacturers literature and instructions to ensure compliance with the limited warranty. If any part of these instructions are in conflict with the contract documents request clarification from the architect.

3.6 JANITOR ROOM CONSTRUCTION

- .1 Wrap waterproof membrane under stud and track and up wall to protect steel from corrosion from incidental water exposure.
- .2 Install 1200 mm (48") high cement board base around perimeter of room. Remainder of wall to be constructed of water-resistant gypsum board.

3.7 ADJUSTMENT & CLEANING

- .1 Remove droppings and excess of joint compound from Work of others, and from Work of this Section, before it sets.
- .2 Make good to cut-outs for services and other Work, fill in defective joints, holes and other depressions with joint compound.
- .3 Make good defective work, and ensure that surfaces are smooth, evenly textured and within specified tolerances to receive finish treatment.
- .4 Clean off beads, casings and other metal trim, and leave all surfaces ready for specified finishes.

END OF SECTION

DIVISION 09 - FINISHES

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Gypsum Board Assemblies Section 09 21 16

1.3 REFERENCE STANDARDS

- .1 Do tile work in accordance with Installation Manual 200 Ceramic Tile, produced by the Terrazzo, Tile and Marble Association of Canada (T.T.M.A.C.).

1.4 SUBMITTALS

- .1 Submit 2 random samples of each colour of ceramic tile used on this project; clearly identify with manufacturer's name, colour number and project number. Do not proceed with work until samples have been approved by Consultant.
- .2 Mount tile on ½" plywood 12" x 12" complete with grout colour to represent project installation.

1.5 PROTECTION

- .1 Protect Work of this Section against damage by other trades for minimum 72 hours after application by prohibiting passage of traffic over tile.
- .2 To prevent soiling or damage to finish flooring where pedestrian traffic occurs after the flooring has been installed, install and maintain 0.152mm polyethylene membrane or reinforced kraft paper temporary protection, secured in place and with joints sealed by reinforced pressure sensitive tape.
- .3 Install plywood panels of minimum 6mm thickness over completed finish flooring materials on which further construction work is performed or delivery of products is made, or both. Seal joints between panels with reinforced pressure sensitive tape.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Ceramic Floor Tile and Base (Shower): Quebec Series, Porcelain Dot mounted mosaic tile, 2" x 2" by Olympia Tile, colour to be selected from full range of colour options.

- 2.1 **MATERIALS (CONT'D)**
- .2 Ceramic Floor Tile and Base (All Other Areas): Lea Stone Series, Unglazed Porcelain tile, 12" x 24" by Olympia Tile, colour to be selected from full range of colour options.
 - .3 Ceramic Wall Tile: Colour and Dimension Series, Glazed wall tile, 4" x 16" by Olympia. Colour to be selected from full range of colour options.
 - .4 Waterproofing Mortar : "Mapelastic 315" .
 - .5 Cement: to CAN/CSA-A5-M77, colour to Consultant's selection.
 - .6 Sand: to CAN/CSA A82.56-M1976.
 - .7 Lime: to CAN/CSA A82.43-1950 (R1971).
 - .8 Latex: formulated for use in cement mortar.
 - .9 Water: potable and free of minerals which may discolour mortar.
 - .10 Dry Set Mortar: to ANSI A118.1-1976 - Kerabond by Mapei.
 - .11 Grouts:
 - .1 Keracolor S Grout by Mapei: For all floor tiles;
 - .2 Keracolor U Grout by Mapei: For all wall tiles
 - .3 All grouts to be sealed through.
 - .12 Epoxy Mortar: "Flextile 100 Epoxy mortar or approved alternate.
 - .13 Epoxy Grout: Kerapoxy or Kerapoxy CQ Grout by Mapei, or LATICRETE® SPECTRALOCK® PRO Premium Grout
 - .14 Level Cure - LCB as manufactured by Master Builders Ltd.
 - .15 Sealants - conform to Section 07 90 00.
NOTE: Colour selection for acid resistant grout shall match tile colour.
 - .16 Sealers - as recommended by the Mortar Manufacturer. Wax for protection after sealer as recommended by the Mortar Manufacturer to meet pre-requirements of T.T.MAC #3000 series.
 - .17 Special Tile Shapes - bullnosed, dado cap and coved bases.
 - .18 Metal Edge and Transition Strips: Extruded aluminum edge strips, 3mm wide at top edge, with integral perforated anchoring leg for setting the strip into the setting material, height as required to suit tile, Brushed nickel anodized finish, as manufactured by Schluter Systems.

2.1 **MATERIALS (CONT'D)**

- .19 Decorative Edge Trim: Extruded aluminum decorative edge trim with integral perforated anchoring leg for setting the strip into the setting material, complete with pre-formed corners, Brushed nickel anodized finish, "Jolly Edge" as manufactured by Schluter Systems.
- .20 Expansion and Control Joints for Thin Set Applications: Extruded aluminum profiles joined by a soft CPE movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed, height as required to suit the application, insert colour as selected by the Consultant, Brushed nickel anodized finish, by Schluter Systems.
- .21 Scratch & Levelling Coat: (by volume): One part Portland cement, 4 parts sand and latex additive where required by TTMAC Details. Premixed mortar may be used per manufacturers instructions. Adjust water volume depending on moisture content of sand to obtain the required consistency and workability.
- .22 Waterproofing Membrane: Kerdi Band as manufactured by Schluter.

PART 3 - EXECUTION

3.1 **EXAMINATION**

- .1 Examine surfaces prepared to receive installation of tiling. If discrepancies exist, report to Architect. Installation of any part of the Work will be construed as acceptance of such surfaces as being satisfactory.
- .2 Ensure compatibility of abrasives and fillers supplied under this Section and which will bear contact with substrate materials.

3.2 **INSTALLATION**

- .1 **Prior to installation of floor finishes, the General Contractor is to verify and confirm that there is Positive Drainage to all floor and trench drains without ponding. Failure to comply with this requirement will result in the removal and replacement of the floor slab at his cost.**
- .2 Do not install any floor finishes until the requirement in 3.2.1 has been met.
- .3 Regard recommendations, installation methods specified and illustrated in Terrazzo, Tile and marble Association Manual No. 22 - 1979, and applicable manufacturer's instructions as minimum acceptable standard, except as varied by this Specification.
- .4 Use tile setting method specified hereinafter.
- .5 Obtain Architect's approval of surfaces over which tile is to be installed before commencing tiling.

3.2 INSTALLATION (CONT'D)

- .6 Place tile snugly around piping, fixtures and other items built in or passing through tile work. Form external angles with round edge tile extending over edge of square edge adjacent tile. Internal angles shall be formed square, carrying 1 flat tile past edge of other.
- .7 Drill holes for fixing accessories of other trades.
- .8 Finish surfaces flat and level or sloped and graded as required.
- .9 Provide strings, caps, coves, corners, angles and other moulded pieces to suit requirements of job. Ensure that striping and joints are in alignment.
- .10 Lay out borders and defined lines, wherever they occur, prior to setting of adjacent tiles. Keep inner edges of borders against fields or wall panels straight.
- .11 Cut tiles to conform to irregularities in wall lines and vertical planes along outer edges. Smooth cut edges with carborundum block or by other means to provide clean straight edges.
- .12 Make joints of tiles 3 mm (1/8") in width. Point joints with specified mortar or grout. Remove strings and wedges used for jointing and bracing prior to mortar or grouting.
- .13 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.
- .14 Finished tile to be clean and free of tiles which are pitted, chipped, cracked or scratched.
- .15 Apply by steel trowel level cure where required to build up existing concrete floors to elevations as noted on the Drawings or as directed by the Consultant or Owner.
- .16 Install expansion joints at maximum 20'-0" o.c. in both directions.
- .17 All floor and wall tiles to be installed with acid resistant grout and waterproof mortar.
- .18 All grouts are to match colours in Schedules on Specification. All grouts to be sealed through.
- .19 Tile setting accessory installation
 - 1. Install solid metal edge strips at unprotected exposed edges of flooring and wall tiles.
 - 2. Install in continuous lengths, to level straight lines by pressing the perforated anchoring leg of the accessory solidly into the tile setting adhesive.
 - 3. Butt ends of units tightly together with hairline joints.
 - 4. Trowel an additional layer of tile setting material over the anchored leg of the accessory prior to placement of tiles.
 - 5. Set tile flush with top of setting accessory.

3.2 **INSTALLATION (CONT'D)**

6. Leave a 3mm joint between tile and tile setting accessory for the filling of grout.
7. Install preformed corners, endcaps, and trim at changes in direction and at terminations.
8. Mitred joints are not acceptable and will be rejected.

.20 **Layout tile pattern on walls and floors such that pieces at either end are no smaller than 1/3 of a full tile.**

3.3 **INSTALLATION WATERPROOF MEMBRANE**

- .1 Installation of Waterproofing membrane "Schluter-Kerdi" at floor and wall for wet area as shown on drawings. Installation to be in accordance with the following:
 - .1 The substrate must be clean, even and load bearing. The thin-set mortar used for bounding Schluter-Kerdi must be appropriate for the substrate, and it must penetrate and engage the Kerdi-fleece. Generally, an unmodified thin-set mortar is used. Cut Schluter-Kerdi to side prior to application.
 - .2 Apply thin-set mortar to substrate using a ¼" x 3/16" (6 mm x 4 mm) V – notched trowel (Note the open time of the mortar). Press Schluter-Kerdi into the bond coat. Work the Kerdi into the mortar by applying pressure to the membrane with the flat side of the trowel in smooth, diagonal sweep. Air bubble must be avoided.
 - .3 Seams can be constructed by overlapping the edges of the KERDI 2" (5cm) using unmodified thin-set mortar.
 - .4 Waterproofing of the Assembly: prior to setting tile, wait 24 hours to allow for final set of the mortar before testing ensuring waterproof performance of the assembly at seams and connections.
 - .5 Movement Joints: This product does not eliminate the need for movement joints, including perimeter joints, within the tiled surface. Movement joints should be installed in accordance with the industry standards and norms.
 - .6 For tile installations using the thin – bed method, apply unmodified thin-set mortar directly to the exposed Schluter-Kerdi surface and install the tiles, ensuring full coverage. For acid resistant covering, use an epoxy adhesive to set and grout the tile.
 - .7 Setting & Grouting Materials: Unmodified thin – set – mortar – ANSI A118.1, Grout – ANSI A118.3, ANSI A118.6, ASNI A118.9, ANSI a118.10.
 - .8 Setting & Grouting Specifications: Tile: ANSI A108.5, Grout – ANSI A108.10.

3.4 MOVEMENT JOINTS

- .1 Install expansion and control joints in strict compliance with the TTMAC detail 301 MJ.
- .2 Keep expansion and control joints free of setting materials.
- .3 In addition to the guidelines outlined in the TTMAC Specification Guide 09 30 00, provide movement joints over cold joints, saw cuts, at columns and at wall plane changes.

3.5 CLEANING

- .1 Clean tile work progressively as work proceeds. Do not allow mortar to stain absorbent tile.
- .2 Do not use acids for cleaning unless specifically recommended by the manufacturer.
- .3 Clean tile in accordance to tile manufacturer's recommendations by procedures and products certified with the T.T.M.A.C. "Maintenance Guide".
- .4 Machine scrub unglazed tile.
- .5 Remove and replace defective, damaged, loose and unbonded tile, and point defective joints.

3.6 SEALING

- .1 Seal tiles subject to discolouration from grouts prior to grouting.
- .2 Seal tiles where recommended by manufacturer using procedures and products certified with the T.T.M.A.C.
- .3 Apply 2 coats of #3000 series sealer to unglazed floor tile after being cleaned and dried.

3.7 MAINTENANCE MATERIALS

- .1 Supply to owner min 4 boxes of each tile colour, pattern and type of material, labelled by colour and area of use.
- .2 Submit as per Specification Section 01 33 00.

END OF SECTION

DIVISION 09 - FINISHES

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Hollow Metal Doors and Frames Section 08 11 13
- .2 Gypsum Board Assemblies Section 09 21 16
- .3 Shop Priming Specified in Various Sections of the Specification
- .4 Factory Applied Paint Coatings Unless otherwise Specified
- .5 Mechanical Division 23 00 00
- .6 Electrical Division 26 00 00

1.2 SCOPE OF WORK

- .1 With exceptions specified above or specifically called for in other Sections of the Specification, all paintwork is included in the scope of this Section of the Specification. Colours will be specified at a later date by the Owner, allow for accent walls of primary colour to some areas, **maximum 12 colours.** Refer to Finish Plans & Details, Room Finish Schedule on Drawings &/or in Specification.
- .2 In locations where Drawings do not call for paint or similar finish on walls and/or ceilings, the intent of this Specification is that all wood and metal surfaces normally painted or similarly finished shall be so treated.
- .3 Paint exposed drywall and the like in locations where finish is not otherwise specified or noted. Do not paint such surfaces in mechanical shafts, unless specifically noted.
- .4 In locations where Drawings do not call for paint or similar finish on walls and/or ceilings, the intent of this Specification is that items such as new work or patched work, including miscellaneous metal work, shall be painted.
- .5 Patched work on walls or ceilings shall require a complete surface to be painted, back to a proper cut off point, i.e. corner or change in direction from floor to ceiling for walls and wall to wall for ceilings.

1.2 SCOPE OF WORK (CONT'D)

- .6 Paint all perimeter and interior walls floor to ceiling prior to the installation of equipment, millwork or other devices.
- .7 Paint new pipes, conduit, ducts and related thermal insulation and all prime painted mechanical and electrical equipment and supports located in mechanical and electrical storage and maintenance rooms in all locations where Drawings call for paint or similar finish on walls and/or ceilings.
- .8 Do not paint pipe, conduit, ducts, insulation and the like where concealed above ceilings or in service shafts.
- .9 Items exposed on the roof shall be shop painted. Refinish all new and existing H.V.A.C. units to selected colours where noted on Elevation, Plans and Schedules.
- .10 Make good paint finish on shop coated work where damaged.
- .11 Paint edges and all faces of doors where primed for paint supplied.
- .12 Paint all exposed suspension rods and hanging devices located in an exposed ceiling being painted.
- .13 Interior of ducts and diffusers visible from exterior on room side.
- .14 Repaint existing surfaces after approved preparation, includes all previously painted surfaces, i.e. walls, doors, frames, handrails, closets, etc.
- .15 Paint all exposed roof deck, steel joists, beams, conduits, sprinklers and plumbing lines and all other items in ceiling area where left exposed.

NOTE: Care is to be taken NOT to paint sensitive services/devices.

- .16 Finish all wood where exposed to view.
- .17 Paint electrical baseboard heaters/force flow units.
- .18 Paint all exposed steel columns and R.W.L./piping where not concealed.
- .19 Prepare, prime & paint concrete floors.
- .20 Prepare, prime and paint all exterior steel, concrete & masonry where shown on the Exterior Building Elevations. Refer to specific Preparation procedures noted by the Paint Companies Instructions.

1.3 REFERENCE STANDARDS

- .1 Do painting and finishing to CGSB-85-GP series standards including Appendix A and to material manufacturer's instructions and/or to Canadian Painting Contractor's Association except where specifically specified otherwise.

1.4 ENVIRONMENT

- .1 Do not commence interior painting in temperatures below 15 deg. C or when adequately controlled ventilation is not available. Do not paint exterior surfaces during cold, windy, rainy, dusty, foggy or frosty weather when temperature is likely to drop below 5 deg. C.
- .2 Test for moisture content in each location immediately before commencing application of paint. Do not apply paint on surfaces where moisture content exceeds 14%. Promptly notify Architect if such conditions are encountered.
- .3 Provide approved equipment for testing moisture content of surfaces to receive paint finishes and have available on Site at all times during Work of this Section.

1.5 SUBMITTALS

- .1 Submit triplicate samples 12" x 8" (300 mm x 200 mm) panels of each type of paint finish specified. Panels shall be of same material as that on which sample coatings are to be applied in the field where possible. Identify each sample as to job, name of paint manufacturer, finish, colour, name and number, sheen and gloss units and name of Contractor.
- .2 Submit in accordance to Section 01 33 00.

1.6 MAINTENANCE MATERIALS

- .1 Provide one sealed can, 4 litre capacity, of each product in each colour used in the Work for Owner's use in maintenance Work.
- .2 Container to be new fully labelled with manufacturer's name, type of paint, and colour.

1.7 STORAGE

- .1 Store paint and painter's materials in locations approved by the Architect.
- .2 Provide CO2 fire extinguisher minimum 20 lbs. (9 kg.) capacity in paint storage area.

1.8 SIGNS

- .1 Provide legible signs throughout the Work reading "WET PAINT" in prominent positions during painting and while paint is drying.
- .2 Use 75 mm (3 inch) high letters on white card or board.

1.9 TEMPORARY COVERS AND PROTECTION

- .1 Protect floors and other surfaces with temporary covers such as dust sheets, polyethylene film or tarpaulins. All to Architect's approval.
- .2 Mask identification plates occurring on equipment, switch boxes, and fire rating labels, etc. which require painting.
- .3 Protect, remove and replace hardware, accessories, lighting fixtures, and similar items as required except primed for paint door closures which shall be painted. Light switches and electrical communication outlet plates to be removed and reinstalled on completion of paint application.
4. Keep oily rags, waste and other similar combustible materials in closed metal containers; take every precaution to avoid spontaneous combustion, remove waste and combustible materials daily.
- .5 Clean surfaces soiled by spillage of paint, paint spattering and the like. If such cleaning operations damage the surface, repair and replace damaged work at no cost to the Owner.

1.10 RETOUCHING

- .1 Do all retouching, etc. to ensure that the building may be handed over to the Owner in perfect condition, free of spatter, fingerprints, rust, watermarks, scratches, blemishes of other disfiguration.
- .2 After fully decorating and retouching a room or other area, notify Architect. After inspection and final approval by Architect post sign 'DECORATING COMPLETE - NO ADMITTANCE WITHOUT PERMISSION'.

1.11 TEST AREA

- .1 A room or area in the building will be designated by the Architect as a test area to establish standard of workmanship, texture, gloss and coverage.
- .2 Prior to any painting being started, request a meeting between Architect, Contractor, Subcontractor and Material Manufacturer's Representative to review conditions, surfaces, anticipated problems and to clarify quality of workmanship acceptable to Architect.
- .3 Apply finishes to each type of surface within room with correct material, coats, colour, texture and degree of gloss in sample area and have same approved prior to providing Work of this Section.
- .4 Retain test area until after completion of Work. Test area to be minimum standard for the Work.

1.11 TEST AREA (CONT'D)

- .5 Failure to comply with the above will be cause for Architect to request all Work previously painted to be repainted.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint and finishing materials - highest grade, Acrylic Latex, stain resistance, easy to clean, first line quality provided by manufacturer who agrees to provide supervision service during painting operations. The following manufacturers are acceptable:

- .1 Benjamin Moore Company
- .2 Glidden Company, Division of S.C.C. (Canada) Ltd.
- .3 Para Paints Ltd.
- .4 Pratt & Lambert Inc.
- .5 Pittsburgh Paint
- .6 Sherwin Williams
- .7 Dulux

Or other approved manufacturer providing inspection service and proving same prior to bidding.

- .2 Paint Gloss Rating Description: Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following gloss level categories, as defined in the MPI Architectural Specification Manual:

- .1 Gloss Level G1: Matte or Flat Finish.
- .2 Gloss Level G2: Velvet Finish.
- .3 Gloss Level G3: Eggshell Finish.
- .4 Gloss Level G4: Satin Finish.
- .5 Gloss Level G5: Sem-Gloss Finish.
- .6 Gloss Level G6: Gloss Finish.
- .7 Gloss Level G7: High Gloss Finish.

2.1 **MATERIALS (CONT'D)**

- .3 Paints, enamels, fillers, primers, varnishes and stains- ready mixed products of one of the manufacturers listed herein. Substitutes will not be allowed.
- .4 Thinners, cleaners - type and brand recommended by the paint manufacturer.
- .5 Only products manufactured by paint manufacturer stated at time of submission of samples will be allowed on Site unless other materials specifically specified herein. No painting to be performed until paint manufacturer identified and acceptance received from the Architect.
- .6 Deliver materials to Site in original unbroken containers bearing brand and maker's name. The presence of any unauthorized material or containers for such, on Site shall be of sufficient cause for rejection of ALL paint materials on Site at that time.

PART 3 - EXECUTION

3.1 **GENERAL PREPARATION OF SURFACES**

NOTE: ALL NOTED SURFACES MAY NOT BE APPLICABLE TO THIS PROJECT.

- .1 Prepare surfaces in accordance with the following standards unless otherwise specified:
 - .1 Prepare wood surfaces to MPI Architectural Paint Specification Manual and Approved Product List as standards of reference for vinyl sealer over knots and resinous areas, wood paste filler for nail holes. Tint filler to match for stained woodwork.
 - .2 Touch up damaged spots of shop paint primer on steel MPI # 79 Primer, Alkyd Anti-Corrosion and MPI Architectural Paint Specification Manual Surface Preparation.
 - .3 Prepare galvanized steel and zinc coated surfaces to CGSB 85-GP-16. This includes wiped coated steel surfaces. Use top finish coat manufacturers recommended products and procedures for preparation.
 - .4 Prepare masonry and concrete surfaces to CGSB 85-GP-31. Refer to MPI Architectural Paint Specification Manual Surface Preparation and the Paint Manufacturers Recommended Instructions.
 - .5 Prepare wallboard surfaces to CGSB 85-GP-33. Fill minor cracks with plaster patching compound. Refer to MPI Architectural Paint Specification Manual Surface Preparation.
 - .6 Prepare concrete floors to CGSB 85-GP-32. Refer to MPI Architectural Paint Specification Manual Surface Preparation.

3.1 PREPARATION OF SURFACES (CONT'D)

- .7 Prepare copper piping and accessories to CGSB 85-GP-20. Refer to MPI Architectural Paint Specification Manual Surface Preparation.
- .8 Apply prime coat on wood scheduled for paint finish before installation.
- .9 Back prime wood scheduled for transparent finish. Do not prime surfaces scheduled for transparent finish.
- .10 The basic standards for preparing metal substrates and cleaning shall be to the Society for Protective Coatings (SSPC) and the National Association of Corrosion Engineers International (NACE) Standards SP1 to SP14, and as per the Manufacturers recommendations.

3.2 APPLICATION

- .1 In accordance with manufacturer's printed instructions and manufacturers Site representative.
- .2 With suitable, clean equipment in good condition.
- .3 Clean all structure, services, ducts, diffusers, destratification fans, prior to painting. Do not paint any dirty surface.
- .4 In dust-free suitable conditions on the surfaces free from machine, tool or sandpaper marks, insects, grease, or any other condition liable to impair finished work to prevent production or good results.
- .5 Even, uniform in sheen, colour and texture, free from brush or roller marks, well brushed or rolled in and free of crawls, runs, join marks or other defects.
- .6 Painting coats are intended to cover surfaces perfectly; if in painter's opinion, formula specified is inadequate to provide a first class finished surface, report to the Architect before commencing work. Surfaces imperfectly covered shall receive additional coats at no additional cost.
- .7 Use paint unadulterated. Use same brand of paint for primer, intermediate and finish coats. Factory mix all paints.
- .8 Paint finish shall be applied by roller except in the case of wood trim, door frames, base board and similar work of small surface area which shall be painted by brush. Do not use roller for applying finish other than paint.

3.2 APPLICATION (CONT'D)

- .9 Spray painting will not be permitted unless specifically approved in writing by the Architect in each instance. Architect may withdraw approval at any time and prohibit spray painting for reasons such as carelessness, poor masking or protection measures drifting paint fog, disturbance to other Trades or failure to obtain a dense, even, opaque finish. Spray painting shall be full double coat, i.e. at least two passes for each coat. Do not use spray or roller on wood or metal surfaces, brush only unless approved in writing by Architect.
- .10 Finish edges of doors with paint or stain treatment as required to match face of door. Seal hidden edges of wood doors with one coat of shellac and one coat gloss varnish or two coats paint. Repaint tops and edges of wood doors after fitting.
- .11 Even up stained woodwork in colour as required by nature of wood and as directed by Architect. Apply same finish on trim, fitments, cupboards and other protecting ledges as on surrounding work, disregard sight lines.
- .12 Carefully hand smooth and sandpaper wood between coats (including priming). Apply one coat sealer before applying first coat print filler to knots or sap blemishes on wood surfaces to receive paint or stain finish.
- .13 Remove rust, oil, grease and loose shop paint from metal work by brushing or with wire brushes and make good shop coat before proceeding with final finish. Feather out edges to make touch up patches inconspicuous.
- .14 After first coat, fill nail holes, splits and scratches, using putty coloured to match finish.
- .15 Clean castings with wire brush before application of first paint coat.
- .16 Clean galvanized metal surfaces thoroughly with xylol. Do not etch galvanized metal. Use zinc rich primer. This includes metal door frames and the like with wiped zinc coating.
- .17 Remove form oil or parting compounds from concrete surfaces. Use Xylol or approved compound.
- .18 Paint interior of pipe spaces, ducts, etc. visible through grilles or through linear metal ceilings in black matt finish.
- .19 Conform with Architect's colour schedule and exactly match approved samples.
- .20 Mechanical and Electrical Pipes, Ducts and Conduits:
 - .1 Commence Work when piping installation complete in the area concerned.
 - .2 Do not paint plated or other pre-finished surfaces, unless otherwise noted.
 - .3 Paint conduit in same colour as background paint.

3.2 **APPLICATION (CONT'D)**

- .4 Apply formula specified even though surface prime painted at shop prior to delivery. Touch up shop priming where damaged.
- .5 Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65 degrees C.
- .6 Paint exposed pipes and ducts and their supports and related items in colours to suit colour coding adopted by Owner, to Architect's later instructions. Refer to Mechanical Division 20 for further instructions.
- .21 During the application of paint to the underside of exposed steel deck, structure and mechanical and electrical components this contractor is to ensure the provision of adequate lighting to enable a consistent, even and thorough coating.

3.3 **REPAIRS**

- .1 Cracks occurring in walls or ceilings requiring patching during "Warranty Period" shall be repainted in such a way that the patch is not visible at a distance of 3'-0".
- .2 If patch painting is not acceptable, repaint entire wall, or ceiling.
- .3 Patch and make good existing damaged masonry surfaces: Provide smooth, brush grade patching compound for cracks in masonry. Spot Prime: WL700GLSB - Masonry Patch And Seal Brush-Grade, Smooth.

3.4 **FORMULAE**

- .1 The finish called for is eggshell, semi-gloss or gloss may be ordered for specific applications at no additional charge. On drywall eggshell shall be mixed with flat to provide low sheen to hide imperfections to Architect's approval or method agreed between Architect and material manufacturer's representative.

- .2 **INTERIOR WORK**

Drywall

- 1 Coat Latex primer
- 2 Coats Latex paint (where paint noted).
Gloss Level 2 (Velvet)
Gloss Level 3 (Eggshell)
Gloss Level 5 (Semi-Gloss)

Prime all walls whether paint scheduled at this time or not.

3.4 FORMULAE (CONT'D)

Concrete Block	1	Coat block filler. Apply at maximum coverage of 80 sq.ft. per gallon
	2	Coats Latex paint. Gloss Level 2 (Velvet) Gloss Level 3 (Eggshell) Gloss Level 5 (Semi-Gloss)
Cast-In-Place Concrete (not floors)	1	Coat alkali resistant primer.
	2	Coats Latex paint Gloss Level 2 (Velvet) Gloss Level 3 (Eggshell) Gloss Level 5 (Semi-Gloss)
Concrete Floors (Epoxy Finish)	1	Abrade surface to grit 60 roughness
	1	Coat application Amerlock-2 high performance epoxy coating
Concrete Floors (Enamel Paint Finish)	2	Coat application
Woodwork (Opaque Finish)	1	Coat wood primer
	2	Coats Latex trim enamel Gloss Level 5 (Semi-Gloss)
Woodwork (Natural Finish)	1	Coat paste-filler
	3 2	Coats varnish Coats varnish satin finish
Ferrous Metal	1	Coat metal primer
	2	Coats enamel
Shop Primed Ferrous Metal	2	Touch-up prime coat where damaged Coats enamel

3.4 **FORMULAE (CONT'D)**

Galvanized Metal	1	Coat zinc rich primer to touch up galvanized only
	1	Coat galvanized iron primer
	2	Coats enamel

Insulation on Pipes & Ducts	1	Coat standard latex primer/ sealer – reference
	2	Coat enamel

Mechanical Equipment	1	Coat alkyd enamel undercoat
	1	Coat enamel

Piping, conduit & ductwork (uncoated)	1	Coat metal primer
	1	Coat enamel, gloss

PVC primer for pipes	1	Primer: .09403429 - UMA BRAND WH 3.78L
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Surfaces behind grilles	2	Coats vinyl latex matt within 12" of grille black
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NOTE: Use heat resistant paint where required.

.3 **EXTERIOR WORK**

Concrete Block	1	Coat block filler. Apply at maximum coverage of 80 sq.ft. per gallon.
	2	Coats Latex paint. Latex - Gloss Level 1 (Flat) Gloss Level 3/4 (Low Sheen) Gloss Level 5 (Semi-Gloss)

Galvanized Steel	1	Coat zinc rich primer to touch up zinc coat only
	1	Coat Galvanized iron primer

DIVISION 10 - SPECIALITIES

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 DESCRIPTION

- .1 Work Included: To complete special items as shown or specified and summarized but not restricted to:
 - .1 Room Signage.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Gypsum Board Section 09 21 16
- .2 Painting - Finish painting Section 09 91 00

1.3 QUALITY ASSURANCE

- .1 Reference Standards: Reference standards quoted in this Section refer to:
 - .1 ASTM A525-75, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
 - .2 CGSB Specification 1-GP-109998C, Paint, Acid and Alkali Resistant Black.
 - .3 CGSB Specification 1-GP-121M, Coating, Vinyl, Pretreatment, for Metals (Vinyl Wash Primer).
- CSA Standard G164-9165, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.4 SUBMITTALS

- .1 Submit shop drawings, samples and maintenance instructions for Work of this Section as specified for each specialty product.
- .2 Submit in accordance with specification Section 01 33 00.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Package or crate, and brace products to prevent distortion in shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING (CONT'D)

- .2 Deliver products to location at building site designated by Contractor.

PART 2 - PRODUCTS

2.1 SPECIALTY PRODUCTS

- .1 Provide reinforcing, fastenings and anchorage required for building in of products.
- .2 Insulate between dissimilar metals, and metal and masonry materials to prevent electrolysis, with bituminous paint.
- .3 Prime Paint on Steel:

For finishing under Work of other Sections shall meet specifications 1-GP-40M for oil alkyd type structural steel primer, 1-GP-48 for steel marine primer, 1-GP-121 for vinyl wash primer, or 1-GP-132 for zinc chromate primer as applicable for specified finish treatments.
- .4 Specified materials are minimum acceptable quality. Manufacturer's standards exceeding specified quality will be accepted.

2.2 LIST AND DESCRIPTION OF PRODUCTS

- .1 **Interior Room Signage**
- .1 Coordinate with the Owner's Project Manger to confirm all signage, type and locations.
- .2 Refer to Allowances Section 01 21 00.

PART 3 – EXECUTION

3.1 PREPARATION

- .1 Verify substrate surfaces are solid, free from surface water, dust, oil, grease, projections and other foreign matter detrimental to performance.
- .2 Items to be built-in: Provide 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.
- .3 Verify there is adequate supports and/or blocking in gypsum wall assemblies prior to installation of wall mounting items.

3.2 INSTALLATION: GENERAL

- .1 Install miscellaneous specialties level and securely and rigidly anchored to substrate in accordance with authorities having jurisdiction, reviewed shop drawings, and manufacturer's written instructions.
- .2 Isolate dissimilar metals and metal to concrete or masonry with 2 coats of bituminous paint.
- .3 After installation, adjust miscellaneous specialties in accordance with manufacturer's written instructions.
- .4 Install items plumb, straight and level to a tolerance of 1:500.
- .5 Securely fix items in place with concealed fasteners.

3.3 ADJUSTMENT AND CLEANING

- .1 Verify under Work of this Section 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. Refinish work at site only if approved.

END OF SECTION

PART 1 – GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 SECTION INCLUDES

- .1 Toilet partitions & Shower doors.
- .2 Hardware for toilet partitions.

1.2 RELATED SECTIONS

- .1 Washroom Accessories Section 10 28 00

1.3 REFERENCES

- .1 ASTM-A167-96, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 CAN/CSA-B651-95, Barrier-Free Design.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01300 – Submittals.
- .2 Submit colour samples of panel material for selection by the Consultant.
- .3 Submit duplicate 300mm by 300mm samples of panel in colour selected.
- .4 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.

1.5 SHOP DRAWINGS

- .1 Submit Shop Drawings in accordance with Section 01300 – Submittals.
- .2 Indicate fabrication details, plans, elevations, hardware, and installation details.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for composite panels for incorporation into manual specified in Section 01721 – Project Record Documents.

1.7 STORAGE AND PROTECTION

- .1 Protect finished composite panel surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

1.8 QUALITY CONTROL

- .1 The toilet partition Subcontractor shall be an approved installer of the toilet partition manufacturer's products and shall have a minimum of five years proven experience of satisfactory installation of comparable structures.
- .2 Installation shall be by competent tradesman under the full-time experienced supervision of the toilet partition Subcontractor.

PART 2 – PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- .1 Base Bid: Water and fire resistant, solid colour reinforced composite toilet partitions for overhead braced installation with vandal-resistant, extra heavy duty institutional hardware. Bobrick Washroom Equipment of Canada Ltd. – Duraline Series 1080/1180.

2.2 MATERIALS

- .1 Solid Phenolic Composite Toilet Partitions:
 - .1 Constructed of solid colour reinforced composite material composed of dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - .2 Surfaces shall be non-ghosting, graffiti-resistant, integrally bonded to core.
 - .3 Material shall be same solid surface colour throughout.
- .2 Stainless Steel Sheet Metal: to ASTM-A167, Type 304 with satin finish.
- .3 Headrails: Stainless steel, anti grip design.
- .4 Pilaster Shoe: stainless steel.
- .5 Attachment: stainless steel tamper proof type screws and bolts.
- .6 Colour to be chosen from Manufacturer's complete range of colours.

2.3 COMPONENTS

- .1 Hinges:
 - .1 Heavy duty, continuous full length.

2.3 **COMPONENTS (CONT'D)**

- .2 Material/finish: 1.6mm stainless steel.
- .3 Swing: as shown on drawings.
- .4 Return movement: gravity.
- .5 Adjustable to hold door open at any angle up to 90 degrees.
- .6 Adjustable door-open angle.
- .7 Emergency access feature
- .8 3 per door

- .2 Latch Set: surface mounted, combination latch, door-stop, keeper and bumper, stainless steel.
- .3 Wall and Connecting Brackets: 1.2mm full height stainless steel extrusion or casting.
- .4 Door stops: anodized aluminum with vandal proof rubber inserts, 2 per door.
- .5 Door Pull: Barrier-free type suited for out swinging doors, stainless steel.
- .6 Surface-Mounted Door Bumper: stainless steel and nylon base and post with black neoprene bumper, wall mounted where door opens against wall. Bobrick Washroom Equipment of Canada Ltd.: B-6877.
- .7 Fasteners: stainless steel tamperproof type screws and bolts.
- .8 Do Not provide any coat hooks in washroom or toilet partitions.

2.4 **FABRICATION**

- .1 Doors , panels, Stiles: 19mm thick, solid composite panels, to sizes indicated, 1473 high.
- .2 Pilasters: 19 mm thick, constructed same as door, custom size to 2200 mm high.

PART 3- EXECUTION

3.1 **INSTALLATION**

- .1 Ensure supplementary anchorage, if required, is in place.
- .2 Do work in accordance with CAN/CSA-B651 and all applicable regulations.

3.2 ERECTION

.1 Partition Erection:

- .1 Install partitions secure, plumb and square.
- .2 Leave maximum 12mm space between wall and panel or end pilaster.
- .3 Anchor mounting brackets to masonry or concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes.
- .4 Attach panel and stile to brackets with through type sleeve bolt and nut.
- .5 Provide for adjustment of floor variations with screw jack through steel saddles made integral with pilaster. Conceal floor fixings with stainless steel shoes.
- .6 Equip each door with hinges, and latch set. Do not install coat hooks. Adjust and align hardware for proper function. Set door open position at 30° to front. Install door bumper.
- .7 Coat hooks in barrier-free stalls shall be mounted on the side wall at maximum 1200mm above the floor and shall project no more than 50mm.
- .8 Equip out swinging doors with door pulls on outside of door.
- .9 Install hardware for grab bars mounted on toilet partitions.

.2 Floor Supported and Overhead Braced Partition Erection:

- .1 Attach stiles to floor with stile supports and level, plumb, and tighten installation with leveling device.
- .2 Secure stile shoes in position.
- .3 Secure headrail to stile face with not less than two fasteners per face.
- .4 Set tops of doors parallel with overhead brace when doors are in closed position.

3.3 ADJUSTMENT

- .1 Upon completion of the work or when directed to do so, removal all traces of protective coating or paper from toilet partition surfaces.
- .2 Clean exposed surfaces and fittings.
- .3 Test hinges, locks, and latches and, where necessary, adjust and lubricate.

3.3 ADJUSTMENT (CONT'D)

- .4 Ensure that partitions are will secured, stable and solid and that spaces at door perimeter, between panels and stiles, between panels and walls, and between stiles and walls are of a uniform and consistent width and of a minimal size to ensure it is not possible to see persons using the stalls.

END OF SECTION

DIVISION 10 - SPECIALITIES

PART 1 - GENERAL

1.0 CONTRACT DOCUMENTS

- .1 The Instructions to Bidders, the General Conditions of CCDC 2 - 2020, Supplementary Conditions and all Sections of Division 01 apply to and form part of this section of the specification.

1.1 WORK INCLUDED

- .1 Toilet and washroom accessories.
- .2 Attachment hardware.

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- .1 Furnish backing plate reinforcement to Section 06 10 00 wood blocking for installation.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Wood: In wall framing for support of accessories. Section 06 10 00
- .2 Glazing (Mirrors) Section 08 80 00
- .3 Gypsum Board System: Section 09 21 16
- .4 Mechanical Division 21- 23
- .5 Electrical Division 25- 28

1.4 REFERENCES

- .1 ASTM A366 - Steel, Carbon, Sheet, Commercial Quality.
- .2 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .3 ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .4 ASTM B456 - Electro-deposited Coatings of Nickel/Chromium.
- .5 CSA G164M - Hot Dip Galvanizing of Irregularly Shaped Articles.

1.5 REGULATORY REQUIREMENTS

- .1 Conform to Ontario Building Code for installation work in conformance with Barrier Free Access.

1.7 PRODUCT DATA

- .1 Submit product data to requirements of Section 01 33 00.
- .2 Provide product data on accessories describing size, finish, details of function, attachment methods.

1.8 INSTALLATION INSTRUCTIONS

- .1 Submit manufacturer's installation instructions to requirements of Section 01 33 00.

1.9 CO-ORDINATION

- .1 Co-ordinate work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- .1 Acceptable manufacturers as noted on drawings or approved alternate:
- .1 Frost
 - .2 Watrous
 - .3 Bobrick
 - .4 Or Approved Alternate

2.2 MATERIALS

- .1 Sheet Steel: ASTM A366.
- .2 Stainless Steel Sheet: ASTM A167, Type 304.
- .3 Tubing: ASTM A269, stainless steel.
- .4 Fasteners, Screws, and Bolts: Hot dip galvanized tamper-proof, security type.
- .5 Expansion Shields: Fibre, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

- .1 Weld and grind smooth, joints of fabricated components.
- .2 Form exposed surfaces from single sheet of stock, free of joints.
- .3 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .4 Back paint components where contact is made with building finishes to prevent electrolysis.
- .5 Shop assemble components and package complete with anchor components for installation.
- .6 Provide steel anchor plates, adapters, and anchor components for installation.
- .7 Hot dip galvanize exposed and painted ferrous metal and fastening devices.

2.4 FINISHES

- .1 Galvanizing: CSA G164 to 380 g/sq m.

2.4 **FINISHES (CONT'D)**

- .2 Shop Primed Ferrous Metals: Pre-treat and clean, spray apply one coat primer and bake.
- .3 Enamel: Pre-treat to clean condition, apply one coat primer and minimum two coats epoxy electrostatic baked enamel.
- .4 Chrome/Nickel Plating: ASTM B456, Type SC2 Satin finish.
- .5 Stainless Steel: No. 4 satin lustre finish.

PART 3 - EXECUTION

3.1 **INSPECTION**

- .1 Verify the site conditions are ready to receive work and dimensions are as indicated on shop drawings instructed by the manufacturer.
- .2 Beginning of installation means acceptance of existing conditions substrate.

3.2 **PREPARATION**

- .1 Verify the side conditions are ready to receive work and dimensions are as indicated on shop drawings instructed by the manufacturer.
- .2 Deliver inserts and rough-in frames to site at appropriate time for building-in.
- .3 Provide templates and rough-in measurements as required.

3.3 **INSTALLATION**

- * .1 Verify exact location of accessories before installation.
- .2 Install fixtures, accessories and items in accordance with manufacturers' instruction.
- .3 Install plumb and level, securely and rigidly anchored to substrate.

3.4 **SCHEDULE**

- .1 Universal Washroom Accessories - All accessories will be stainless steel finish.
 - .1 Grab bars. Equal to:
 - .1 24" horizontal Grab Bars: Bobrick B-5806x24.99 (peened finish).
 - .2 30" Horizontal Grab Bars: Bobrick B-5806x30.99 (peened finish).
 - .3 Fold down Grab bar: Bobrick B-4998.99.
 - .4 30"x30" 'L' Shaped Grab Bars: Bobrick B-5898.99 (peened finish).
 - .1 Soap Dispenser: Supplied By Owner
 - .2 Paper Towel Dispenser: Supplied by Owner

3.4

SCHEDULE (CONT'D)

- .3 Toilet Paper Dispenser: Supplied by Owner.
- .4 Washroom signage will be supplied under Cash Allowance and installed by the General Contractor.
- .5 Stainless Steel framed Mirror (Tilt Mirrors for B.F. Washroom). 1 per basin 18" x 36", equal to Bobrick B-293-1836 & B290 - 1836.
- .6 Wall mounted vandal resistant hook: Bobrick B-983
- .7 Sanitary Napkin Disposal: Surface mounted sanitary napkin disposal unit: Model 620 by Frost.
- .8 Stainless Steel Surface Mounted Waste Receptacle: Model 326 by Frost.
- .9 Stainless Steel Shelf: Bobrick B-295 x 16".
- .10 Emergency call station. Refer to Electrical Drawings.
- .11 Emergency Sign:
 - .1 Emergency Sign: sign to contain the words "In the event of an emergency push emergency button and audible and visual signal will activate" in a Letters At Least 25 Mm High With 5 Mm Stroke. To Be Posted Above the Emergency Button.
 - .2 Refer to door schedule as this is part of the Camden Control Kit.
- .12 Electric Hand Dryer: Supplied by G.C., Refer to Electrical Drawings for Details.

PART 1 - GENERAL

1.1. GENERAL

- 1.1.1 This specification defines the general requirements and procedures for submittals. A submittal is information submitted for the Consultant's review to establish compliance with the contract documents.
- 1.1.2 Detailed submittal requirements are found in the technical sections of the contract specifications. The Consultant may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the Client
- 1.1.3 Consultant review of a submittal does not relieve the Contractor of the responsibility for compliance with the contract documents or any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

- 1.2.1 Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.
- 1.2.2 Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.
- 1.2.3 Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.
- 1.2.4 Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.
- 1.2.5 Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- 1.2.6 Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.
- 1.2.7 Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and SDS concerning impedances, hazards, and safety precautions.

- 1.2.8 Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.
- 1.2.9 Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.
- 1.2.10 Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Operation and Maintenance manuals, as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

- 1.3.1 The submittal register prepared by the Contractor will list items of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.
- 1.3.2 The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.
- 1.3.3 The Contractor shall provide the initial submittal register in electronic format. Thereafter, the Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Consultant.
- 1.3.4 The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Client representative.
- 1.3.5 The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMISSION PROCEDURES – SHOP DRAWINGS

- 1.4.1. The contractor shall review all shop drawings before submittal to the Consultant. This review implies that the Contractor has determined or will determine measurements and has verified or will verify on the site, the construction criteria, materials, catalog numbers and similar data, and that he has reviewed and coordinated each shop drawing with the Contractual Documents and Specifications.
- 1.4.2. Submit shop drawings to the Consultant within reasonable delays and in a logical sequence in compliance with the construction schedule.
- 1.4.3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements.

Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals.

1.4.4. Submission Preparation

- 1.4.4.1. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.
- 1.4.4.2. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.
- 1.4.4.3. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned with review.
- 1.4.4.4. Forward submittals in sufficient time to permit proper consideration and approval action by the Consultant; minimum time required for Consultant's review shall be 10 business days or longer, if the submitted equipment does not match the standard of acceptance and additional time is required for the evaluation.
- 1.4.4.5. Schedule submission to assure adequate lead time for procurement of contract required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1.4.4.6. The Consultant's review consists in reviewing the conformity of shop drawings with the contract documents for recommendation to the Client or Owner. The Consultant is not liable for any responsibility for dimensions, details nor quantities.
- 1.4.4.7. After an item has been reviewed by the Consultant no change in brand or make will be permitted unless:
 - 1.4.4.7.1. Satisfactory written evidence is presented to, and positively reviewed by the Consultant, that manufacturer cannot make scheduled delivery of approved item or;
 - 1.4.4.7.2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - 1.4.4.7.3. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Client.
- 1.4.5. If the Contractor installs equipment or material for which he has not submitted shop drawings for verification, the Consultant may, if the equipment or material is not installed in accordance with plans and specifications, require the equipment or material to be removed and replaced by a compliant product at no additional cost to the Client

- 1.4.6. Shop drawings relating to products, special design systems or installations, custom equipment or similar to, all of which are not standard or catalogued products, will be considered engineering documents and as such, shall be authenticated by their author engineer. Authentication shall be in conformity with current Province of Ontario Laws and By-Laws. As an example, not limited to, shop drawings of a custom air-handling unit are covered by the present article and as such, constitute engineering documents that will require an authentication by their author engineer.
- 1.4.7. When shop drawings are resubmitted, indicate in writing all revisions other than those required by the Consultant.
- 1.4.8. Submit for review by the Consultant, within reasonable delays of the contract award, the complete set of shop drawings required. Faxed shop drawings are not accepted.
- 1.4.9. Shop drawings shall be submitted in electronic format. The following rules must be followed entirely:
 - 1.4.9.1. The identification form must be included;
 - 1.4.9.2. A shop drawing identification sheet hereby mentioned shall be included;
 - 1.4.9.3. A single file in PDF format for each shop drawing shall be submitted. In the case where more than one document constitute the drawing, they must all be incorporated into a single file;
 - 1.4.9.4. Printing parameters of the drawings must be incorporated in the file to assure a scaled printing on a commercial printer;
 - 1.4.9.5. The file must be of an excellent graphical quality;
 - 1.4.9.6. Transmission of the shop drawings must follow the path of communication established for the project;
 - 1.4.9.7. A transmittal sheet shall be attached to submitted drawings.
- 1.4.10. Shop drawings not following these directives will be returned to the contractor with a "Rejected" recommendation.
- 1.4.11. Each shop drawing shall be presented with an identification form. The shop drawing identification sheet shall include as a minimum the following information:
 - 1.4.11.1. Owner's name
 - 1.4.11.2. Project's name
 - 1.4.11.3. Consultant's name
 - 1.4.11.4. Contractor's name
 - 1.4.11.5. Name of sender
 - 1.4.11.6. Sub contractor's name
 - 1.4.11.7. Supplier's name
 - 1.4.11.8. Specialty
 - 1.4.11.9. Description
 - 1.4.11.10. Specifications section number and article number
 - 1.4.11.11. Revision number
 - 1.4.11.12. Blank space for stamp of Conformity Review.

- 1.4.12. Submit all shop drawings in English, certified for construction by the manufacturer.
- 1.4.13. Drawings for non-standard articles or materials shall be produced, especially for the project.
- 1.4.14. Shop drawings shall include:
- 1.4.14.1. Construction details, dimensions, weights and equipment or material characteristics together with supplementary information such as bulletins, illustrations and exploded views of constituting parts.
 - 1.4.14.2. Graphs, curves, capacities, efficiency and other technical data submitted by the manufacturer or requested by the Engineer concerning the operation of the equipment.
 - 1.4.14.3. Wiring diagrams, single line diagrams, principle diagrams, control diagrams, operating sequences and all interconnections with other systems when required.
 - 1.4.14.4. Flow diagrams for air, water, oil, fuel, etc. if applicable.
 - 1.4.14.5. Marketing folders or publicity brochures will not be accepted.
- 1.4.15. Shop drawings will be returned with one or two of the following mentions: "Reviewed", "Modify and resubmit", "Modify as noted", "Rejected".
- 1.4.16. Drawings stamped "Reviewed" will not be further commented. Drawings comply with contractual documents.
- 1.4.17. Drawings stamped "Rejected" shall be done over again and resubmitted for approval. Drawings do not comply with contractual documents.
- 1.4.18. Drawings stamped "Modify as noted" shall not be resubmitted. Conditionally to the corrections indicated, drawings comply with contractual documents.
- 1.4.19. Drawings stamped "Modify and resubmit" shall be resubmitted, in part or in whole, as indicated for further examination. Drawings do not comply with contractual documents.
- 1.4.20. Drawings stamped "Modify as noted" and "Modify and resubmit" shall be resubmitted in part or in whole, as indicated, for further examination. Conditionally to the corrections indicated, drawings comply with contractual documents.
- 1.4.21. The Consultant's examination of the shop drawings does not relieve the Contractor from supplying equipment conforming to current standards and bylaws and to the requirements of this specification.
- 1.4.22. Any equipment, which is manufactured without the Engineer's prior examination, may be rejected. Assume all costs inherent to such a rejection.

1.5. SUBMISSION SCHEDULING

- 1.5.1. Submittals are to be scheduled, submitted, reviewed, and returned to the Contractor prior to the acquisition of the material or equipment. All comments marked by the Consultant shall be incorporated in the item for which a submission was made. No material or equipment shall be acquisitioned if the respective submissions was reviewed and rejected by the Consultant
- 1.5.2. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential re-submittal.
- 1.5.3. No delay costs or time extensions will be allowed for time lost in late submittals or re-submittals.
- 1.5.4. All submittals are required to be reviewed prior to the start of the specified work activity.

1.5 AS BUILT DOCUMENTATION

- 1.5.5. During progress of the Work, Contractor shall maintain a set of Record Documents and Shop Drawings at the Site. Contractor must update these documents weekly, at a minimum, with mark-ups of actual installations that vary from the Work as originally shown. Contractor shall include all Drawings issued as addenda, clarifications, or Change Orders.
- 1.5.6. Contractor shall maintain and have available for review in conjunction with project progress meetings, a current set of the marked-up Record Documents and Shop Drawings. Availability for review and acceptability of both the format and content are prerequisites for certification and acceptance of the Application for Payment by the Client and Consultant.
- 1.5.7. Contractor must protect marked-up Record Documents from deterioration and loss in a secure location.

1.6 RECORD DOCUMENTS EDIT LOG

- 1.5.8. During progress of the Work, Contractor shall update the Record Documents Edit Log each time updates or edits are made, or information is added. The Record Documents Edit Log shall be submitted to the Consultant and Client prior to submitting each monthly Application for Payment.
- 1.5.9. The Record Documents Edit Log shall include the following information as a minimum:
- 1.5.9.1. Date Edited.
 - 1.5.9.2. Name and Company of Person Making Edit.
 - 1.5.9.3. Edit Type: RFI, Change Order/Request for Proposal, Field Change, Red Line,
 - 1.5.9.4. Supplemental Document, and Revision/ASI.
 - 1.5.9.5. Reference: name and number of the source document if applicable, such as Change Order
 - 1.5.9.6. or RFI number.
 - 1.5.9.7. Sheet(s) Edited.

1.7 AS-BUILT DRAWINGS

- 1.5.10. Contractor must mark-up Drawings that are most compatible for showing actual physical condition, fully and accurately and must reference all other appearances of this Work to the updated sheet. Contractor must include cross-references to the Change Order number on the updated Drawing sheet and all additional sheets where the Work is shown.
- 1.5.11. Contractor must mark-up with erasable colored pencil, in a legible and professional manner using separate colors where feasible, to distinguish between changes for different categories of Work at the same general location.
- 1.5.12. Contractor must mark-up important additional information, which was either shown schematically only or omitted from the Construction Documents. Contractor must give particular attention to information on concealed work that would be difficult to identify or measure and record at a later date.
- 1.5.13. The contractor shall receive from the Consultant a set of electronic files of the project, with the engineering seal, stamp, signature and Consultant's logo removed.
- 1.5.14. The contractor shall use the files as backgrounds on which all the changes recorded during the construction phase shall be transcribed electronically.
- 1.5.15. Once all the changes have been transcribed on the backgrounds, the drawings shall be electronically stamped "AS BUILT DRAWINGS" and shall be converted to pdf format and submitted to the Consultant for review. The Contractor remains responsible for the accuracy of the recorded information.

- 1.5.16. In association with Contractor's request for Substantial Completion inspection, Contractor must submit one (1) electronic copy of the marked-up as-built drawings to Client's representative.

1.8 RECORD SPECIFICATIONS

- 1.8.1. It is mandatory that all changes to specified materials, installation, warranty, etc. be clearly and fully marked within the applicable Specification section in a manner acceptable to the Consultant and Client. Contractor shall review with the Owner and document an acceptable procedure early in the construction phase.
- 1.8.2. Contractor must give particular attention to substitutions, selection of options, and similar information on work where the exact products used are not clearly identified or readily discernible in the original Specifications. When applicable, Contractor must cross-reference related Record Drawing information and product data.
- 1.8.3. Contractor must neatly transcribe and post all marked-up information to a "clean" copy of the Specifications, ensuring that similar types of information are annotated in like fashion throughout the Specifications. The Record Specifications shall then be converted to pdf format and submitted to the Consultant for review. The Contractor remains responsible for the accuracy of Record Specifications content. .
- 1.8.4. In association with Contractor's request for Substantial Completion inspection, Contractor must submit the electronic version (pdf) of the Record Specifications to the Client representative.

1.9. OPERATION AND MAINTENANCE MANUALS

- 1.9.1. Submit operations and maintenance and operation data for all required equipment min. 15 days before application for Substantial Completion of the work. Substantial Completion status for the work will not be granted in the absence of full Operations and maintenance Information.
- 1.9.2. Contractor shall furnish the following equipment data content to be Included in Operating and Maintenance Manuals:
- 1.9.2.1. *Description of Equipment.*
 - 1.9.2.2. *Record Product Submittals.* Clearly identify all options and accessories of actual installed product and variations in the actual Work in comparison with submitted information.
 - 1.9.2.3. *Parts List.* Clearly identify every part in the item of equipment with the proper manufacturer's name, part nomenclature and number, local source, and list price.
 - 1.9.2.4. *Recommended Spare Parts List.* For each equipment item that Owner will likely need within a 12-month period to support and operate that item of equipment. The quantities of spare parts recommended must be based upon the quantity of like equipment items installed under the Contract Documents.
 - 1.9.2.5. *Normal Operating Instructions.* Detailed information to permit a journeyman mechanic to adjust, start-up, operate, and shut down the equipment. Special start-up precautions shall be noted as well as other action items required before the equipment is put into service.

- 1.9.2.6. Emergency Operating Procedures. Detailed description of the sequence of action to be taken in the event of a malfunction of the unit, either to permit a short period of continued operation or emergency shutdown to prevent further damage to the unit and to the system in which it is installed.
 - 1.9.2.7. *Preventive Maintenance*. Detailed information to cover routine and special inspection requirements, including but not limited to, field adjustments, inspections for wear, adjustment changes, packing wear, lubrication points, frequency and specific lubrication type required, cleaning of the unit and type solvent to use, and such other measures as are applicable to preventive maintenance program.
 - 1.9.2.8. *Calibration*. Detailed data on what to calibrate, how to calibrate, when to calibrate and procedures to enable checking the equipment for reliability or indications as well as data for test equipment, special tools and the location of test points.
 - 1.9.2.9. *Scale and Corrosion Control*. Detailed information covering the prevention of and removal of scale and corrosion.
 - 1.9.2.10. *Trouble Shooting Procedures*. Detailed information and procedures for detecting and isolating malfunctions and detailed information concerning probable causes and applicable remedies.
 - 1.9.2.11. *Removal and Installation Instructions*. Detailed information concerning the logical sequence of steps required to remove and install the item including instructions for the use of special tools and equipment.
 - 1.9.2.12. *Disassembly and Assembly Instructions*. Detailed illustrations and text to show the logical procedure and provide the instructions necessary to disassemble and assemble the unit properly. The text shall include all checks and special precautions as well as the use of special tools and equipment required to perform the assembly or disassembly.
 - 1.9.2.13. *Repair Instructions*. Detailed repair procedures to bring the equipment up to the required operating standard including instruction for examining equipment and parts for needed repairs and adjustments, and tests or inspections required to determine whether old parts may be reused or must be replaced.
 - 1.9.2.14. *Special Tools and Test Equipment*. Detailed list of the special tools and test equipment needed to perform repair and maintenance for each equipment item. The list shall contain the special tool and test equipment part number, size, quantity, price, manufacturer's name and address, and local supplier's name and address.
 - 1.9.2.15. *System Drawings*. Contractor shall furnish detailed drawings, where applicable, that clearly show wiring diagrams, utility service diagrams, control diagrams, system schematics, pneumatic and fluid flow diagrams, etc., which pertain to the unit function. System drawings must show major pieces of equipment, such as chillers, boilers, heat exchangers, pumps, air handlers, tanks, switchgear, etc., as meaningful to the Project. Fluid flow and direction and valves with their valve tag identification numbers must be clearly noted on drawings. Drawings must show modifications to another manufacturer's standard unit when it is incorporated into the assembly or package unit.
- 1.9.3. Warranties And Guarantees
- 1.9.3.1. Contractor shall include, within the Operating and Maintenance Manual organizational structure for each system, equipment item, or material, an executed copy of the specified warranty/guarantee with warranty effective dates covering that particular system, equipment

item, or material. Contractor shall include the manufacturer's warranty as specified and the installing subcontractor's and supplier's guarantee for workmanship and system operation.

1.9.4. Requirements For Close-Out Manual

1.9.4.1. The Commissioning and Close-Out Manual shall include, but is not limited to, the following:

- 1.9.4.1.1. Commissioning documentation, pre-functional and functional check lists and forms.
- 1.9.4.1.2. Final air balance reports produced by the Test, Adjust, and Balance Firm.
- 1.9.4.1.3. Completed Valve Schedule and Fire, Fire/Smoke and Smoke Damper Schedule
- 1.9.4.1.4. Owner Demonstration / Training Reports: Contractor shall furnish Training Plan and
- 1.9.4.1.5. Documentation of Owner's personnel training regarding operation of systems. Contractor shall include identification of parties receiving training and date(s) of such training.
- 1.9.4.1.6. Electrical Test Reports (including factory tests and settings).
- 1.9.4.1.7. Miscellaneous Equipment Test Reports (including factory tests and settings).
- 1.9.4.1.8. HVAC Calibration Reports (including duct testing reports).
- 1.9.4.1.9. Fire Alarm Test Reports.
- 1.9.4.1.10. Piping Test Reports.
- 1.9.4.1.11. Sewer Video Log.
- 1.9.4.1.12. Code-required Certifications as described within Technical Specifications.
- 1.9.4.1.13. Safety Data Sheets (SDS) for any and all products incorporated into the Project.

1.9.5. Miscellaneous Close-out Documents.

1.9.5.1. Contractor shall provide categories of requirements resulting in miscellaneous work records including, but not be limited to, the following:

- 1.9.5.1.1. Required field records on excavations, foundations, underground construction, wells and similar work.
- 1.9.5.1.2. Accurate survey showing locations and elevations of underground lines, including invert elevations of drainage piping. Surveys establishing lines and levels of building.
- 1.9.5.1.3. Certifications received in lieu of labels on products and similar record documentation.
- 1.9.5.1.4. Testing and qualification of tradesmen.
- 1.9.5.1.5. Documented qualification of installation firms.
- 1.9.5.1.6. Materials testing reports.
- 1.9.5.1.7. Final inspection Punch-list and deficiency corrections.
- 1.9.5.1.8. All original, signed Project warranties and guarantees.

1.10. MAINTENANCE AND OPERATIONS MANUAL FORMATTING

1.10.1. Provide minimum of two (2) hard copies and one electronic copy of Mechanical Maintenance Manuals, in accordance to the following:

1.10.2. Manuals to be bound in a hard cover neatly labeled: "OPERATING AND MAINTENANCE INSTRUCTIONS".

1.10.3. The Maintenance and Operations Manuals shall be divided into sections with neatly labeled and tabbed dividers between each section. The sections to be included in the manual are:

1.10.3.1. Section I General.

1.10.3.2. Section II Piping and Pump Systems, Ductwork and Accessories.

1.10.3.3. Section III – HVAC Equipment/Electrical Equipment

1.10.3.4. Section IV Automatic Controls

1.10.3.5. Section V - Air and Water Balancing

1.10.4. The following information shall be contained within the sections:

1.10.4.1. SECTION I: A list giving name, address and telephone number of the Consultant, Engineers, General Contractor, Mechanical Trade and Controls Trade. Written warranties for the Mechanical Systems. A copy of the Valve directory giving number, valve location, normal valve position, and purpose of valve. Equipment lists and certificates shall be provided - certificates shall be signed and sealed by the appropriate suppliers.

1.10.4.2. 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.

1.10.4.3. SECTION IV: Complete Control Diagrams, Wiring Diagrams and description of Control system and the functioning sequence of the system.

1.10.4.4. SECTION V: Complete air and hydronic balancing reports.

1.11. WITHHOLDING OF PAYMENT

1.11.1 Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 1 - GENERAL

1.1. DESCRIPTION:

- 1.1.1. This section specifies demolition and removal of utilities, services and equipment, as noted on the drawings and as required for the completion of the new work

1.2. DEFINITIONS

- 1.2.1. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- 1.2.2. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse or store as noted on Drawings.
- 1.2.3. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- 1.2.4. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- 1.2.5. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3. WARRANTY

- 1.3.1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

- 1.3.1.1. N/A

Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.4. PROTECTION:

- 1.4.1. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.
- 1.4.2. Carry out all demolition work in a neat and orderly manner. Keep noise, dust, and similar nuisances to a minimum. Do not collapse walls. Do not throw or drop materials.
- 1.4.3. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.
- 1.4.4. Where material indicated to be removed is suspected of containing asbestos, inform Client's Representative immediately. Do not disturb materials suspected of containing asbestos until asbestos content has been verified by Client.
- 1.4.5. Use extreme caution when cutting into shafts and chases. Shafts and chases may end above occupied areas within building. Take all necessary precautions to prevent debris from falling through openings between floors during demolition operations.
- 1.4.6. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- 1.4.7. Prevent debris from blocking drainage systems (floor drains) or affecting other mechanical and electrical systems that must remain in operation.
- 1.4.8. 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.
- 1.4.9. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

- 1.4.10. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- 1.4.11. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
- 1.4.12. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
- 1.4.13. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- 1.4.14. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Client.
- 1.4.15. Any damaged items shall be repaired or replaced as approved by the Consultant. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required.
- 1.4.16. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

1.5. QUALIFICATIONS

- 1.5.1. 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 as required to complete the work in an efficient and orderly manner.

1.6. EXAMINATION

- 1.6.1. Examine existing property. Determine the nature of materials to be removed.

- 1.6.2. When utilities or building services are encountered that are not indicated on the drawings, the Consultant shall be notified prior to further work in that area.

1.7. SCHEDULING

- 1.7.1. Coordinate the timing and duration of DCW, DHW and power shut-down with the Board representatives.

1.8. MAINTAINING TRAFFIC

- 1.8.1. Maintain and preserve Board's access requirements within, to and from existing building in areas where demolition and removal work is being carried out.
- 1.8.2. Do not close, obstruct, place or store material in the building driveways and passageways. Conduct operations with minimum interference with roads, streets, driveways, user traffic and passageways.

1.9. HAULING OPERATIONS

- 1.9.1. Maintain roadways and paving in the hauling areas clean on a daily basis and as required by Municipal Authorities.
- 1.9.2. Parking is not ample or readily available in the area where the building is located. Coordinate delivery of equipment with the Board representatives.

1.10. INTERRUPTIONS TO CLIENT'S OPERATIONS

- 1.10.1. There will be absolutely no interruptions to the building 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 building, including parking, receiving areas, deliveries and site and means of access and egress.
- 1.10.2. Where interruptions of domestic cold and hot water are necessary, coordinate with the School Representatives the timing and duration of such interruptions.

1.11. SAFETY REQUIREMENTS

- 1.11.1. Coordinate posting of danger signs conspicuously around property. Close doorways and thoroughfares giving access to area of demolition with barricades.

1.11.2. Provide a competent, experienced supervisor in charge of the Work and on Site while Work is in progress.

1.11.3. 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.

1.12. WORK INCLUDED IN THIS SECTION

1.12.1. The following is an over-all description of the demolition work; equipment, devices or services not specifically mentioned herein but obviously necessary to be demolished or temporarily relocated/reinstated to allow for the completion of the project shall be included in the demolition cost.

1.12.1.1. Remove existing plumbing fixtures approximately as noted on the drawings. Remove all associated plumbing accessories. Disconnect from DCW, DHW, & SAN piping as applicable.

1.12.1.2. Remove existing underground sanitary piping approximately as noted. Contractor to confirm exact underground sanitary routing prior to proceeding with demolition work

1.12.1.3. Remove existing DCW & DHW piping approximately as noted on the drawings.

1.12.1.4. Remove existing terminal grilles & diffusers approximately as noted on the drawings. Remove portions of ductwork as noted on the drawings and as necessary to complete the demolition work.

1.12.1.5. All existing ceilings in the area of work are being removed, refer to architectural plans. Remove all existing electrical devices in the existing ceilings including lighting, smoke sensors, heat detectors, occupancy sensors, etc. All existing electrical devices are to be re-installed in the new ceilings except for lighting fixtures, which are to be new fixtures.

1.12.1.6. Remove existing lighting in the cafeteria area at high level. Existing cafeteria ceiling to remain.

1.12.2. Miscellaneous

1.12.2.1.1. Include for cutting of existing block walls and existing flooring as required to complete the plumbing demolition.

1.12.2.1.2. Temporarily remove and relocate all building elements necessary for the installation of new plumbing fixtures & HVAC elements (ceiling tiles, drywall ceiling, cabinets, black boards, conduits, clocks, speakers etc.). All building services and elements temporarily removed shall be re-instated at the conclusion of the work and made good to their original condition. All fire alarm devices are to be re-verified once re-instated.

PART 2 - PRODUCTS

- 2.1. Not applicable

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. 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.
- 3.1.2. 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.
- 3.1.3. Provide any additional labour, materials and services not specifically indicated on the drawings but required to complete the demolition work.
- 3.1.4. Do not disturb adjacent structures or equipment designated to remain in place.
- 3.1.5. 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 Client.

3.2. DUST CONTROL

- 3.2.1. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily

3.3. DISPOSAL

3.3.1. Removed Items

- 3.3.1.1. Unless otherwise instructed by the Client's representative, all materials from demolition including brick, concrete, stone, metals, insulation, wiring, tubing and similar materials shall be removed

3.3.1.2. Removed items become property of Contractor and shall be disposed of by him daily, off the site to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Consultant. Contractor shall dispose debris in compliance with applicable federal, provincial or local permits, rules and/or regulations.

3.3.1.3. Dispose of demolished materials in accordance with the requirements of Authorities Having Jurisdiction. 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.

3.3.2. Removed and Salvaged Items:

3.3.2.1. The Board Representative will review the Site prior to commencement of demolition and instruct the Contractor, in writing, as to the items to be Removed and Salvaged. Perform the following:

3.3.2.1.1. Clean salvaged items.

3.3.2.1.2. Pack or crate items after cleaning. Identify contents of containers.

3.3.2.1.3. Store items in a secure area until delivery to Owner.

3.3.2.1.4. Transport items to Owner's storage area location in building.

3.3.2.1.5. Protect items from damage during transport and storage.

3.3.3. Removed and Reinstalled Items:

3.3.3.1. Clean and repair items to functional condition adequate for intended reuse.

3.3.3.2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3.3.3.3. Protect items from damage during transport and storage.

3.3.3.4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.3.4. Existing Items to Remain:

3.3.4.1. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner's Representative, items may be removed to a suitable, protected storage location off-site during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.4. REFRIGERANTS

3.4.1. Refrigerant handling requirements are specified in Section 23 23 00.

3.5. DEMOLITION OF ARCHITECTURAL FINISHES

3.5.1. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

- 3.5.1.1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
- 3.5.1.2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- 3.5.1.3. Do not use cutting torches without written permission from Client's Representative. Comply with Owner's rules and procedures.
- 3.5.1.4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loading on supporting walls, floors, or framing.
- 3.5.1.5. Dispose of demolished items and materials promptly.
- 3.5.1.6. Remove all loose material from partially demolished work leaving only sound and secure construction.

3.5.2. Plaster:

- 3.5.2.1. Remove loose plaster that will be exposed in finished construction. Loose plaster is defined as plaster material of at least 2 inches by 4 inches in size that can be moved by touch or that sounds hollow when lightly tapped with a hammer.

3.5.3. Flooring:

- 3.5.3.1. Where shown, scheduled or otherwise required for application or installation of new floor finishes or coverings, remove existing flooring tile, resilient sheet flooring as follows:
 - 3.5.3.1.1. Remove all traces of existing flooring materials. Remove resilient sheet and tile flooring products
 - 3.5.3.1.2. Remove adhesives, except those containing asbestos. Use chemical strippers approved by manufacturer of new flooring materials, or grind concrete floor surfaces to completely

remove adhesive. Obtain Client's Representative's approval of removal method prior to beginning removal work.

3.5.3.1.3. Do not remove vinyl composition tile or adhesives suspected of containing asbestos. Client will verify asbestos content of questionable materials. Removal of asbestos-containing adhesives (if any) shall be undertaken separately by the Client

3.5.3.1.4. Clean floor slabs of dust and adhesive residue.

3.6. DEMOLITION OF CONCRETE OR ASPHALT

3.6.1. Water used during concrete and asphalt work (including sweeping and saw-cutting) must be contained and collected for proper disposal. Do not discharge water containing dust or debris from concrete or asphalt work into storm drains, catch basins or to the sanitary sewer system.

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. Design, installation and testing shall be in accordance with NFPA 13.
- 1.1.2. The design and installation of a hydraulically calculated automatic wet-pipe system complete and ready for operation, for all portions of Building, as required by NFPA-13
- 1.1.3. Modification of the existing sprinkler system as indicated on the drawings and as further required by these specifications, as applicable to the project

1.2. RELATED WORK

- 1.2.1. Section 01 33 23, SHOP DRAWINGS.

1.3. DESIGN CRITERIA

- 1.3.1. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13.
- 1.3.2. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section. Calculations to be performed by a licensed Professional Engineer specialized in the field of fire protection.
- 1.3.3. Sprinkler Protection: Sprinkler hazard classifications shall be in accordance with NFPA 13. The hazard classification examples of uses and conditions identified in the Annex of NFPA 13 shall be mandatory for areas not listed below. Request clarification from the Client for any hazard classification not identified.
- 1.3.4. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.

1.3.5. Contractor to carry the cost of performing a pressure and flow test at the nearest available public hydrant. Coordinate with the City the performance of the test. Use the test results as the basis for hydraulic calculations.

1.3.6. The results shall be submitted to the Consultant as part of the Shop Drawings submission and to the fire protection specialist performing the hydraulic calculations, in the following format:

1.3.7. Water Supply: Base water supply on a flow test with the results noted as below:

Location _____

Elevation Static Test Gauge _____ m (_____ ft)

Elevation Residual Test Gauge _____ m (_____ ft)

Static pressure: _____ kPa (_____ psi)

Residual pressure: _____ kPa (_____ psi)

Flow: _____ L/s (_____ gpm)

Date: _____ Time _____

1.3.8. Zoning:

1.3.8.1. Sprinkler zoning to be as indicated on the design documentation. For each sprinkler zone provide a control valve, flow switch, and a test and drain assembly with pressure gauge. For buildings greater than two stories, provide a check valve at each control valve.

1.3.8.2. Ensure that all smoke barriers and zones are shown on the drawings. Sprinkler zones are to coincide with the smoke zones.

1.4. SUBMITTALS

1.4.1. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS. Prepare detailed working drawings that are signed and stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering. As the Consultant review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site.

1.4.2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to the Plans and Calculations chapter of NFPA 13. Drawings shall include graphical scales that allow the user

to determine lengths when the drawings are reduced in size. Include a plan showing the piping to the water supply test location.

- 1.4.3. **Manufacturer's Data Sheets:** Provide data sheets for all materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheets describe items in addition to those proposed to be used for the system, clearly identify the proposed items on the sheet.
- 1.4.4. **Calculation Sheets:**
 - 1.4.4.1. Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of the Plans and Calculations chapter of NFPA 13.
 - 1.4.4.2. **Valve Charts:** Provide a valve chart that identifies the location of each control valve. Coordinate nomenclature and identification of control valves. The chart shall include no less than the following: Tag ID No., Valve Size, Service (control valve, main drain, aux. drain, inspectors test valve, etc.), and Location.
 - 1.4.4.3. **Final Document Submittals:** Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS. In addition, submittals shall include, but not be limited to, the following:
 - 1.4.4.4. A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc.
 - 1.4.4.4.1. One full size printed copy.
 - 1.4.4.4.2. One complete set in electronic pdf format.
 - 1.4.4.4.3. One complete set in AutoCAD format or a format as directed by the Consultant
 - 1.4.5. **Material and Testing Certificate:** Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13. Certificates shall be provided to document all parts of the installation.
 - 1.4.6. **Operations and Maintenance Manuals** that include step-by-step procedures required for system startup, operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, and tools that should be kept in stock by the owner for routine maintenance, including the name of a local supplier, simplified wiring and controls

diagrams, troubleshooting guide, and recommended service organization, including address and telephone number, for each item of equipment.

1.4.7. One paper copy of the Material and Testing Certificates and the Operations and Maintenance Manuals above shall be provided in a binder. In addition, these materials shall be provided in pdf format on a compact disc.

1.4.8. Provide one additional copy of the Operations and Maintenance Manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser or as directed by the COR.

1.5. QUALITY ASSURANCE

1.5.1. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.

1.5.2. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL or approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials and equipment shall be free from defect. All materials and equipment shall be new unless specifically indicated otherwise on the contract drawings.

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. National Fire Protection Association (NFPA):

1.6.2.1. 13-13 Installation of Sprinkler Systems

1.6.2.2. 25-14 Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

1.6.2.3. 101-15 Life Safety Code

1.6.2.4. 170-15 Fire Safety Symbols

1.6.3. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory (2011)

1.7. Factory Mutual Engineering Corporation (FM): Approval Guide

PART 2 - PRODUCTS

2.1. PIPING & FITTINGS

2.1.1. Piping and fittings for private underground water mains shall be in accordance with NFPA 13.

2.2. UNDERGROUND PIPING COMPONENTS

2.2.1.1. N/A

2.3. ABOVEGROUND PIPING COMPONENTS

2.3.1. Steel Pipe

2.3.1.1. Steel pipe shall be Schedule 40 black steel for all piping 150 mm (6 inches) in diameter and smaller, Schedule 30 for steel pipe greater than 150 mm (6 inches) in diameter, and shall conform to applicable provisions of ASTM A795/A795M, ASTM A53/A53M, or ASTM A135/A135M. Plastic piping shall not be permitted except for drain piping.

2.3.1.2. Pipe in which threads or grooves are cut or rolled formed shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut or rolled formed.

2.3.1.3. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.3.2. Fittings for Non-Grooved Steel Pipe

2.3.2.1. Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3.

2.3.2.2. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.3.3. Grooved Mechanical Joints and Fittings

- 2.3.3.1. Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer; segmented welded fittings shall not be used.
- 2.3.3.2. Fitting and coupling houses shall be malleable iron conforming to ASTM A47/A47M, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12.
- 2.3.3.3. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe.
- 2.3.3.4. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated

2.3.4. Flanges

- 2.3.4.1. Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type.

2.4. **VALVES**

2.4.1. General:

- 2.4.1.1. Valves shall be in accordance with NFPA 13.

2.5. **WET SPRINKLER ALARM CHECK VALVE**

- 2.5.1.1. N/A

2.6. **CHECK VALVE**

- 2.6.1. N/A

2.7. **WET SPRINKLER SUPERVISED VALVES**

- 2.7.1. N/A

2.8. BACKFLOW PREVENTER

2.8.1. N/A

2.9. EXCESS PRESSURE PUMP

N/A

2.10. SPRINKLERS

2.10.1. General

2.10.1.1. Locate sprinklers as required to provide full coverage in accordance with the requirements of NFPQA-13.

2.10.1.2. Arrange sprinklers in patterns that fit a grid-type installation and are coordinated with the reflective ceiling plant and the rest of the building services (lights, air distribution equipment, fire alarm and PA devices).

2.10.1.3. Type of sprinklers: as noted on the drawings; coordinate with the architect.

2.10.1.4. Standards of Acceptance: Viking, National Fire Equipment, Tyco

2.10.2. Upright/Pendant Sprinklers

2.10.2.1. Standard Response, standard coverage

2.10.2.2. All hazard types

2.10.2.3. ULC and FM listed

2.10.2.4. Construction

2.10.2.4.1. Frame: Brass UNS-C84400

2.10.2.4.2. Deflector: Brass UNS-C26000

- 2.10.2.4.3. Bushing: Brass UNS-C36000
- 2.10.2.4.4. Bulb: Glass, nominal 5 mm diameter
- 2.10.2.4.5. Glass-bulb fluid temperature rating: -65 °F (-55 °C)
- 2.10.2.4.6. Compression Screw: Brass CW612N, CW508L, UNS-C36000 or UNS-C26000
- 2.10.2.4.7. Minimum Operating Pressure: 7 psi (0.5 bar)
- 2.10.2.4.8. Maximum Working Pressure: 250 psi (17 bar) wwp
- 2.10.2.4.9. Factory tested hydrostatic rating: 500 psi (34.5 bar)
- 2.10.2.4.10. Thread size: 1/2" or 3/4" NPT, (15 mm or 22 mm BSP) to match the discharge K factor
- 2.10.2.4.11. Overall Length: 2-1/4" (58 mm)
- 2.10.2.4.12. Finish: as per architectural specifications (brass, chrome, white polyester)
- 2.10.2.4.13. Discharge coefficient - as per the hydraulic calculations
- 2.10.2.4.14. K=2.8 GPM/psi^{1/2} (40,3 LPM/bar^{1/2})
- 2.10.2.4.15. K=5.6 GPM/psi^{1/2} (80,6 LPM/bar^{1/2})
- 2.10.2.4.16. K=8.0 GPM/psi^{1/2} (115,2 LPM/bar^{1/2})
- 2.10.2.4.17. Note: NFPA 13 prohibits installation of 1/2 in. NPT (15 mm BSB) sprinklers with K-factors greater than 5.6 in new construction. They are intended for retrofit in existing sprinkler systems only.
- 2.10.2.4.18. Temperature rating: 155 deg.F (68 deg.C) for regular use, or 175 deg.F (79 deg.C) where located in the proximity of a heat source (unit heater, exposed boiler vent, stage light, generator room, elevator room, under skylight, etc)

2.10.3. Semi-Recessed Sprinklers

- 2.10.3.1. Construction, discharge coefficient and temperature ratings: same as pendant Sprinklers
- 2.10.3.2. It uses a two piece Style 20 (1/2 inch NPT) or Style 30 (3/4 inch NPT) Recessed Escutcheon. The Recessed Escutcheon provides 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush pendent position.
- 2.10.3.3. Escutcheon finish: As per architectural finish schedules; Signal or Pure White, Grey Aluminum, Stainless Steel, Chrome Plated, or Natural Brass

2.10.4. Concealed Sprinklers

- 2.10.4.1. Standard response, standard coverage
- 2.10.4.2. Concealed in an enclosed escutcheon plate with flat cover for use in those applications where aesthetics is a primary consideration

- 2.10.4.3. Separable, two-piece design of the mounting cup and cover plate allows installation of the sprinklers and pressure testing of the fire protection system prior to installation of a suspended ceiling or application of the finish coating to a fixed ceiling
- 2.10.4.4. Internally threaded closure with 1/2" (12,7 mm) of adjustment
- 2.10.4.5. Available with optional dust and air seal
- 2.10.4.6. Construction
 - 2.10.4.6.1. Maximum 250 psi (17,3 bar) by UL/ULC
 - 2.10.4.6.2. Discharge Coefficient
 - 2.10.4.6.3. $K= 5.6 \text{ GPM}/\text{psi}^{1/2}$ (80,6 LPM/ $\text{bar}^{1/2}$)
 - 2.10.4.6.4. Adjustment: 1/2 inch (12,7 mm)
 - 2.10.4.6.5. Finishes: as per architectural finish schedules (pure white, grey-white, brushed chrome, black)
 - 2.10.4.6.6. Frame Bronze
 - 2.10.4.6.7. Support Cup Plated Steel
 - 2.10.4.6.8. Guide Pins Stainless Steel
 - 2.10.4.6.9. Deflector Bronze
 - 2.10.4.6.10. Compression Screw Brass
 - 2.10.4.6.11. Bulb Glass
 - 2.10.4.6.12. Cap Bronze or Copper
 - 2.10.4.6.13. Sealing Assembly. . Beryllium Nickel w/TEFLON
 - 2.10.4.6.14. Cover Plate Brass
 - 2.10.4.6.15. Retainer Brass
 - 2.10.4.6.16. Ejection Spring Stainless Steel
 - 2.10.4.6.17. Temperature ratings: 155°F (68°C) Sprinkler with 139°F (59°C) Cover Plate, 200°F (93°C) Sprinkler with 165°F (74°C) Cover Plate where located in the proximity of a heat source (unit heater, exposed boiler vent, stage light, generator room, elevator room, under skylight, etc)
- 2.10.5. Side-Wall Sprinklers
 - 2.10.5.1. UL and C-UL Listed, FM Approved
 - 2.10.5.2. Standard response, standard coverage
 - 2.10.5.3. Hazard type: Light/Ordinary

2.10.5.4. Construction

- 2.10.5.4.1. Frame Brass
- 2.10.5.4.2. Strut MONEL
- 2.10.5.4.3. Deflector Bronze
- 2.10.5.4.4. Hook Bronze/MONEL
- 2.10.5.4.5. Fusible Element Solder, Copper, Stainless Steel balls.
- 2.10.5.4.6. Ejection Spring Stainless Steel
- 2.10.5.4.7. Sealing Button Bronze w/TEFLON
- 2.10.5.4.8. Maximum Working Pressure: 175 psi (12,1 bar)
- 2.10.5.4.9. Discharge Coefficient
- 2.10.5.4.10. K=5.6 gpm/psi^{1/2} (80,6 lpm/bar^{1/2})
- 2.10.5.4.11. Finishes: Natural brass, Chrome plated
- 2.10.5.4.12. Temperature rating: 165 deg. (74 deg.C).

2.10.6. Protective Wire Guards

- 2.10.6.1. 1-pc or 2-pc head guards are designed to provide protection against low level impacts to the sprinkler head.
- 2.10.6.2. The 1-pc design features a dual hook attaching system to allow for installation on most ½" and ¾" IPS sprinkler heads. The 1-pc also can be provided with a water shield for in-rack sprinkler systems.
- 2.10.6.3. The 2-pc designed features a cage and clamping base plate. This design can provide additional protection for sprinklers that may experience greater opportunity for repeated abuse.
- 2.10.6.4. Construction
 - 2.10.6.4.1. Type: Formed wire cage
 - 2.10.6.4.2. Sizes: 1-pc ½" or ¾" IPS
 - 2.10.6.4.3. 2-pc ½" IPS
 - 2.10.6.4.4. Material: .12" steel wire
 - 2.10.6.4.5. Finishes: Red enamel or Chrome

2.11. SENSORS AND DETECTORS

2.11.1.1. N/A

2.12. EXPOSED FIRE DEPARTMENT CONNECTION

2.12.1. N/A

2.13. FLUSH FIRE DEPARTMENT CONNECTION

2.13.1. N/A

2.14. SPRINKLER CABINETS

2.14.1.1. N/A

2.15. GAUGES

2.15.1. Provide gauges as required by NFPA 13. Provide gauges where the normal pressure of the system is at the midrange of the gauge.

2.16. PIPE HANGERS, SUPPORTS AND RESTRAINT OF SYSTEM PIPING

2.16.1. Pipe hangers, supports, and restraint of system piping shall be in accordance with NFPA 13.

2.16.2. Hangers and braces shall be listed and of the type suitable for the application, construction, and pipe type and sized to be supported and braced.

2.17. WALL, FLOOR AND CEILING PLATES

2.17.1. Provide chrome plated steel escutcheon plates.

2.18. VALVE TAGS

2.19. N/A

2.20. SPRINKLER SYSTEM SIGNAGE

2.20.1. N/A

PART 3 - EXECUTION

3.1. GENERAL

3.1.1. Pipe size and layout:

3.1.2. Sprinkler main pipes locations have been shown on the drawings for reference purpose only. Final size and location of mains and branch pipes to be determined based on hydraulic calculations and coordinated with the rest of the trades. Provide interference drawings as required to coordinate work with other trades. Refer to details on drawings and locate sprinkler lines to avoid interference with lights, ductwork and other equipment in the ceiling space.

3.1.3. Locate sprinkler heads as shown on architectural reflected ceiling plans and/or at centre lines of panels as required to produce orderly and symmetrical patterns with other ceiling mounted devices, and to meet or exceed the requirements of NFPA-13, Authorities Having Jurisdiction and insurance underwriters.

3.1.4. Provide wire guards on all heads located in:

3.1.4.1. Elevator machine rooms.

3.1.4.2. All Mechanical/Fan Rooms

3.1.4.3. Sprinkler heads within 2.0 m of finished floor.

3.1.5. Owing to different levels of ceiling, allow for main and branch pipes offsets as required to accommodate structural, architectural elements and other building services. Allow 10 additional heads for final site coordination and piping for all additional heads required at no cost to the Client.

3.1.6. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.

3.2. INSTALLATION

- 3.2.1. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- 3.2.2. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. In stairways, locate piping as near to the ceiling as possible to prevent tampering by unauthorized personnel and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). Piping shall not obstruct the minimum means of egress clearances required by NFPA 101. Pipe hangers, supports, and restraint of system piping shall be installed accordance with NFPA 13.
- 3.2.3. Welding: Conform to the requirements and recommendations of NFPA 13.
- 3.2.4. Drains: Provide drips and drains, including low point drains, in accordance with NFPA 13. Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13. The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector.
- 3.2.5. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- 3.2.6. Water Flow Alarm Switches: Install waterflow alarm switches and valves in stairwells or other easily accessible locations.
- 3.2.7. Inspector's Test Connection: Install and supply in accordance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
- 3.2.8. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- 3.2.9. Provide escutcheon plates for exposed piping passing through walls, floors or ceilings.

- 3.2.10. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction.
- 3.2.11. Where dry pendent sprinklers are used for freezers or similar spaces and they are connected to the wet pipe system, provide an EPDM boot around the dry pendent sprinkler on the heated side and securely seal to the pipe and freezer to prevent condensation from entering the freezer.
- 3.2.12. Provide pressure gauges at each water flow alarm switch location and at each main drain connection.
- 3.2.13. For each fire department connection, provide the symbolic sign given in NFPA 170. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
- 3.2.14. Firestopping shall be provided for all penetrations of fire resistance rated construction.
- 3.2.15. Painting of Pipe: In finished areas where walls and ceilings have been painted, paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with two coats of gloss red enamel. Exercise care to avoid painting sprinklers. Painting of sprinkler systems above suspended ceilings and in crawl spaces is not required. Any painted sprinkler shall be replaced with a new sprinkler.
- 3.2.16. Sprinkler System Signage: Provide rigid sprinkler system signage in accordance with NFPA 13 and NFPA 25. Sprinkler system signage shall include, but not limited to, the following:
 - 3.2.17. Identification Signs:
 - 3.2.17.1. Provide signage for each control valve, drain valve, sprinkler cabinet, and inspector's test.
 - 3.2.17.2. Provide valve tags for each operable valve. Coordinate nomenclature and identification of operable valves with COR. Where existing nomenclature does not exist, the Tag Identification shall include no less than the following: (FP-B-F/SZ-#) Fire Protection, Building Number, Floor Number/Smoke Zone (if applicable), and Valve Number. (E.g., FP-500-1E-001) Fire Protection, Building 500, First Floor East, Number 001.)
- 3.2.18. Instruction/Information Signs:
 - 3.2.18.1. Provide signage for each control valve to indicate valve function and to indicate what system is being controlled.
 - 3.2.18.2. Provide signage indicating the number and location of low point drains.

3.2.19. Hydraulic Placards:

3.2.19.1. Provide signage indicating hydraulic design information. The placard shall include location of the design area, discharge densities, required flow and residual pressure at the base of riser, occupancy classification, hose stream allowance, flow test information, and installing contractor. Locate hydraulic placard information signs at each alarm check valve.

3.2.20. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.

3.2.21. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve occupied spaces. Request in writing at least one week prior to the planned interruption.

3.3. EXCESS PRESSURE PUMP

3.3.1. Connect to power and controls

3.3.2. Provide auto control for excess pressure pump and final wiring and connections as required to place in operation. Adjust and maintained pump at 20 PSI above the normal water supply pressure. Pump shall be complete with ¼" pressure relief valve and other associated hardware. A high & low water pressure supervisory switch shall also be provided on the system riser.

3.4. INSPECTION AND TEST

3.4.1. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Consultant or Commissioning Agent (as applicable to the project). Test and flush underground water line prior to performing these hydrostatic tests.

3.4.2. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise Client to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and

materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test

3.5. INSTRUCTIONS

- 3.5.1. Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the Client.

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. The requirements of this Section shall apply to all sections of Division 22.

1.2. DEFINITIONS:

1.2.1. Exposed: Piping and equipment exposed to view in finished rooms.

1.3. RELATED WORK

1.3.1. Section 01 33 23, SHOP DRAWINGS,

1.3.2. Section 22 05 53. IDENTIFICATION FOR PLUMBING SYSTEMS

1.3.3. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

1.3.4. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4. APPLICABLE PUBLICATIONS

1.4.1. The publications listed below shall 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. Ontario Building Code – Part 7 latest edition

1.4.3. Ontario Standard CSA-B149.1 latest edition

1.4.4. American Society for Testing and Materials (ASTM):

1.4.4.1. A36/A36M-2012 Standard Specification for Carbon Structural Steel

1.4.4.2. F1760-01(R2011) Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content

1.4.5. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

1.4.5.1. SP-58-2009 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation

1.4.5.2. SP-69-2003 Pipe Hangers and Supports - Selection and Application

1.4.6. National Fire Protection Association (NFPA):

1.4.6.1. 51B-2014 Standard for Fire Prevention During Welding, Cutting and Other Hot Work

1.4.6.2. 70-2011 National Electrical Code (NEC)

1.5. SUBMITTALS

- 1.5.1. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS,
- 1.5.2. Manufacturer's Literature and Data: submit all equipment and material performance and characteristics, operational curves, diagrams and schematic, power wiring schematics and all other pertinent operational information. Submit all equipment physical sizes, weights, methods of lifting and installation, support requirements.
- 1.5.3. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
- 1.5.4. Equipment and materials identification.
- 1.5.5. Fire stopping materials.
- 1.5.6. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
- 1.5.7. Wall, floor, and ceiling plates.
- 1.5.8. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

1.6. DUTIES OF MECHANICAL CONTRACTOR

- 1.6.1. The mechanical contractor shall assume the responsibilities and duties including but not limited to the ones described below:
- 1.6.2. Superintendence
 - 1.6.2.1. Provide full time on-site superintendent personnel and supporting staff with proven experience in project of similar value and complexity.
 - 1.6.2.2. Site superintendent shall have over-all authority to speak for and represent the mechanical contractor.

1.6.3. Coordination

- 1.6.3.1. Coordinate the work with all the sub-trades involved to ensure that the work will be carried out on schedule and in proper sequence.
- 1.6.3.2. 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.
- 1.6.3.3. Take responsibility for the delivery of equipment necessary to complete the work in accordance with the approved schedule.

1.6.4. Staffing and Scheduling

- 1.6.4.1. Within seven days after the award of the contract, the Mechanical Contractor shall provide to the Client representative the following information:
 - 1.6.4.1.1. Appointment of official representatives in the project.
 - 1.6.4.1.2. Schedule of work.
 - 1.6.4.1.3. Delivery schedule for specified equipment.
 - 1.6.4.1.4. Requirements for temporary facilities, site signs, storage, etc.

1.6.5. Work Completion Meeting

- 1.6.5.1. Prior to application for Substantial Performance of the Work, the mechanical contractor shall participate in the take-over meeting. Agenda to include the following:
 - 1.6.5.1.1. Review of outstanding deficiencies.
 - 1.6.5.1.2. Submission of maintenance manuals, warranties and as-built drawings.
 - 1.6.5.1.3. Results of performance tests and described further in this section.
 - 1.6.5.1.4. Scheduling of training to Board's personnel.

1.7. SCHEDULING OF WORK

- 1.7.1. For all work to be performed under this contract, adhere to Construction Schedule agreed upon with the Client.

1.8. INTENT

- 1.8.1. Bidders for this work shall include for all labor, material, equipment and all other related cost including all applicable taxes (except GST) and fees to provide the work as indicated on the drawings.
- 1.8.2. 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.

1.9. INTERFERENCES

- 1.9.1. 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 charge, 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.
- 1.9.2. 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.
- 1.9.3. Field verifications of dimensions on plans shall be made since actual locations, distances, and levels will be governed by actual field conditions.
- 1.9.4. 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.
- 1.9.5. 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. 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 Board.

- 1.9.6. Before commencing work, check and verify all grade and invert elevations, stacks, levels, and dimensions, to ensure proper and correct installation of the work.
- 1.9.7. 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.
- 1.9.8. 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.
- 1.9.9. The mechanical plans show approximate locations for wall mounted devices. Obtain Consultant's approval of mounting heights and locations before commencement of work.

1.10. EXAMINE SITE

- 1.10.1. 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.

1.11. INTERFERENCE DRAWINGS:

- 1.11.1. Complete consolidated and coordinated interference drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:200. Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, controls, piping, pumps, valves and other items. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.
- 1.11.2. Mechanical equipment rooms.
- 1.11.3. Interstitial space.

1.11.4. Pipe sleeves.

1.11.5. Equipment penetrations of floors, walls, ceilings, or roofs.

1.12. MAINTENANCE DATA AND OPERATING INSTRUCTIONS:

1.12.1. Maintenance and operating manuals, for systems and equipment. Include complete list indicating all components of the systems with diagrams of the internal wiring for each item of equipment.

1.12.2. Include listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.13. MATERIALS AND STANDARDS OF ACCEPTANCE

1.13.1. 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.

1.13.2. Where two or more designations are listed, the contractor shall choose one of those listed and state the choice made on the Bid Form (where applicable). *First choice shall be given to the equipment selected as the basis of design; equipment listed as equal shall be considered only if it suits the local conditions in terms of clearances, power supply availability and weight restrictions.*

1.14. MATERIAL SUBSTITUTIONS

1.14.1. After execution of the Contract, requests for substitution of materials or makes other than those specifically named in the Contract Documents may be reviewed and approved by the Consultant, subject to Client's review and acceptance of the financial credits involved.

1.14.2. In the absence of such express approval by the Consultant, the Mechanical Contractor will be held to furnish specified items under the base bid as the standard of acceptance.

1.14.3. If equipment is submitted which differs in arrangement from that specified/shown on the documents, provide drawings that show the rearrangement of all associated systems. Approval will

be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

1.15. CODES, PERMITS, FEES AND CONNECTIONS

- 1.15.1. 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.
- 1.15.2. 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.
- 1.15.3. For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.
- 1.15.4. 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.
- 1.15.5. 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.

1.16. CONSULTANT'S INSTRUCTIONS

- 1.16.1. During construction the Consultant will issue such instructions as may be necessary for verification and correction of the work. These instructions shall be binding as part of the specification.

1.17. ADDITIONAL WORK AND CHANGES

- 1.17.1. Unless a written order, reviewed by the Consultant and countersigned or otherwise approved by the Client Representative, no additional work shall be undertaken by the Contractor.

1.18. QUALITY ASSURANCE

1.18.1. Products Criteria:

- 1.18.1.1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
- 1.18.1.2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming shall be submitted upon completion of the project, for project record and inserted into the operations and maintenance manual.
- 1.18.1.3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
- 1.18.1.4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Consultant.
- 1.18.1.5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- 1.18.1.6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
- 1.18.1.7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

1.18.2. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1.18.2.1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

1.18.2.2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

1.18.3. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Consultant and then incorporated in the Operations and Maintenance Manuals prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.19. EXECUTION (INSTALLATION, CONSTRUCTION) QUALITY:

1.19.1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the Consultant for resolution at least 10 working days prior to commencing installation of any item.

1.19.2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution.

1.19.3. Plumbing Systems: Unless otherwise required herein, perform plumbing work in accordance with the latest version of OBC section 7 and other applicable by-laws by the Authorities Having Jurisdiction.

1.20. CLEANLINESS OF PIPING AND EQUIPMENT SYSTEMS:

1.20.1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.

1.20.2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

1.20.3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Client. All piping shall be tested in accordance with the specifications and OBC requirements. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.

1.20.4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.21. DELIVERY, STORAGE AND HANDLING

1.21.1. Protection of Equipment:

1.21.1.1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government 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.

1.21.1.2. Damaged equipment shall be replaced with an identical unit as determined and directed by the COR. Such replacement shall be at no additional cost or additional time to the Client.

1.21.1.3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.

1.21.1.4. 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.

1.22. AS-BUILT DOCUMENTATION

1.22.1. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

1.22.2. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any

special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

- 1.22.3. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on Auto-Cad version 2007 or higher provided on compact disk or DVD. Should the installing contractor engage the consulting company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party company' requirement.
- 1.22.4. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1. MATERIALS FOR VARIOUS SERVICES

- 2.1.1. Plastic pipe, fittings and solvent cement shall meet C-NSF/ANSI 14 and C-NSF/ANSI 61. Solder or flux containing lead shall not be used with copper pipe.
- 2.1.2. n-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers shall comply with C-NSF/ANSI 61 and C-NSF/ANSI 372.
- 2.1.3. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of C-NSF/ANSI 61 and C-NSF/ANSI 372.

2.2. FACTORY-ASSEMBLED PRODUCTS

- 2.2.1. Standardization of components shall be maximized to reduce spare part requirements.
- 2.2.2. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

- 2.2.3. All components of an assembled unit need not be products of same manufacturer.
- 2.2.4. Constituent parts that are alike shall be products of a single manufacturer.
- 2.2.5. Components shall be compatible with each other and with the total assembly for intended service.
- 2.2.6. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.
- 2.2.7. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- 2.2.8. Major items of equipment, which serve the same function, shall be the same make and model.

2.3. COMPATIBILITY OF RELATED EQUIPMENT

- 2.3.1. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4. SAFETY GUARDS

- 2.4.1. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 8 mm (¼ inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- 2.4.2. All Equipment shall have moving parts protected from personal injury.

2.5. LIFTING ATTACHMENTS

- 2.5.1. Equipment shall be provided 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.

2.6. ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

- 2.6.1. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.

2.6.2. Special Requirements:

- 2.6.2.1. 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 cost or time to the Government.
- 2.6.2.2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
- 2.6.2.3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
- 2.6.2.4. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
- 2.6.2.5. Other wiring at boilers and water heaters, and to control panels, shall be NFPA 70 designation THWN.
- 2.6.2.6. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
- 2.6.3. Motor sizes shall be selected 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.
- 2.6.4. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1.
- 2.6.5. Motor Efficiency and Power Factor: All motors, when specified as "high efficiency or Premium Efficiency" by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING

EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient”. Motors not specified as “high efficiency or premium efficiency” shall comply with the requirements of the Energy Policy and Conservation Act.

- 2.6.6. Single phase Motors: Capacitor start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).
- 2.6.7. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.
- 2.6.8. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.
- 2.6.9. Insulation Resistance: Not less than one half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

2.7. VARIABLE SPEED MOTOR CONTROLLERS

- 2.7.1. N/A.

2.8. EQUIPMENT AND MATERIALS IDENTIFICATION

- 2.8.1. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with facility maintenance staff. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 22 05 53. IDENTIFICATION FOR PLUMBING SYSTEMS
- 2.8.2. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black filled letters, or rigid black plastic with white letters specified in Section 22 05 53. IDENTIFICATION FOR PLUMBING SYSTEMS shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. shall be identified.
- 2.8.3. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

2.8.4. Control Items: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.

2.8.5. Valve Tags and Lists:

- 2.8.5.1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
- 2.8.5.2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1 1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
- 2.8.5.3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 215 mm (8 1/2 inches) by 275 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3 ring binder notebook. An additional copy of the valve list shall be mounted in picture frames for mounting to a wall. COR shall instruct contractor where frames shall be mounted.
- 2.8.5.4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling or access door.

2.9. GALVANIZED REPAIR COMPOUND

2.9.1. Mil. Spec. DOD P 21035B, paint.

2.10. PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

2.10.1. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP 58. For selection and application refer to MSS SP 69.

2.10.2. For Attachment to Concrete Construction:

- 2.10.2.1. Concrete insert: Type 18, MSS SP 58.
- 2.10.2.2. Self drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

- 2.10.2.3. Power driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
- 2.10.3. For Attachment to Steel Construction: MSS SP 58.
- 2.10.3.1. Welded attachment: Type 22.
- 2.10.3.2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.
- 2.10.4. Attachment to Metal Pan or Deck: As required for materials specified
- 2.10.5. For Attachment to Wood Construction: Wood screws or lag bolts.
- 2.10.6. Hanger Rods: Hot rolled steel, ASTM A36/A36M or ASTM 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 40 mm (1 1/2 inches) minimum of adjustment and incorporate locknuts. All thread rods are acceptable.
- 2.10.7. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 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.
- 2.10.8. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.
- 2.10.9. Pipe Hangers and Supports: (MSS SP 58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
- 2.10.10. General Types (MSS SP 58):
- 2.10.10.1. Standard clevis hanger: Type 1; provide locknut.
- 2.10.10.2. Riser clamps: Type 8.
- 2.10.10.3. Wall brackets: Types 31, 32 or 33.
- 2.10.10.4. Roller supports: Type 41, 43, 44 and 46.
- 2.10.10.5. Saddle support: Type 36, 37 or 38.

- 2.10.10.6. Turnbuckle: Types 13 or 15.
- 2.10.10.7. U-bolt clamp: Type 24.

- 2.10.11. Copper Tube:
 - 2.10.11.1. Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
 - 2.10.11.2. For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
 - 2.10.11.3. For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
 - 2.10.11.4. Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

- 2.10.12. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

- 2.10.13. Spring Supports (Expansion and contraction of vertical piping):
 - 2.10.13.1. Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
 - 2.10.13.2. 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.
 - 2.10.13.3. Spring hangers are required on all plumbing system pumps one horsepower and greater.

- 2.10.14. Plumbing Piping (Other Than General Types):
 - 2.10.14.1. Horizontal piping: Type 1, 5, 7, 9, and 10.
 - 2.10.14.2. Chrome plated piping: Chrome plated supports.
 - 2.10.14.3. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

- 2.10.15. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

- 2.10.16. Pre-insulated Calcium Silicate Shields:
 - 2.10.16.1. Provide 360 degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
 - 2.10.16.2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.

- 2.10.16.3. Shield thickness shall match the pipe insulation.
- 2.10.16.4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
- 2.10.16.5. Shields for supporting cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.
- 2.10.16.6. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
- 2.10.16.7. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

2.11. PIPE PENETRATIONS

- 2.11.1. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- 2.11.2. Pipe penetration sleeve materials shall comply with all firestopping requirements for each penetration.
- 2.11.3. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 2.11.3.1. For sleeves: Extend sleeve 50 mm (2 inch) above finished floor and provide sealant for watertight joint.
 - 2.11.3.2. For blocked out floor openings: Provide 40 mm (1 1/2 inch) angle set in silicone adhesive around opening.
 - 2.11.3.3. For drilled penetrations: Provide 40 mm (1 1/2 inch) angle ring or square set in silicone adhesive around penetration.
 - 2.11.3.4. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of the Consultant.
- 2.11.4. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

- 2.11.5. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- 2.11.6. Galvanized steel or an alternate black iron pipe sleeve with asphalt coating sleeves shall be used for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.
- 2.11.7. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- 2.11.8. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.
- 2.11.9. Pipe passing through roof shall be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange shall extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane shall be provided with a clamping flange. The annular space between the sleeve and pipe shall be sealed water

2.12. TOOLS AND LUBRICANTS

- 2.12.1. Furnish, and turn over to the Client, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- 2.12.2. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- 2.12.3. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the Client.
- 2.12.4. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials shall be utilized when possible.

2.13. WALL, FLOOR AND CEILING PLATES

- 2.13.1. 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.
- 2.13.2. 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 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.
- 2.13.3. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1. ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- 3.1.1. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.
- 3.1.2. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.
- 3.1.3. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

- 3.1.4. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.
- 3.1.5. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- 3.1.6. Cutting Holes:
 - 3.1.6.1. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
 - 3.1.6.2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
 - 3.1.6.3. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by the Consultant where working area space is limited.
- 3.1.7. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, trap priming and other service are not shown but must be provided.

3.2. PROTECTION AND CLEANING:

- 3.2.1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations. Damaged or defective items in the opinion of the Consultant, shall be replaced at no additional cost or time to the Client.
- 3.2.2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- 3.2.3. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, shall be used for all pad or floor mounted equipment.

- 3.2.4. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- 3.2.5. Interconnection of Electrical Instrumentation and Controls: Electrical interconnection is generally not shown but shall be provided as specified. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

3.3. WORK IN EXISTING BUILDING:

- 3.3.1. Make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.
- 3.3.2. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
- 3.3.3. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve shall be provided in low point of casement pipe.
- 3.3.4. Inaccessible Equipment:
 - 3.3.4.1. Where the Client determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Client.
 - 3.3.4.2. The term "conveniently accessible" is defined as capable of being reached without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.4. TEMPORARY PIPING AND EQUIPMENT

- 3.4.1. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.

- 3.4.2. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.
- 3.4.3. Temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are not allowed in potable water systems. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.5. RIGGING

- 3.5.1. Openings in building structures shall be planned to accommodate design scheme.
- 3.5.2. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- 3.5.3. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- 3.5.4. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- 3.5.5. Contractor shall check all clearances, weight limitations and shall prepare a rigging plan; All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

3.6. THERMOMETERS AND PRESSURE GAUGES

3.6.1. General:

- 3.6.1.1. Locate direct reading thermometers and gauges for reading from floor or platform.
- 3.6.1.2. Provide remote reading thermometers and gauges where direct reading instruments cannot be satisfactorily located.

3.6.1.3. Locate engraved lamacoid nameplate as specified in Section Identification, identifying medium adjacent to thermometers and gauges.

3.6.2. Thermometers:

3.6.2.1. 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.

3.6.2.2. Scale shall be suitable for 2 times the temperature range of service. Scale shall be combined Celsius and Fahrenheit.

3.6.2.3. Standard of Acceptance: Weiss, Ashcroft, Terrice.

3.6.3. Pressure Gauges:

3.6.3.1. 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".

3.6.3.2. On pumps liquid filled gauges shall be utilized.

3.6.3.3. Standard of Acceptance: Weiss, Ashcroft, Terrice.

3.6.3.4. 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.

3.6.3.5. Use materials compatible with system requirements.

3.6.4. Gauges shall have combined kilopascal and psi scales.

3.7. PIPE AND EQUIPMENT SUPPORTS

3.7.1. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the Consultant

3.7.2. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.

3.7.3. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work shall be provided.

3.7.4. Overhead Supports:

3.7.4.1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.

3.7.4.2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.

3.7.5. Tubing and capillary systems shall be supported in channel troughs.

3.7.6. Floor Supports:

3.7.6.1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.

3.7.6.2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.

3.7.6.3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.

3.8. LUBRICATION

3.8.1. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.

3.8.2. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to COR in unopened containers that are properly identified as to application.

- 3.8.3. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- 3.8.4. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- 3.8.5. All lubrication points shall be extended to one side of the equipment.

3.9. PLUMBING SYSTEMS DEMOLITION

- 3.9.1. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Client's personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards.
- 3.9.2. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Client's property. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- 3.9.3. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Client property and shall be removed and delivered to Client and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Client's property expeditiously and shall not be allowed to accumulate.

3.10. CLEANING AND PAINTING

3.10.1. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Client, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.

3.10.2. In addition, the following special conditions apply:

3.10.2.1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.

3.10.3. The following Material and Equipment shall NOT be painted:

- 3.10.3.1. Motors, controllers, control switches, and safety switches.
- 3.10.3.2. Control and interlock devices.
- 3.10.3.3. Regulators.
- 3.10.3.4. Pressure reducing valves.
- 3.10.3.5. Control valves and thermostatic elements.
- 3.10.3.6. Lubrication devices and grease fittings.
- 3.10.3.7. Copper, brass, aluminum, stainless steel and bronze surfaces.
- 3.10.3.8. Valve stems and rotating shafts.
- 3.10.3.9. Pressure gages and thermometers.
- 3.10.3.10. Glass.
- 3.10.3.11. Name plates.

3.10.4. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint type and color obtained from manufacturer or computer matched.

3.10.5. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.

3.10.6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this. Lead based paints shall not be used.

3.11. IDENTIFICATION SIGNS

3.11.1. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters,

control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

3.11.2. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data shall be placed on factory built equipment.

3.11.3. Pipe Identification: Refer to Section 22 05 53. IDENTIFICATION FOR PLUMBING SYSTEMS

3.12. STARTUP AND TEMPORARY OPERATION

3.12.1. Startup of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation.

3.12.2. Where commission is applicable, the commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Commissioning Agent. Provide a minimum of 1 week weeks prior notice.

3.13. OPERATING AND PERFORMANCE TESTS

3.13.1. Prior to the final inspection, all required tests shall be performed. Submit the test reports and records to the Consultant.

3.13.2. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Client.

3.13.3. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests shall be requested in writing to the Consultant for approval.

3.14. OPERATION AND MAINTENANCE MANUALS

- 3.14.1. All new and temporary equipment and all elements of each assembly shall be included.
- 3.14.2. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- 3.14.3. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- 3.14.4. Lubrication instructions, type and quantity of lubricant shall be included.
- 3.14.5. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- 3.14.6. Set points of all interlock devices shall be listed.
- 3.14.7. Trouble-shooting guide for the control system troubleshooting shall be inserted into the Operations and Maintenance Manual.
- 3.14.8. The control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- 3.14.9. Emergency procedures for shutdown and startup of equipment and systems.

3.15. CLOSE-OUT DOCUMENTATION

- 3.15.1. 10 (ten) days prior to substantial performance of work obtain documentation and/or prepare certification of the following items and submit them to the Client representative:
 - 3.15.1.1. All inspection certificates.
 - 3.15.1.2. Guarantee certificates as called for under "Warranty".
 - 3.15.1.3. Record drawings.
 - 3.15.1.4. Operating and Maintenance Manuals.
 - 3.15.1.5. Test certifications as called for under "Testing".
 - 3.15.1.6. 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.

3.16. COMMISSIONING

- 3.16.1. Where applicable, provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

3.17. OPERATING AND PERFORMANCE TESTS

- 3.17.1. Prior to the final inspection, perform required tests as specified and submit the test reports and records to the Consultant. 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.
- 3.17.2. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Client.
- 3.17.3. At the successful completion of Performance Tests and all testing and balancing, make the systems ready for final inspection and subsequent acceptance of the Client. 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 current by-laws. Disinfect all domestic water as required by current by-laws and Authorities Having Jurisdiction.
- 3.17.4. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.18. DEMONSTRATION AND TRAINING

- 3.18.1. Provide services of manufacturer's technical representative for four hours to instruct Client's personnel in operation and maintenance of the system.

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. This section describes the requirements for general-duty valves for domestic water.

1.2. RELATED WORK

1.2.1. Section 01 23 33, SHOP DRAWINGS AND PROJECT DOCUMENTATION.

1.2.2. Section 23 05 11, COMMON WORK RESULTS FOR HVAC

1.3. APPLICABLE PUBLICATIONS

1.3.1. 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.

1.3.2. Ontario Building Code

1.3.2.1. Part 3

1.3.2.2. Part 7

1.3.3. American Society of Mechanical Engineers (ASME):

1.3.3.1. A112.14.1-2003 Backwater Valves

1.3.4. American Society of Sanitary Engineering (ASSE):

1.3.4.1. 1001-2008 Performance Requirements for Atmospheric Type Vacuum Breakers

1.3.4.2. 1003-2009 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems

1.3.4.3. 1017-2009 Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

1.3.4.4. 1069-2005 Performance Requirements for Automatic Temperature Control Mixing Valves

1.3.4.5. 1070-2004 Performance Requirements for Water Temperature Limiting Devices

1.3.4.6. 1071-2012 Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

1.3.5. American Society for Testing and Materials (ASTM):

- 1.3.5.1. A126-2004(R2009) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- 1.3.5.2. A276-2013a Standard Specification for Stainless Steel Bars and Shapes
- 1.3.5.3. A536-1984(R2009) Standard Specification for Ductile Iron Castings

1.3.6. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

- 1.3.6.1. SP-25-2008 Standard Marking Systems for Valves, Fittings, Flanges and Unions
- 1.3.6.2. SP-67-2011 Butterfly Valves
- 1.3.6.3. SP-70-2011 Gray Iron Gate Valves, Flanged and Threaded Ends
- 1.3.6.4. SP-71-2011 Gray Iron Swing Check Valves, Flanged and Threaded Ends
- 1.3.6.5. SP-80-2013 Bronze Gate, Globe, Angle, and Check Valves
- 1.3.6.6. SP-85-2011 Gray Iron Globe & Angle Valves, Flanged and Threaded Ends
- 1.3.6.7. SP-110-2010 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.3.7. NSF International (NSF):

- 1.3.7.1. 61-2012 Drinking Water System Components – Health Effects
- 1.3.7.2. 372-2011 Drinking Water System Components – Lead Content

1.4. SUBMITTALS

1.4.1. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION

1.4.2. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

- 1.4.2.1. Ball Valves.
 - 1.4.2.2. Gate Valves.
 - 1.4.2.3. Butterfly Valves.
 - 1.4.2.4. Balancing Valves.
 - 1.4.2.5. Check Valves.
 - 1.4.2.6. Globe Valves.
 - 1.4.2.7. Water Pressure Reducing Valves and Connections.
 - 1.4.2.8. Backflow Preventers.
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- 1.4.2.9. Vacuum Breakers
- 1.4.2.10. Expansion tanks – potable water
- 1.4.2.11. Chain wheels.
- 1.4.2.12. Thermostatic Mixing Valves.
- 1.4.2.13. Trap primer devices
- 1.4.2.14. Strainers
- 1.4.2.15. Non-freezing wall hydrants

1.4.3. Test and Balance reports for balancing valves.

1.4.4. Piping diagrams of thermostatic mixing valves to be installed.

1.5. DELIVERY, STORAGE, AND HANDLING

1.5.1. Valves shall be prepared for shipping as follows:

- 1.5.1.1. Protect internal parts against rust and corrosion.
- 1.5.1.2. Protect threads, flange faces, grooves, and weld ends.
- 1.5.1.3. Set angle, gate, and globe valves closed to prevent rattling.
- 1.5.1.4. Set ball and plug valves open to minimize exposure of functional surfaces.
- 1.5.1.5. Set butterfly valves closed or slightly open.
- 1.5.1.6. Block check valves in either closed or open position.

1.5.2. Valves shall be prepared for storage as follows:

- 1.5.2.1. Maintain valve end protection.
- 1.5.2.2. Store valves indoors and maintain at higher than ambient dew point temperature.

PART 2 - PRODUCTS

2.1. VALVES, GENERAL

2.1.1. Asbestos packing and gaskets are prohibited.

2.1.2. All valves shall have seats, stem seals and disc materials compatible with intended fluid, temperature, pressure and service.

2.1.3. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.

- 2.1.4. Valves in insulated piping shall have 50 mm (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.
- 2.1.5. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.
- 2.1.6. All valves used to supply potable water shall meet the requirements of NSF 61 and NSF 372.
- 2.1.7. Unless noted otherwise, valves shall be same size as piping.
- 2.1.8. Standards of acceptance: Crane, Toyo, Kitz, Milwaukee Valve, Appolo Valves, Watts Industries

2.2. SHUT-OFF VALVES

2.2.1. Cold, Hot and Re-circulating Hot Water:

- 2.2.1.1. Ball Valves: Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.
- 2.2.1.2. Butterfly Valves: Flanged Joint Non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated butterfly valves, each complete with a coated cast ductile iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for domestic water bubble-tight dead end service with valve in position and either side of connecting piping removed. Butterfly valves to and including 100 mm (4") dia. are to be equipped with lever handles. Butterfly valves larger than 100 mm (4") dia. are to be equipped with worm gear operators.

2.3. BALANCING VALVES

- 2.3.1. Hot Water Re-circulating, 75 mm or DN75 (3 inches) and smaller: manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (1/4 inch NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without
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disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.

2.3.2. Standard of Acceptance: Armstrong, Bell&Gossett, T&A suitable for potable water.

2.4. CHECK VALVES

2.4.1. 75 mm or DN75 (3 inches) and smaller shall be Class 125, bronze swing check valves with bronze disc suitable for type of service. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.

2.4.2. 100 mm or DN100 (4 inches) and larger: Check valves shall be Class 125, iron swing check valve, bronze disk, with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.

2.4.3. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

2.5. GLOBE VALVES

2.5.1. 75 mm or DN75 (3 inches) or smaller: Class 150, bronze globe valve with non-metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B62 with solder ends, copper-silicon bronze stem, PTFE or TFE disc, and malleable iron hand wheel.

2.5.2. Larger than 75 mm or DN75 (3 inches): Similar to above, except with cast iron body and bronze trim, Class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A126 with flanged ends, bronze trim, and malleable iron handwheel.

2.6. WATER PRESSURE REDUCING VALVE AND CONNECTIONS

2.6.1. 75 mm or DN75 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The pressure reducing valve shall meet ASSE 1003. The bronze bell housing and access cap shall be

threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.

- 2.6.2. The regulator shall have a tap for pressure gauge.
- 2.6.3. The regulator shall have a temperature rating of 100 degrees C (212 degrees F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9 kPa (+/- 1 psig).
- 2.6.4. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.
- 2.6.5. Connections Valves and Strainers: Shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gage shall be installed on the inlet and outlet of the valve.
- 2.6.6. Standard of Acceptance: Watts, Zurn, Powers

2.7. **BACKFLOW PREVENTERS**

2.7.1. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination.

2.7.2. Premises isolation Backflow Preventers

2.7.2.1. *50 mm (2 inches) and smaller*

- 2.7.2.1.1. Double Check Valve Assembly shall be installed at each noted location.
 - 2.7.2.1.2. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a single access cover secured with stainless steel bolts.
 - 2.7.2.1.3. The Double Check Valve Assemblies shall be constructed using Lead Free* cast copper silicon alloy.
 - 2.7.2.1.4. The assembly shall also include two resilient seated isolation valves; four top mounted, resilient seated test cocks.
 - 2.7.2.1.5. The assembly shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510.
 - 2.7.2.1.6. Standard of Acceptance: Watts Series LF007.
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2.7.2.2. *65 mm (2½ inches) and larger*

- 2.7.2.2.1. Double Check Valve Assembly shall consist of two independent tri-link check modules within a single housing, sleeve access port, four test cocks and two drip tight OS&Y gate-type shut-off valves.
- 2.7.2.2.2. Tri-link checks shall be removable and serviceable, without the use of special tools. The housing shall be constructed of 304 Schedule 40 stainless steel pipe with groove end connections.
- 2.7.2.2.3. Tri-link checks shall have reversible elastomer discs and in operation shall produce drip tight closure against reverse flow caused by backpressure or back siphonage.
- 2.7.2.2.4. Standard of acceptance: Watts Series 757, 757N.

2.7.3. Connections between domestic water and HVAC make-up water systems

- 2.7.3.1. Application: make-up water connections to heating systems, chilled water systems, glycol systems, cooling tower systems, irrigation systems, hose bibbs.
- 2.7.3.2. 6 mm to 75 mm (¼ to 3 inches)
- 2.7.3.3. Reduced Pressure Zone Assembly shall be installed at each potential health hazard location to prevent backflow due to backsiphonage and/or backpressure.
- 2.7.3.4. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts. Body and shutoffs shall be constructed using Lead Free* cast copper silicon alloy materials.
- 2.7.3.5. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511; CSA B64.4.
- 2.7.3.6. Standard of Acceptance: Watts Series LF009.

2.7.4. Vacuum Breakers

- 2.7.4.1. Atmospheric vacuum breakers shall be installed in the following applications.
 - 2.7.4.1.1. Hose bibbs.
 - 2.7.4.1.2. Wall hydrants
 - 2.7.4.1.3. Irrigation systems
 - 2.7.4.1.4. All kitchen equipment, if not protected by air gap.
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- 2.7.4.2. A spill-resistant atmospheric vacuum breaker shall be installed, in accordance with the manufacturer's instructions, as noted on the plans and specified herein.
- 2.7.4.3. The Lead Free* Atmospheric Vacuum Breaker shall be constructed using Lead Free* materials. Lead Free atmospheric vacuum breaker shall comply with provincial codes and standards where applicable, requiring reduced lead content.
- 2.7.4.4. The valve shall consist of a one piece modular check and float assembly made of engineered thermoplastic and housed in a Lead Free cast copper silicon alloy body. Springs shall be stainless steel. The valve shall be constructed with a molded diaphragm separating the air inlet from the potable water supply to prevent spillage.
- 2.7.4.5. Standard of Acceptance: Watts Series LF289.

2.8. STRAINERS

- 2.8.1. Minimum service rating of 860 kPa (125 psi) gauge pressure or 1½ times system pressure whichever is greater.
- 2.8.2. Cast iron body, cleanable Y pattern, Wye-pattern, removable stainless steel 20 (standard) mesh screen.
- 2.8.3. NSF 61/ANSI 372 compliant.
- 2.8.4. NPS 50 mm (2") nominal and under, screwed with brass cap.
- 2.8.5. NPS 65 mm (2½") and over flanged with bolted cap. Threaded screwed off center opening; blow down valve same diameter as threaded opening.
- 2.8.6. Standard of Acceptance; Zurn, Watts, Apollo

2.9. EXPANSION TANKS

2.9.1. Application

- 2.9.1.1. For use in closed, potable hot water systems to control pressure build-up and protect the water heater.
- 2.9.1.2. Accepts expanded water as system temperature rises and returns hot water to system when demand occurs.

2.9.2. Construction

- 2.9.2.1. Shell: High Strength Steel
- 2.9.2.2. Diaphragm: Heavy Duty Butyl NSF/ANSI 61
- 2.9.2.3. Liner: Antimicrobial
- 2.9.2.4. System Connection: Stainless Steel
- 2.9.2.5. Water Circulator: Patented Turbulator™
- 2.9.2.6. Air Valve: Projection Welded
- 2.9.2.7. Air Valve Cap: Patented InSight™ Indicator Cap
- 2.9.2.8. Factory Precharge:
 - 2.9.2.8.1. In-Line Models: 50 PSIG (3.5 bar)
 - 2.9.2.8.2. Stand Models: 40 PSIG (2.8 bar)

2.9.3. Performance

- 2.9.3.1. Max. Operating Temperature: 200° F (93° C)
- 2.9.3.2. Max. Working Pressure: 150 PSIG (10.3 bar)
- 2.9.3.3. Warranty:
 - 2.9.3.3.1. In-line models: 7-Year Limited
 - 2.9.3.3.2. Floor mounted models: 1-Year Limited

2.9.4. Standard of Acceptance: Amtrol

2.10. TRAP PRIMERS

2.10.1. Pressure operated (max. 4 traps)

- 2.10.1.1. Diaphragm operated primer with 13 mm (½") NPT connection, automatically activated when the pressure drops. Operating range of 138 to 552 kPa (20 to 80 psig) for a maximum of four (4) drain traps. To be installed on a cold fresh water line of 38 mm (1½") or less. Max. distance between trap primer and most remote trap: as per manufacturer's instruction
- 2.10.1.2. Provide ½" Type K hard copper tubing connection between trap primer valve and floor drain.
- 2.10.1.3. Acceptable product: PPP Oregon series.

2.10.2. Electronic trap primer (max. 12 traps)

- 2.10.2.1. With 13 mm (½") NPT connection, for a maximum of twelve (12) drain traps.
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- 2.10.2.2. Supplied in a NEMA 1 box, power supply 115V. To be installed on a cold fresh water line of 38 mm (1½") or less. The prime-time priming assembly will supply a minimum of 600 ml (1 oz.) of potable water at 20 PSIG at a preset factory setting of 6 seconds every 24 hours.
- 2.10.2.3. The entire unit is pre-assembled in a steel cabinet ready to be either surface or flush wall mounted. The Priming assembly must be mounted above the finished floor.
- 2.10.2.4. Factory assembled with a bronze body ball valve, water hammer arrestor, solenoid valve, atmospheric vacuum breaker, 24 hour timer, 3/4" NPT connection, and a type L copper manifold. Electronic single point power connection 120V/1 amp draw and manual override switch
- 2.10.2.5. Provide ½" Type K hard copper tubing connection between trap primer valve and floor drain.
- 2.10.2.6. Acceptable product: PPP PTS series.

2.11. WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- 2.11.1. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel.
- 2.11.2. Provide arrestors at all solenoid valves and on branch supplies to each fixture or group of fixtures and where indicated. Conform to ASSE-1010. Stainless steel or copper construction.
- 2.11.3. Water-hammer arrestors dimension must be conform to ASSE-1010. Water inlet maximum pressure is 468.8 kPa (68 psi). NSF 61/ANSI 372 compliant.
- 2.11.4. Standard of Acceptable: Watts, Zurn, PPP

2.12. NON FREEZING WALL HYDRANTS

- 2.12.1. Wall type, recessed 177 x 177 (7" x 7") box, bronze or stainless steel; nickel finish, polished face brass valve with vacuum breaker, copper casing and key NPS 18 mm (¾").
 - 2.12.2. Standards of Acceptance: Jay-R. Smith, Zurn, Watts.
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2.12.3. Hose bib for garbage room: Recessed valve with 75 mm (3") center to center, screwdriver operated integral stops, C & F indexed cross handle, vacuum breaker for hose, spring loaded, lever operated self closing stop and check, 1500 mm (5') long flexible hose and spray. Mounted 1200 mm (4') above floor.

2.12.4. Acceptable Product: Cambridge Brass 53T4543, 53T5547.

2.13. CHAIN WHEELS

2.13.1. Valve chain wheel assembly with sprocket rim brackets and chain shall be constructed according to the following:

- 2.13.1.1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
- 2.13.1.2. Attachment: For connection to butterfly or valve stem.
- 2.13.1.3. Sprocket rim with chain guides: Ductile or cast iron of type and size required for valve with zinc coating.
- 2.13.1.4. Chain: hot dipped galvanized steel of size required to fit sprocket rim.

2.14. THERMOSTATIC MIXING VALVES

2.14.1. Thermostatic Thermostatic Mixing Valves shall comply with the following general performance requirements:

- 2.14.1.1. Shall meet ASSE requirements for water temperature control.
 - 2.14.1.2. The body shall be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
 - 2.14.1.3. No special tool shall be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
 - 2.14.1.4. Valve shall be able to be placed in various positions without making temperature adjustment or reading difficult.
 - 2.14.1.5. Valve shall allow easy temperature adjustments to allow hot water circulation. Internal parts shall be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.
 - 2.14.1.6. Parts shall be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
 - 2.14.1.7. Valve shall have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature shall be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.
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2.14.1.8. Standards of Acceptance: Lawler, Powers

2.14.2. Hi-Lo Water-Mixing-Valve Assemblies:

2.14.2.1. N/A

2.14.3. Water Temperature Limiting Devices(point of use tempering valves)

2.14.3.1. Application: Single plumbing fixture point-of-use such as sinks or lavatories.

2.14.3.2. Standard: ASSE 1070.

2.14.3.3. Pressure Rating: 861 kPa (125 psig).

2.14.3.4. Thermostatic tempering valve shall be constructed using lead free* cast copper silicon alloy material.

2.14.3.5. The valve shall feature advanced paraffin-based actuation technology and union connections for ease of maintenance. All internal components shall be corrosion-resistant. Valve shall feature integral checks to prevent crossflow and inlet screens to filter out debris. The valve shall be asse 1069, ASSE 1070, ASSE 1017 and IAPMO CUPC listed.

2.14.3.6. Capacity of the valve shall be up to 12.0 gpm (45.0 lpm) at 45psi (310 kpa) differential. Valve shall perform to a minimum flow of 0.5 gpm (2 lpm) to ASSE 1070.

2.14.3.7. Control temperature shall be adjustable between 80°F - 120°F (27 - 49°C). The valve shall feature a vandal-resistant lockable handle to prevent tampering.

2.14.3.8. Standard of acceptance: Powers Hydroguard LFLM 495. Max. Pressure drop: 5 psi (34.5 kPa).

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.

3.1.2. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.

3.1.3. Threads on valve and mating pipe shall be examined for form and cleanliness.

3.1.4. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

3.1.5. Do not attempt to repair defective valves; replace with new valves.

3.2. INSTALLATION

3.2.1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

3.2.2. Valves Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

3.2.3. Valves shall be located for easy access and shall be provide with separate support.

3.2.4. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

3.2.5. Valves shall be installed in horizontal piping with stem at or above center of pipe.

3.2.6. Valves shall be installed in a position to allow full stem movement.

3.2.7. Install chain wheels on operators for all valves 100 mm (4 inches) and larger and more than 3.6 m (12 feet) above floor. Chains shall be extended to 1524 mm (60 inches) above finished floor.

3.2.8. Check valves shall be installed for proper direction of flow and as follows:

3.2.8.1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.

3.2.8.2. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.

3.2.8.3. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3.2.8.4. Install pressure gages on outlet of backflow preventers.

3.2.8.5. Do not install bypass piping around backflow preventers.

3.2.9. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.

3.2.10. Install cabinet-type units recessed in or surface mounted on wall as specified.

3.3. STRAINERS

3.3.1. Install upstream of all:

3.3.1.1. Solenoid valves

3.3.1.2. Pressure reducing valves

3.4. WATER HAMMER ARRESTORS

3.4.1. Arrestors should always be installed so that there is an unobstructed shock path to the arrestor. Doing otherwise could result in shake and rattle of the pipes when the valve is closed.

3.4.2. Arrestors should always be placed as near to the source of shock as possible (shower valves, dishwashers, laundry machines, flush valves) - one each on the hot and cold water lines.

3.4. ELECTRONIC TRAP PRIMING

3.4.1. Make all wiring and power supply connections in accordance with the manufacturer's instructions.

3.5. THERMOSTATIC MIXING VALVES

3.5.1. Install and pipe in strict accordance with the manufacturer's instructions

3.5.2. Provide all accessories required by the manufacturer's instructions (balancing valves, check valves, etc)

3.5.3. Start-up and adjustment: by manufacturer's representative

3.6. LABELING AND IDENTIFYING

3.6.1. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

3.6.2. Calibrated balancing valves.

3.6.3. Master, thermostatic, water mixing valves.

- 3.6.4. Manifold, thermostatic, water-mixing-valve assemblies.
- 3.6.5. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.7. ADJUSTING

- 3.7.1. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves shall be replaced if persistent leaking occurs.
- 3.7.2. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- 3.7.3. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- 3.7.4. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the Client.

3.8. DEMONSTRATION AND TRAINING

- 3.8.1. Provide services of manufacturer's technical representative for four hours to instruct Board's Personnel in operation and maintenance of the system.
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PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- 1.1.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

1.2.1. Section Includes:

- 1.2.1.1. Equipment labels.
- 1.2.1.2. Pipe labels.
- 1.2.1.3. Valve tags.
- 1.2.1.4. Warning tags.

1.3. ACTION SUBMITTALS

- 1.3.1. Product Data: For each type of product indicated.
- 1.3.2. Samples: For color, letter style, and graphic representation required for each identification material and device.
- 1.3.3. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- 1.3.4. Valve numbering scheme.
- 1.3.5. Valve Schedules: For each piping system to include in maintenance manuals.

1.4. COORDINATION

- 1.4.1. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
 - 1.4.2. Coordinate installation of identifying devices with locations of access panels and doors.
 - 1.4.3. Install identifying devices before installing acoustical ceilings and similar concealment.
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1.5. WORK INCLUDED

- 1.5.1. Furnish and install nameplates, valve tags, valve charts, and pipe markers on all Plumbing equipment, and piping.
- 1.5.2. Provide nameplates with the unit number and service designation on all plumbing equipment.
- 1.5.3. Indicate all valve tag numbers on As-Built Drawings and submit framed under glass valve tag charts including valve service and location.
- 1.5.4. Install color coded ceiling tacks in acoustical tile ceilings or color coded tape on ceiling grid to identify location of equipment, valves and dampers that require regular maintenance or are part of a life safety system (fire dampers, smoke dampers, sprinkler valves or main isolation valves).

PART 2 - PRODUCTS

2.1. GENERAL

- 2.1.1. Acceptable manufactures contingent on compliance with the specification.
 - 2.1.1.1. Seton
 - 2.1.1.2. Brady Corporation
 - 2.1.1.3. Marking Services Incorporated

2.2. EQUIPMENT NAMEPLATES

- 2.2.1. Metal Labels for Equipment:
 - 2.2.1.1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having pre-drilled or stamped holes for attachment hardware.
 - 2.2.1.2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 2.2.1.3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
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- 2.2.2. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 2.2.3. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 - 2.2.4. Plastic Labels for Equipment:
 - 2.2.4.1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2.2.4.2. Letter Color: White.
 - 2.2.4.3. Background Color: Black.
 - 2.2.4.4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 2.2.4.5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 2.2.4.6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 2.2.5. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 2.2.6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 - 2.2.7. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
 - 2.2.8. Label is to also indicate area and type of service being provided.
 - 2.2.8.1. For Example AHU - 3 Services floors 1-4 etc.
 - 2.2.8.2. P3 HHW Pump Services building perimeter
 - 2.2.9. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is
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indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3. PIPE IDENTIFICATION AND VALVE TAGS

2.3.1. General Requirements for Manufactured Pipe Labels:

- 2.3.1.1. Preprinted, color-coded, with lettering indicating service, showing flow direction, and area served (i.e. “domestic cold water”).
- 2.3.1.2. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- 2.3.1.3. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
- 2.3.1.4. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction, and visible all around pipe.
- 2.3.1.5. Lettering Size: At least 38 mm (1-1/2 inches) high.

2.3.2. All piping, except that piping which is within inaccessible chases, shall be identified.

2.3.3. Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the “Scheme for the Identification of Piping Systems” (ASME A13.1-1981).

2.3.4. Setmark snap-around markers shall be used for overall diameters up to 6” and straparound markers shall be used above 6” overall diameters.

2.3.5. Markers shall be located:

- 2.3.5.1. Adjacent to each valve
- 2.3.5.2. At each branch
- 2.3.5.3. At each cap for future
- 2.3.5.4. At each riser takeoff,
- 2.3.5.5. At each pipe passage through wall (each side)
- 2.3.5.6. At each pipe passage at 20' – 0" intervals maximum.
- 2.3.5.7. At each piece of equipment.
- 2.3.5.8. At all access doors.
- 2.3.5.9. A minimum of one (1) marker shall be provided at each room.

2.3.6. Valve tags

- 2.3.6.1. All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall include what room(s) the valve serves and piece of equipment served.
- 2.3.6.2. Valve tags shall be according to project valve specification section(s). Unless required differently in project valve specification section(s), valve tags to be minimum 1.5" round brass, attached with metallic chains.

2.3.7. Plumbing tags shall be square 2" x 2" similar to Seton 42769.

2.3.8. Lettering shall be ¼" high for type service and ½" for valve number. Tag shall indicate service and valve number.

2.3.9. Each service shall be a different color.

2.3.10. Tag shall be attached to valves with chain similar to Seton No 16 stainless steel jack chain.

2.3.11. Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.

2.3.12. Provide a tag for every valve except:

- 2.3.12.1. Plumbing equipment shut-off valves

2.3.13. Printed framed valve lists shall be displayed in each Mechanical Room or in a location designated by the Board.

PART 3 - EXECUTION

3.1. PREPARATION

- 3.1.1. All surfaces shall be cleaned and insulated (if applicable) prior to installing any identification.
- 3.1.2. Exterior surfaces of outdoor equipment shall be dry and prepared to accept the specified identification.

3.2. INSTALLATION

- 3.2.1. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion. Seal with clear lacquer.
 - 3.2.2. Install valve tags with chain.
 - 3.2.3. Install plastic pipe markers in accordance with manufacturer's Instructions.
 - 3.2.4. Install plastic tape markers complete around pipe in accordance with manufacturer's instructions.
 - 3.2.5. Identify pumps, domestic hot water heaters, fire pumps, heat transfer equipment tanks, water treatment devices, etc. with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
 - 3.2.6. Identify control panels and major control components outside panels with plastic nameplates.
 - 3.2.7. Identify thermostats relating to air handling equipment serving multiple spaces.
 - 3.2.8. Identify valves in main and branch piping with valve tags.
 - 3.2.9. Tag automatic controls, instruments and relays. Key to control schematic.
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PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. Field applied insulation for thermal efficiency and condensation control for Plumbing piping and equipment.
- 1.1.2. Re-insulation of plumbing piping and equipment after asbestos abatement.
- 1.1.3. Definitions
 - 1.1.3.1. ASJ: All service jacket, white finish facing or jacket.
 - 1.1.3.2. Concealed: Piping above ceilings and in chases, interstitial space, and pipe chases.
 - 1.1.3.3. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 1.1.3.4. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
 - 1.1.3.5. Thermal conductance: Heat flow rate through materials.
 - 1.1.3.6. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
 - 1.1.3.7. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). or the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.

1.2. RELATED WORK

- 1.2.1. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 22/23.

1.3. QUALITY ASSURANCE

- 1.3.1. Criteria:
 - 1.3.2. Comply with OBC requirements for flame spread and smoke development rates.
 - 1.3.3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
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- 1.3.4. 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.
- 1.3.5. 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

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION

1.4.2. Shop Drawings:

- 1.4.2.1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
- 1.4.2.2. Insulation materials: Specify each type used and state surface burning characteristics.
- 1.4.2.3. Insulation facings and jackets: Each type used.
- 1.4.2.4. Insulation accessory materials: Each type used.
- 1.4.2.5. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
- 1.4.2.6. Make reference to applicable specification paragraph numbers for coordination.

1.5. STORAGE AND HANDLING OF MATERIAL

- 1.5.1. 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.

1.6. 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 basic designation only.
 - 1.6.2. National Fire Protection Association (NFPA):
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- 1.6.2.1. 101-09 Life Safety Code
- 1.6.2.2. 251-06 Standard methods of Tests of Fire Endurance of Building Construction Materials
- 1.6.2.3. 255-06 Standard Method of tests of Surface Burning Characteristics of Building Materials

1.6.3. Underwriters Laboratories, Inc (UL):

- 1.6.3.1. 723 UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 08/03

1.6.4. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

- 1.6.4.1. SP58-2002 Pipe Hangers and Supports Materials, Design, and Manufacture

1.7. STANDARDS OF ACCEPTANCE

- 1.7.1. Owens/Corning, Knauf, Johns Mansville

PART 2 - PRODUCTS

2.1. MINERAL FIBER OR FIBER GLASS - PIPING

- 2.1.1. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), class 1, k = 0.037 (0.26) at 24 degrees C (75 deg. F), for use at temperatures from -20 deg. C (-4 deg.F) and up to 230 deg.C (450 deg. F)with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
 - 2.1.2. Application: all domestic water supply piping (hot, cold, recirculation), all horizontal sections of storm drains.
 - 2.1.3. Thickness:
 - 2.1.3.1. Piping larger than 75mm (3"): 38 mm thickness
 - 2.1.3.2. Piping nominal 25mm-75mm (1-3"): 25 mm thickness
 - 2.1.3.3. Piping nominal 19mm (3/4") and less: 12 mm thickness
 - 2.1.3.4. Outdoor insulation (any size): increase insulation thickness by 12 mm (1/2")
 - 2.1.4. At fittings and flanges (including water meter and body of roof drains), insulate with wrapped fiberglass insulation of same thickness as adjacent pipe, and cover with pre-molded PVC jackets. Seal edge of jacket with self-sealing vapor barrier tape.
 - 2.1.5. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.
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2.2. HOT EQUIPMENT INSULATION

- 2.2.1. Application: Bare DHW storage tanks, tube-in-shell heat exchangers, hot water expansion tanks
- 2.2.2. Insulate all equipment with surface temperature over 100°F, using rigid fiberglass insulation board. Insulation: ASTM C612 Class 2, conductivity of 0.23 @75F, density of 6.0. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.2, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.
- 2.2.3. Apply insulation in thickness as follows: 1-1/2" (38 mm) for operating temperature up to 150°F, 2" (50 mm) for operating temperature of 150F to 200F, 3" (75 mm) for operating temperature over 200°F. Cut, score, or miter insulation to fit contour of equipment and secure with galvanized steel bands or wire, or weld pins. Stagger joints where possible and fill voids with insulating cement. Apply 1" galvanized wire mesh over entire exterior surface and finish with two coats of insulating cement troweled to a hard finish.
- 2.2.4. Tape: self adhesive, 100 mm wide.

2.3. INSULATION FACINGS AND JACKETS

- 2.3.1. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets.
- 2.3.2. Facings and jackets
 - 2.3.2.1. Concealed indoor areas:
 - 2.3.2.1.1. Shall be all service type (ASJ) in concealed spaces and PVC Vapor Retarder jacketing in all exposed areas, including mechanical rooms and service areas.
 - 2.3.2.1.2. All service Jacket (ASJ) shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
 - 2.3.2.1.3. Standard of Acceptance: Zeston, Ceeco, Proto

2.3.2.2. Piping in exposed indoor areas and Equipment:

2.3.2.2.1. Shall be heavy PVC fitting covers (0.75 mm thickness. Overlap PVC covers on pipe insulation jackets as least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

2.3.2.3. Indoor Fittings Jackets

2.3.2.3.1. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

2.3.2.4. Adhesive for piping: Compatible with PVC jacket, and recommended by insulation material manufacturer.

2.3.2.4.1. Standard of Acceptance: Zeston, Ceeco, Proto

2.3.2.5. Hot Equipment

2.3.2.5.1. ULC listed plain weave, cotton fabric canvas, 220 g/m². Fastening: Washable adhesive for cementing canvas lagging cloth to equipment insulation.

2.4. PIPE COVERING PROTECTION SADDLES

2.4.1. Cold pipe support - indoors: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

2.4.2. Warm or hot pipe supports - indoors: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

2.5. ADHESIVE, MASTIC, CEMENT

2.5.1. Insulation manufacturers' published recommendations.

2.6. MECHANICAL FASTENERS

2.6.1. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.

2.6.2. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.7. FLAME AND SMOKE

2.7.1. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1. GENERAL REQUIREMENTS

3.1.1. 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.

3.1.2. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

3.1.3. Insulation materials shall be installed in a first class manner 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).

3.1.4. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

- 3.1.5. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
 - 3.1.6. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
 - 3.1.7. 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.
 - 3.1.8. Plumbing work not to be insulated:
 - 3.1.8.1. Piping and valves of fire protection system.
 - 3.1.8.2. Factory pre-insulated components.
 - 3.1.8.3. Over equipment nameplates.
 - 3.1.8.4. Chromium plated brass piping.
 - 3.1.8.5. Water piping in contact with earth.
 - 3.1.8.6. Vibration control devices
 - 3.1.8.7. Air chambers, unions, strainers, check valves, flow regulators.
 - 3.1.8.8. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
 - 3.1.9. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
 - 3.1.10. Firestop Pipe insulation:
 - 3.1.10.1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed.
 - 3.1.10.2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - 3.1.10.2.1. Pipe risers through floors
 - 3.1.10.2.2. Pipe chase walls and floors
 - 3.1.10.2.3. Smoke partitions
 - 3.1.10.2.4. Fire partitions
-

3.1.10.2.5. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide where indicated on the drawings

3.1.11. Provide additional vapor barrier jackets over insulation as follows:

3.1.11.1. All piping exposed to outdoor weather.

3.1.11.2. All interior piping conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.

3.1.12. Provide metal jackets over insulation as follows:

3.1.12.1. All plumbing piping exposed to outdoor weather.

3.2. INSULATION INSTALLATION

3.2.1. Molded Mineral Fiber/Fiberglass Pipe and Tubing Covering:

3.2.1.1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

3.2.2. Contractor's options for fitting, flange and valve insulation:

3.2.2.1. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

3.2.2.2. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3.2.2.3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

3.2.3. Hot Equipment Insulation

- 3.2.3.1. Cut, score, or miter insulation to fit contour of equipment and secure with galvanized steel bands or wire, or weld pins. Stagger joints where possible and fill voids with insulating cement. Apply 1" galvanized wire mesh over entire exterior surface and finish with two coats of insulating cement troweled to a hard finish.

3.3. FIELD-APPLIED JACKET APPLICATION

- 3.3.1. Apply PVC jacket where indicated, with 1 inch (25 mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- 3.3.2. Apply metal jacket where indicated, with 2-inch (50 mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel band 12 inches (300 mm) o.c. and at end joints. Provide vapor-barrier jackets. Aluminum jackets shall have seams located below the horizontal plane of the horizontal piping route. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and cover with aluminum jackets.

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2. RELATED WORK

- 1.2.1. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
1.2.2. Section 22 07 11, INSULATION - PLUMBING.

1.3. SUBMITTALS

- 1.3.1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION
1.3.2. Manufacturer's Literature and Data: All items listed in Part 2 - Products.

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. Ontario Building Code – Part 7

- 1.4.3. American National Standards Institute (ANSI):

- | | | |
|----------|-------------|--|
| 1.4.3.1. | A13.1 | Scheme for Identification of Piping Systems |
| 1.4.3.2. | B16.3-2011 | Malleable Iron Threaded Fittings Classes 150 and 300 |
| 1.4.3.3. | B16.9-2007 | Factory-Made Wrought Butt Welding Fittings |
| 1.4.3.4. | B16.11-2011 | Forged Fittings, Socket-Welding and Threaded |
| 1.4.3.5. | B16.15-2006 | Cast Copper Alloy Threaded Fittings Classes 125 and 250 |
| 1.4.3.6. | B16.18-2001 | Cast Copper Alloy Solder-Joint Pressure Fittings |
| 1.4.3.7. | B16.22-2012 | Wrought Copper and Copper Alloy Solder Joint Pressure Fittings |

- 1.4.4. American Society for Testing and Materials (ASTM):

- | | | |
|----------|---------------|-----------------------------------|
| 1.4.4.1. | A183-03(2009) | Carbon Steel Track Bolts and Nuts |
| 1.4.4.2. | B32-08 | Solder Metal |
| 1.4.4.3. | B61-08 | Steam or Valve Bronze Castings |
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- 1.4.4.4. B75/B75M-11 Seamless Copper Tube
- 1.4.4.5. B88-09 Seamless Copper Water Tube
- 1.4.4.6. B584-12a Copper Alloy Sand Castings for General Applications
- 1.4.4.7. B687-99(2011) Brass, Copper, and Chromium-Plated Pipe Nipples
- 1.4.4.8. E1120-08 Liquid Chlorine
- 1.4.4.9. E1229-08 Calcium Hypochlorite

1.4.5. American Water Works Association (AWWA):

- 1.4.5.1. C110/A21.10-12 Ductile Iron and Gray Iron
- 1.4.5.2. C151/A21.51-09 Ductile-Iron Pipe, Centrifugally Cast
- 1.4.5.3. C153/A21.53-11 Ductile-Iron Compact Fittings
- 1.4.5.4. C651-05 Disinfecting Water Mains

1.4.6. NSF International (NSF)

- 1.4.6.1. NSF/ANSI 61 (2012) Drinking Water System Components – Health Effects
- 1.4.6.2. NSF/ANSI 372 (2011) Drinking Water System Components – Lead Content

1.5. QUALITY ASSURANCE

- 1.5.1. All piping materials shall be compatible for temperature, pressure and service.
- 1.5.2. All piping materials of a given type shall be manufactured by a single source, and supplied by a single supplier.
- 1.5.3. All wetted seals shall be made from materials that are immune from chloramine degradation.
- 1.5.4. All joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
- 1.5.5. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in
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accordance with NSF/ANSI 61 or NSF 372. Endpoint devices used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.

2.2. ABOVE GROUND (INTERIOR) WATER PIPING

2.2.1. Pipe: Copper tube, ASTM B88, Type K or L, drawn.

2.2.2. Fittings for Copper Tube:

2.2.2.1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints. Use 95/5 tin and antimony for all soldered joints.

2.2.2.2. Adapters: Provide adapters for joining screwed pipe to copper tubing.

2.2.3. Unions And Flanges

2.2.3.1. Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.

2.2.3.2. 50 mm (2") and smaller copper unions:

2.2.3.2.1. ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

2.2.3.3. 65 mm (2½ ") and larger flanges:

2.2.3.3.1. ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

2.2.4. Solder: For installation of the potable water systems, only lead free solder shall be used, as required by the Ontario Act. Regulation 815/84 of the Ontario Water Resources.

2.3. EXPOSED WATER PIPING

2.3.1. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment when not concealed.

2.3.2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish.

2.3.3. Nipples: ASTM B 687, Chromium-plated.

2.3.4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 2-1/2 inches (65 mm) and larger shall be flange type with approved gaskets.

2.4. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome plated brass piping is not required.

2.5. TRAP PRIMER WATER PIPING:

2.5.1. Pipe: Copper tube, ASTM B88, type K, hard drawn.

2.5.2. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.

2.5.3. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.6. STRAINERS

2.6.1. Provide on high pressure side of pressure reducing valves, upstream of solenoid valves, on suction side of pumps, 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.

2.6.2. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

2.6.3. Body: Smaller than 3 inches (80 mm), brass or bronze; 3 inches (80 mm) and larger, cast iron or semi-steel.

2.7. DIELECTRIC FITTINGS

2.7.1. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.8. STERILIZATION CHEMICALS

2.8.1. Hypochlorite: ASTM E1120-08

2.8.2. Liquid Chlorine: ASTM E1229-08

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment.
 - 3.1.2. 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.
 - 3.1.3. Install union and shut-off valve on pressure piping at connections to equipment.
 - 3.1.4. Lay out pipe lines straight, plumb and in true alignment. Offset as required to avoid interference with other work, to conceal piping, to allow maximum headroom and to avoid interference with windows and doors. Lay out all pipes and establish their levels from bench marks, existing floors or finished grades.
 - 3.1.5. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment
 - 3.1.6. Piping shall be concealed unless indicated otherwise on drawings. Do not conceal piping until it has been inspected, tested, flushed and approved.
 - 3.1.7. Use eccentric reducing fittings to increase or decrease pipe sizes. Bushings are not acceptable. Orient reducers to prevent trapping of water.
 - 3.1.8. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves. Install hot and cold water lines at least 6 inches apart. Install piping at least 3 inches clear of electrical conduit and avoid running pipe within 3'-6" of electrical equipment, from floor to ceiling.
 - 3.1.9. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
 - 3.1.10. All domestic water piping shall be insulated throughout. For cold water, use vapor barrier.
 - 3.1.11. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.
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3.2. COPPER PIPE JOINTS

- 3.2.1. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.3. THREADED PIPE JOINTS

- 3.3.1. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.4. PIPE HANGERS, SUPPORTS AND ACCESSORIES:

- 3.4.1. All piping shall be supported per the requirements of the Ontario Building Code part 7
- 3.4.2. 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.
- 3.4.3. Floor, Wall and Ceiling Plates, Supports, Hangers:
- 3.4.3.1. Solid or split un-plated cast iron.
 - 3.4.3.2. All plates shall be provided with set screws.
 - 3.4.3.3. Pipe Hangers: Height adjustable clevis type.
 - 3.4.3.4. Adjustable Floor Rests and Base Flanges: Steel.
 - 3.4.3.5. Concrete Inserts: "Universal" or continuous slotted type.
 - 3.4.3.6. 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.
 - 3.4.3.7. Riser Clamps: Malleable iron or steel.
 - 3.4.3.8. Rollers: Cast iron.
 - 3.4.3.9. Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
 - 3.4.3.10. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree 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.
- 3.4.4. For cold piping, install hangers and supports to maintain an effective continuous thermal and vapor barrier between cold piping and hangers and supports.
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- 3.4.5. Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.
- 3.4.6. With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints.
- 3.4.7. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

3.5. PENETRATIONS:

- 3.5.1. Install pipe sleeves where piping passes through building construction including all walls, floors and ceilings.
- 3.5.2. For new wall construction, promptly and accurately locate and securely set sleeves in forms before concrete is poured. For masonry construction, set the sleeves over the piping for Masonry Contractor to build around.
- 3.5.3. 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 as specified in Section 07 84 00. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
- 3.5.4. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant

3.6. TESTS

- 3.6.1. General: Test system either in its entirety or in sections.
 - 3.6.2. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 150 psi (1040 kPa) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
 - 3.6.3. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.
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3.7. VALVES INSTALLATION

- 3.7.1. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
- 3.7.2. Install union and shut off valve on piping at connections to equipment and at all other locations indicated on the drawings.
- 3.7.3. Provide isolation valves on all main branch feeds to washroom fixture groups. Where possible, locate all valves in accessible ceilings. In hard ceiling areas, group valves to be accessed from one access door.
- 3.7.4. Backflow prevention device shall be installed in an accessible location, 5 (five) feet above finish floor.
- 3.7.5. Connect to fixtures and equipment in accordance with manufacturer's instructions.

3.8. STERILIZATION

- 3.8.1. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with the Ontario Building Code part 7, the requirements of Authorities Having Jurisdiction and AWWA C651.
 - 3.8.2. Use liquid chlorine or hypochlorite for sterilization.
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PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section pertains to storm and sanitary sewer and sanitary vent systems, including piping, equipment and all necessary accessories as designated in this section.

1.2. RELATED WORK

- 1.2.1. Section 01 23 33, SHOP DRAWINGS.
1.2.2. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
1.2.3. Section 22 07 11, PLUMBING INSULATION.

1.3. APPLICABLE PUBLICATIONS

- 1.3.1. 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.

- 1.3.1.1. Ontario Building Code – Part 7

1.4. SUBMITTALS

- 1.4.1. Submittals, including number of required copies, shall be submitted in accordance with Section 01 23 33, SHOP DRAWINGS.
- 1.4.2. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
- 1.4.2.1. Piping.
1.4.2.2. Penetration Sleeves.
1.4.2.3. Pipe Fittings.
1.4.2.4. Exposed Piping and Fittings.
- 1.4.3. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.
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1.5. AS-BUILT DOCUMENTATION

- 1.5.1. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on Auto-Cad version 2007 or higher provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- 1.5.2. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1. UNDERGROUND STORM AND SANITARY DRAINS – GRAVITY FLOW

- 2.1.1. Main line sewers will be PVC SDR35 sewer pipe and shall be in compliance with ASTM D3040 or ASTM F1760 and third party certified to CSA B182.2.
- 2.1.2. Sewer laterals will be PVC SDR28 sewer pipe and shall be third party certified by CSA as above.
- 2.1.3. Joints
- 2.1.3.1. Sealing gaskets must meet the requirements of ASTM D3034 or ASTM F1760, CSA B182.2.
- 2.1.3.2. In addition, the pipe joints must be able to withstand a minimum hydrostatic pressure of 345 kPa (50 psi) without leakage.
- 2.1.4. Pipe Stiffness
- 2.1.4.1. The minimum ring stiffness shall be 320 kPa (46 psi) for SDR35 pipe and 625 kPa (90 psi) for SDR 28.
- 2.1.4.2. This stiffness will be determined using the test methods prescribed by ASTM D3034 and ASTM F1760.
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2.1.5. Fittings

2.1.5.1. Injection-molded gasketed PVC fittings shall meet the requirements of ASTM 3034 and ASTM F1336 and shall be certified to CSA B182.1 or CSA B182.2.

2.1.5.2. Fabricated fittings must conform to ASTM F1336 and CSA B182.2

2.1.6. Standard of Acceptance: IPEX Ring-Tite

2.2. ABOVE GROUND STORM AND SANITARY DRAINS/VENTS - GRAVITY FLOW

2.2.1. Smaller than 75 mm (3") diam.

2.2.1.1. Copper DWV tube sanitary waste, drain and vent drawn temper conforming to ASTM B306.

2.2.1.2. The copper drainage fittings shall be cast copper or wrought copper conforming to CSA B158.1, ASME B16.23 or ASME B16.29.

2.2.1.3. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32

2.2.2. Larger than 100 mm (4") diam

2.2.2.1. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).

2.2.2.2. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CSA B70, ASTM A888, or ASTM A74.

2.2.2.3. Cast iron pipe and fittings shall be made from a minimum of 95 percent post-consumer recycled material.

2.2.2.4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

2.3. ACID RESISTANT PIPING

2.3.1. General

- 2.3.1.1. Acid waste drain and vent system, as shown on drawings, shall be NSF listed, Schedule 40, polypropylene as manufactured by IPEX to include pipe supplied in 10 ft. lengths (or 20 ft lengths if NFRPP is specified), and matched fittings, traps and neutralization tanks from the same manufacturer.
- 2.3.1.2. It shall also include recommended adapters to connect to other piping materials, where applicable.

2.3.2. Material

- 2.3.2.1. Pipe shall be made from NSF listed Type 110 or 210, flame retardant polypropylene conforming to ASTM D4101, with a maximum average flame spread of zero seconds and a maximum extent of burning of 13 mm, in accordance with ASTM D635.
- 2.3.2.2. Matched fittings shall be made from NSF listed flame retardant polypropylene with average maximum burn time of 80 seconds and maximum extent of burning of 20 mm in accordance with ASTM D635.
- 2.3.2.3. If NFRPP pipe is specified, it shall be made from NSF 14 listed and CSA certified Schedule 40 PP as manufactured by IPEX. Pipe shall comply with ASTM F1412 and material used shall comply with the material requirements of ASTM D4101.

2.3.3. Fittings

- 2.3.3.1. Fittings shall be NSF listed, be of all plastic construction and be designed to lock into a machined groove on the mating piping. All fittings shall have integrally molded union connections. No metallic grab rings or clamps shall be allowed.
- 2.3.3.2. Fittings containing EVA (ethylene vinyl acetate) are strictly prohibited. Couplings shall not be added to make mechanical joint fittings. Fittings shall be Labline or approved equivalent.

2.3.4. Joints

- 2.3.4.1. Connections between polypropylene pipe and matched fittings shall be made using the Labline Joint.
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2.3.5. Installation And Testing

- 2.3.5.1. Installation and testing shall be in accordance with the contract drawings, the manufacturer's recommendations and the local plumbing codes. Testing with compressed air is prohibited. The entire system shall be installed free of stress and in proper alignment.
- 2.3.5.2. Horizontal supports shall provide a wide bearing area and be free of burrs or sharp edges. Support spacings shall be in accordance with the manufacturer's recommendations and local plumbing codes.
- 2.3.5.3. Vertical piping shall have riser clamps at each floor. Pipe supports shall be installed so that horizontal piping is in uniform alignment and with a uniform slope of at least 1/8" per foot, or in accordance with the local plumbing codes.

2.3.6. Standard of Acceptance: IPEX Labline

2.4. STORM AND SANITARY DRAINS – PUMPED FLOW

2.4.1.1. Smaller than 75 mm (3") diam above ground:

2.4.1.1.1. Copper pump discharge pipe and fittings:

- Copper tube shall be hard drawn Type K or L conforming to ASTM B88.
- Fittings shall be cast copper alloy conforming to ASME B16.18 or wrought copper conforming to ASME B16.22 with solder joint ends.
- Unions shall be copper alloy, hexagonal stock body with ball and socket, metal to metal seating surface conforming to MSS SP-123 with female solder-joint or threaded ends.
- Flanges shall be Class 150, cast copper conforming to ASME B16.24 with solder-joint end.
- Flange gaskets shall be full face, flat nonmetallic, asbestos free conforming to ASME B16.21.
- Flange nuts and bolts shall be carbon steel conforming to ASME B18.2.1.
- Solder shall be lead free, water flushable flux conforming to ASTM B32 and ASTM B813.

2.4.1.2. Larger than 100 mm (4") diam) above ground

2.4.1.2.1. Galvanized steel pump discharge pipe and fittings:

- Galvanized steel pipe shall be Schedule 40 weight class conforming to ASTM A53/A53M, with square cut grooved or threaded ends to match joining method.
- Fittings shall be Class 125, gray-iron threaded fittings conforming to ASME B16.4.
- Unions shall be Class 150 hexagonal-stock body with ball and socket, metal to metal, bronze seating surface, malleable iron conforming to ASME B16.39 with female threaded ends.
- Flanges shall be Class 125 cast iron conforming to ASME B16.1.
- Flange gaskets shall be full face, flat nonmetallic, asbestos free conforming to ASME B16.21.
- Flange nuts and bolts shall be carbon steel conforming to ASME B18.2.1.

2.4.1.3. All sizes, buried pumped sanitary pipe:

2.4.1.3.1. Polyethylene piping, Series 160 or higher of CAN/CSA-B137.1

2.5. EXPOSED SANITARY PIPING

2.5.1. Chrome plated brass piping of full iron pipe size shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment awwhen not concealed by apron.

2.5.1.1. The Pipe shall meet ASTM B43, regular weight.

2.5.1.2. The Fittings shall conform to ASME B16.15 and ASTM D2665.

2.5.1.3. Nipples shall conform to ASTM B687, Chromium-plated.

2.5.1.4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2 1/2 inches) and larger shall be flange type with approved gaskets.

2.5.2. The finished room classification does not include mechanical Rooms, service rooms. .

2.6. SPECIALTY PIPE FITTINGS

2.6.1. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear

and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

- 2.6.1.1. For cast iron drain pipes, the sleeve material shall be rubber conforming to ASTM C564.
 - 2.6.1.2. For PVC drain pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F477 or ASTM D5926.
 - 2.6.1.3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- 2.6.2. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 861 kPa (125 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.
- 2.6.3. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- 2.6.4. The di-electric nipples shall be electroplated steel nipple complying with ASTM F1545 with a pressure rating of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.7. PENETRATION SLEEVES

- 2.7.1. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1. PIPE INSTALLATION

- 3.1.1. The pipe installation shall comply with the requirements of the Ontario Building Code part 7 and these specifications.
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- 3.1.2. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment.
 - 3.1.3. Provide and size venting to all plumbing fixtures and fixture groups in accordance to Ontario Water Resources Act, Plumbing Code most recent edition, and local authorities having jurisdiction.
 - 3.1.4. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
 - 3.1.5. All pipe runs shall be laid out to avoid interference with other work.
 - 3.1.6. The piping shall be installed above accessible ceilings where possible.
 - 3.1.7. The piping shall be installed to permit valve servicing or operation.
 - 3.1.8. The piping shall be installed free of sags and bends.
 - 3.1.9. Seismic restraint shall be installed where required by code.
 - 3.1.10. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
 - 3.1.11. Provide minimum slope of 1% for all horizontal sections larger than 100 mm (4") diam and 2% for all horizontal sections of 75 mm (3") or less. Buried drain lines and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
 - 3.1.12. Except for where a single sink is served, no buried sanitary line shall be less than 100 mm (4") diam. Run buried piping min 200 mm (8") below the bottom of concrete slabs.
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3.2. JOINT CONSTRUCTION

- 3.2.1. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- 3.2.2. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- 3.2.3. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- 3.2.4. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
 - 3.2.4.1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.
 - 3.2.4.2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
- 3.2.5. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- 3.2.6. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3. SPECIALTY PIPE FITTINGS

- 3.3.1. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- 3.3.2. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4. PIPE HANGERS, SUPPORTS AND ACCESSORIES

- 3.4.1. All piping shall be supported according to the requirement of Ontario Building Code and these specifications. Where conflicts arise between the code, these specifications and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.
- 3.4.2. Hangers, supports, rods, inserts and accessories used for pipe supports shall be painted. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- 3.4.3. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- 3.4.4. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
- 3.4.4.1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
 - 3.4.4.2. 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
 - 3.4.4.3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.
 - 3.4.4.4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.
 - 3.4.4.5. 250 mm or DN250 to 300 mm or DN300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 23 mm (7/8 inch) rod.
- 3.4.5. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).
- 3.4.6. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
- 3.4.6.1. Solid or split un-plated cast iron.
 - 3.4.6.2. All plates shall be provided with set screws.
 - 3.4.6.3. Height adjustable clevis type pipe hangers.
 - 3.4.6.4. Adjustable floor rests and base flanges shall be steel.
 - 3.4.6.5. Hanger rods shall be 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.
 - 3.4.6.6. Riser clamps shall be malleable iron or steel.
 - 3.4.6.7. Rollers shall be cast iron.
 - 3.4.6.8. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING SYSTEMS, for requirements on insulated pipe protective shields at hanger supports.
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- 3.4.6.9. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- 3.4.6.10. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

3.4.7. Penetrations:

- 3.4.7.1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
- 3.4.7.2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant

- 3.4.8. Sanitary vents shall be extended separately through roof.

3.5. TESTS

- 3.5.1. Storm and sanitary waste and drain systems shall be tested either in third entirety or in sections.
 - 3.5.2. If tests are required by an Authority Having Jurisdiction, perform tests in the presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.
 - 3.5.3. Tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
 - 3.5.4. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
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- 3.5.5. For an air test, an air pressure of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.

- 3.5.6. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. This section specifies materials and installation for the following specialties:

- 1.1.1.1. Clean-outs
- 1.1.1.2. Access Doors
- 1.1.1.3. Floor Drains
- 1.1.1.4. Trench Drains
- 1.1.1.5. Roof Drains
- 1.1.1.6. Plumbing Fixture Carriers
- 1.1.1.7. Trap Seal Primers
- 1.1.1.8. Water Hammer Arrestor
- 1.1.1.9. Non-freeze Hose Bib
- 1.1.1.10. Strainers

1.2. RELATED WORK

- 1.2.1. Section 01 00 00, GENERAL REQUIREMENTS.
- 1.2.2. Section 01 33 23, SHOP DRAWINGS.
- 1.2.3. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3. APPLICABLE PUBLICATIONS

- 1.3.1. 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.
 - 1.3.2. American Society for Testing and Materials (ASTM):
 - 1.3.2.1. C891-2011 Standard Practice for Installation of Underground Precast Concrete Utility Structures
 - 1.3.3. Ontario Building Code (OBC)
 - 1.3.3.1. Part 7 Plumbing
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1.4. SUBMITTALS

- 1.4.1. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS.
- 1.4.2. Manufacturer's Literature and Data: For each type of plumbing specialty indicated, the submittal shall include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- 1.4.3. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor or roof drain shall be submitted.
- 1.4.4. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
- 1.4.5. Include complete list indicating all components of the systems.
- 1.4.6. Include complete diagrams of the internal wiring for each item of equipment.
- 1.4.7. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

PART 2 - PRODUCTS

2.1. FLOOR CLEAN-OUTS

2.1.1. Standards of Acceptance:

- 2.1.1.1. J R Smith, Zurn, Watts

2.1.2. Finished Floor Clean-outs Round Top for Carpeted Areas

- 2.1.2.1. Description: Duco cast iron floor level cleanout assembly with round, adjustable, scoriated, nickel bronze top, and no-hub outlet. Bronze top shape to be as per architectural schedules.
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2.1.2.2. Outlet size: 2" (50 mm) to 8" (200mm) diam.

2.1.2.3. Application: pedestrian and medium load wheeled traffic

2.1.3. Finished Floor Clean-outs Square Top for Tiled Areas

2.1.3.1. Description: Duco cast iron floor level cleanout assembly with square, adjustable, scoriated, nickel bronze top, and no-hub outlet. Bronze top shape to be as per architectural schedules. Where square tops are selected, align sides with adjacent tiles patterns or walls.

2.1.3.2. Outlet size: 2" (50 mm) to 8" (200mm) diam.

2.1.3.3. Application: pedestrian and medium load wheeled traffic

2.1.4. Finished Floor Clean-Out Square Top for Vynil Tiles

2.1.4.1. Description: Duco Cast Iron Cleanout with Taper Thread Bronze Plug and Square Adjustable Secured Nickel Bronze Top with 1/8 (3 mm) seep Tile Recess. The square top is particularly adaptable to the straight line patterns of tile designs. Allows for easy floor level adjustment.

2.1.4.2. Outlet size: 2" (50 mm) to 8" (200mm) diam.

2.1.4.3. Application: pedestrian and medium load wheeled traffic

2.1.5. Finished Floor Clean-Out Square Top for Terrazzo Floors

2.1.5.1. Description: Duco Cast Iron Cleanout with Square Adjustable Secured Nickel Bronze Top with 1/2"(13) Terrazzo Recess. The recess is filled with the floor material, presenting an unobtrusive appearance. Lock-in design firmly holds floor material in recess. The square top is particularly adaptable to the straight line patterns of tile designs. Allows for easy floor level adjustment.

2.1.5.2. Outlet size: 2" (50 mm) to 8" (200mm) diam.

2.1.5.3. Application: pedestrian and medium load wheeled traffic

2.1.6. Unfinished Floor Clean-Outs with Adjustable Round Cast Iron Cover

- 2.1.6.1. Description: Duco Cast Iron Cleanout with Round Adjustable Scoriated Cast Iron Top with Non-Tilt Tractor Cover.
- 2.1.6.2. Spigot outlet
- 2.1.6.3. Outlet size: 2" (50 mm) to 8" (200mm) diam.
- 2.1.6.4. Application: pedestrian up to heavy load wheeled traffic

2.2. VERTICAL RISERS CLEAN-OUTS

2.2.1. Taper Thread Plug with Round Access Cover

- 2.2.1.1. n/a.

2.3. ACCESS DOORS

2.3.1. Face-of-Wall Type Access Door with Frame

- 2.3.1.1. 16 gauge steel door and frame with concealed hinge and screwdriver operated latch which holds the door securely closed. Nail slots are provided for attaching to studs. When the door opening height is 24 inches (61 cm) or over, a continuous piano hinge and additional latches are provided at the top and bottom of door. When specified with allen latch or cylinder lock, matching latches/locks are furnished.
 - 2.3.1.2. Finish: Prime coat - white
 - 2.3.1.3. Sizes: 6"x6" (150mmx150mm) to 18"x36" (450mmx900mm)
 - 2.3.1.4. Applications: Used to cover cleanout plugs, valves, controls or equipment concealed in walls and ceilings. Larger sizes are used to provide man access to utility and attic spaces. The face-of-the-wall type is for tile, masonry or dry wall construction, and is usually installed in an opening provided in the finished wall. The anchor holes provide a means of securely anchoring so that the face of the cover will be flush with the finished wall.
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2.3.1.5. Standard of Acceptance: J R Smith, Zurn

2.3.2. Fire Rated Wall Access Door

2.3.2.1. Access door and frame shall be fabricated from 16 gage, galvanized steel with a prime coat finish suitable for painting. Hinge shall be concealed type. Door shall have a heavy duty spring to provide positive latching when closed, and an interior latch release slide enabling door to be opened from the inside. Exterior latch shall be recessed and operated using ring attached to the sliding bolt.

2.3.2.2. Finish: Prime coat - white

2.3.2.3. Sizes: 8"x8" (200mmx200mm) to 36"x48" (900mmx1,200mm)

2.3.2.4. Applications: Used to cover cleanout plugs, valves, controls or equipment concealed in walls. Larger sizes are used to provide man access to utility spaces.

2.3.2.5. Standard of Acceptance: J R Smith, Zurn

2.3.3. Fire Rated Ceiling Access Door

2.3.3.1. Access door frame shall be fabricated from 16 gage galvanized steel with a prime coat finish and provided with masonry anchors and bolt holes. Access door panel shall be fabricated from 20 gage, galvanized steel with a prime coat finish. Door shall be filled with 2" thick, fire rated insulation, and be welded pan type. Access door shall have automatic closer, be self-latching and contain interior latch release. Exterior latching shall be recessed and universal self-latching bolt, operated by either a knurled knob or flush key.

2.3.3.2. Finish shall be a prime coat suitable for painting.

2.3.3.3. Access door and fire door assembly rated at 1 1/2 hours.

2.3.3.4. Sizes: 8"x8" (200mmx200mm) to 24"x36" (600mmx900mm)

2.3.3.5. Standard of Acceptance: J R Smith, Zurn

2.4. **FLOOR DRAINS**

2.4.1. Standard of Acceptance:

2.4.1.1. J R Smith, Zurn, Watts.

2.4.2. Floor Drains with Adjustable Strainer Round Heads

2.4.2.1. Duco Cast Iron Body, Adjustable Strainer. Selected with 4"(100) Wide Flange and Secondary Flashing Flange.

2.4.2.2. Applications: General service floor drain for use in showers, toilets, kitchens, and other finished areas where foot traffic is expected. The round top strainer head is used for all types of poured finished floors. General service floor drain for use in showers, toilets, kitchens, and other finished areas where foot traffic is expected. The round top strainer head is used for all types of poured finished floors.

2.4.2.3. ½" (13) Trap Primer connection

2.4.3. Floor Drain with Adjustable Square Strainer Head

2.4.3.1. Duco Cast Iron Body with Flashing Collar and Adjustable Strainer Square Head

2.4.3.2. Applications: General service floor drain for use in showers, toilets, kitchens and other finished areas where foot traffic is expected. The square top strainer head is used for all types of poured finished floors. The square top is particularly adaptable to floors that are finished in material of square or straight line pattern. Reversible flashing collar permits adjustment of the strainer to meet finished floor level.

2.4.3.3. ½"(13) Trap Primer connection

2.4.4. Funnel Floor Drain

2.4.4.1. Epoxy coated cast iron floor drain with anchor flange, reversible membrane clamp with primary and secondary weepholes, 5 in. (127mm) diameter 1/4 in. (6mm) thick adjustable nickel bronze strainer, 4 in. (102mm) x9 in. (229mm) oval cast iron (standard) funnel, and no hub (standard) outlet.

2.4.4.2. 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.

2.4.4.3. Applications: mechanical rooms

2.4.5. Heavy Duty Floor Drains with 12" Top Solid Free Standing Sediment Bucket

2.4.5.1. Duco Cast Iron Body and Flashing Collar with Cast Iron Tractor Grate and Solid Free Standing Sediment Bucket.

2.4.5.2. Application: Used in heavy trucking or traffic areas where waste water contains sand, sediment and other debris. Drain has solid free standing bucket to intercept this type of debris.

2.4.5.3. ½"(13) Trap Primer connection

2.4.6. Modular Cast Iron Trench Drains

2.4.6.1. N/A.

2.4.7. Planting Area Drains

2.4.7.1. N/A

2.5. PLUMBING FIXTURES CARRIERS

2.5.1. Standard of Acceptance:

2.5.1.1. J R Smith, Zurn, Watts

2.5.2. Wall -Mounted Urinal Carrier

2.5.2.1. Wall urinal support system complete with Dura-Coated carbon structural steel rectangular tubing uprights, conforming to ASTM A500 Grade C, with welded base feet having slotted floor anchor holes.

- 2.5.2.2. Lower bearing plate is vertically adjustable with slot to accommodate bearing jack placement. Upper universal hanger plate is pre-notched for back spud inlet and is designed for various hardware positions and fixtures. Includes mounting fasteners and hardware. Carrier system exceeds load and deflection requirements as outlined in ASME Standard A112.6.1M.

2.5.3. Wall Mounted Toilet Carrier - Single Side Arrangement

- 2.5.3.1. Horizontal siphon jet water closet carrier system, with high performance Dura-Coated cast iron main fitting with hydro-mechanically optimized sweep, 4" [102 mm] no-hub connections, and extended 2" [51 mm] vent.
- 2.5.3.2. Corrosion resistant, adjustable 3" [76 mm] dia. X 6" [152 mm] coupling with integral test cap, designed to increase flow velocity and line carry, and bonded gasket optimizes flow performance while reducing installation steps.

Complete system includes an adjustable, gasketed faceplate; floor mounted foot supports; fixture bolts, trim, and stud protectors. Carrier complies with all applicable requirements of ASME

2.5.4. Wall Mounted Toilet Carrier - Back to Back Arrangement

- 2.5.4.1. Horizontal siphon jet water closet carrier system, with high performance Dura-Coated cast iron main fitting with hydro-mechanically optimized sweep, 4" [102 mm] hub & spigot connections, and extended 2" [51 mm] vent. Corrosion resistant, adjustable 3" [76 mm] dia. X 6" [152 mm] couplings with integral test caps, designed to increase flow velocity and line carry, and bonded gaskets optimize flow performance while reducing installation steps. Complete system includes adjustable, gasketed faceplates; floor mounted foot supports; fixture bolts, trim, and stud protectors.
- 2.5.4.2. Carrier system complies with all applicable requirements of ASME A112.6.1M up to a 500 lbs [227 kg] maximum static load.

2.5.5. Concealed Arm System - Wall Lavatories

- 2.5.5.1. Wall Hung Lavatory Support System complete with Dura-Coated upright supports made from structural carbon-steel square tubing, conforming to ASTM A500 Grade C standards, with welded steel plate mounting feet featuring separate bolt patterns for using either 3/8" [10mm] or 1/2" [13mm] anchors, both meeting OSHPD spacing requirements. Includes lower and upper
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plates, marked with an indexed ruler guide for accurate adjustability of upright spacing, from 15" [381mm] to 22" [560mm].

- 2.5.5.2. Individual slotted header plates with integral welded arm sleeves provide 2" [51mm] of additional horizontal adjustment per plate allowing for a total horizontal adjustment range of 11" [279mm] to 26" [660mm]. Arms are Dura-Coated cast iron and include leveling screws and soft-set elastomeric locking devices. Uprights, plates, and header plates are all factory assembled for easy installation. Carrier system exceeds load and deflection requirements when tested in accordance to ASME Standard A112.6.1M at any adjustment position.

2.6. TRAPS

- 2.6.1. Cast iron body deep seal traps, threaded, hub, or spigot on inlet.

2.7. TRAP SEAL PRIMERS

- 2.7.1. Provide for all floor and hub drains and all running traps.

- 2.7.2. Up to four floor drain traps:

- 2.7.2.1. Corrosion resistant brass automatic trap seal primer with integral vacuum breaker. Assembly complete with sediment strainer, union and access door for concealed installations.
- 2.7.2.2. Provide ½" Type K hard copper tubing connection between trap primer valve and floor drain.
- 2.7.2.3. Standard of Acceptance: PPP Model P-1 or P-2 as required

- 2.7.3. Four or more floor drain traps within 100 feet of each other:

- 2.7.3.1. The unit shall supply a minimum of 300 mL of water per opening, once in each 24 hour period based on system pressure of 60 psi. Factory assembled with a bronze body ball valve, water hammer arrestor, solenoid valve, atmospheric vacuum breaker, 24 hour timer, 3/4" NPT connection, and a type L copper manifold. Electronic single point power connection 120V/1 amp draw and manual override switch

- 2.7.3.1.1. Provide ½" Type K hard copper tubing connection between trap primer valve and floor drain.
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2.7.3.2. Standard of Acceptance: PPP model PT-4 through 24 as required.

2.7.4. All floor and hub drains shall have their traps primed.

2.8. WATER HAMMER ARRESTOR

2.8.1. Arrestor with precharged stainless steel bellows in a stainless steel casing size according to manufacturer's recommendations to eliminate water hammer and shock from piping system.

2.8.2. Standard of Acceptance: JR Smith 5000 series, or equivalent.

2.9. NON-FREEZE HOSE BIB

2.9.1. 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

2.9.2. Standard of Acceptance: JR Smith 5509 QTNB, or equivalent.

2.10. STRAINERS

2.10.1. 860 kPa gauge pressure Y type strainer with 20 mesh, bronze or stainless steel removable screen.

2.10.2. 2" nominal and under, bronze, and screwed with brass cap.

2.10.3. Standard of Acceptance: Sarco BT, Armstrong F4SC, Crane 988 1/2, Braukmann FY32, Leitch BE, Toyo 380.

PART 3 - INSTALLATION

3.1. EXAMINATION AND PREPARATION

3.1.1. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

- 3.1.2. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- 3.1.3. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

3.2. INSTALLATION OF PIPING

- 3.2.1. Refer to Related Section 221113 for additional requirements

3.3. INSTALLATION OF CLEANOUTS

- 3.3.1. Cleanout locations should be indicated on drawings.
- 3.3.2. Provide cleanouts at each change in direction of piping greater than 45 degrees, where indicated on drawings and where required by code. Clean-outs shall be same size as pipe served through 4". Above ground cleanouts: install cleanouts at base of each vertical soil or waste stack.
- 3.3.3. Encase exterior cleanouts in concrete flush with grade.
- 3.3.4. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond and alignment. Coordinate installation with masonry and concrete work.
- 3.3.5. Prior to acceptance of the system, demonstrate that cleanout plugs are easily removable and can be easily rodded.
- 3.3.6. When cleanouts are required in above grade floors, flash and clamp cleanouts in floors provided with membrane waterproofing as specified for floor drains.

3.4. INSTALLATION OF FLOOR DRAINS

- 3.4.1. Install floor drains as indicated on drawings, at low points of surface areas to be drained.
 - 3.4.2. Provide trap for all floor drains, minimum 3" trap and waste.
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3.4.3. Check drainage of surfaces by flooding with the hose.

3.4.4. Provide vent for floor drain piping per code, minimum 1 1/2".

3.5. PLUMBING CARRIERS

3.5.1. Install in accordance with the manufacturer's instructions

3.5.2. Coordinate with the architectural division the width of the sanitary chases to ensure adequate access for maintenance and replacement

3.6. WATER HAMMER ARRESTORS

3.6.1. Install on branch supplies to each fixture or group of fixtures and where indicated.

3.7. TRAP SEAL PRIMERS

3.7.1. Install on cold water supply to nearest plumbing fixture, in concealed space and in accordance with manufacturers recommendations.

3.7.2. Install with shut off valves and in accordance with manufacturer's instructions.

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. This section specifies materials and installation for the following plumbing fixtures as applicable to the project:

- 1.1.1.1. Water closets
- 1.1.1.2. Lavatories, sinks, service sinks, and related Faucets and Trim
- 1.1.1.3. Shower heads and shower control valves
- 1.1.1.4. Wash Fountains
- 1.1.1.5. Laboratory plumbing fixtures
- 1.1.1.6. Emergency fixtures, Tempering Valve, Alarm System
- 1.1.1.7. Thermostatic Mixing valves
- 1.1.1.8. Washing Machine Valve Box

1.2. RELATED WORK

- 1.2.1. Section 01 00 00, GENERAL REQUIREMENTS.
- 1.2.2. Section 01 33 23, SHOP DRAWINGS.
- 1.2.3. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- 1.2.4. Section 22-13-19 Plumbing Accessories
- 1.2.5. Division 26, Electrical

1.3. APPLICABLE PUBLICATIONS

- 1.3.1. 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.
- 1.3.2. Do the work in accordance with CAN 3-B45 Series-M81 and CSA B125-1975 except where specified otherwise.

1.3.3. Ontario Building Code (OBC)

1.3.3.1. Part 7 Plumbing

1.4. SUBMITTALS

1.4.1. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS.

1.4.2. Manufacturer's Literature and Data:

1.4.2.1. Construction details, material descriptions, rated capacities, operating characteristics dimensions of individual components and profiles, and finishes for fixtures.

1.4.2.2. Water consumption data.

1.4.2.3. Wiring diagrams for power, signal, and control wiring

1.4.3. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1.4.4. Include complete list indicating all components of the systems.

1.4.5. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5. FIXTURES AND TRIM

1.5.1. Architectural drawings to govern in determination of number and location of fixtures.

1.5.2. Fixtures to be product of one manufacturer.

1.5.3. Unless specified otherwise, trim to be product of one manufacturer.

1.6. QUALITY ASSURANCE

1.6.1. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

- 1.6.2. The Contractor shall verify and resolve compatibility between separate components (e.g. that lavatory hole quantity and centering match that of the specified faucet, supports are compatible with respective urinals and water closets, etc.). Model numbers, when provided, are partial model numbers for identifying style. Provide fixtures that meet all the specified requirements.

1.7. WARRANTY

- 1.7.1. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1. GENERAL

- 2.1.1. Plumbing fixtures shall be as indicated and specified with all required supports, accessories, wastes, vent and water connections as required to make the fixture complete and operational.
- 2.1.2. Unless specified otherwise, fixtures shall be in accordance with the Architect's color schedule.
- 2.1.3. Unless specified otherwise, all exposed valves, pipe, escutcheon, etc., shall be polished chrome finish.
- 2.1.4. Fixtures and trim shall be new and free of all defects or blemishes. Finished surfaces shall be clean, smooth, and bright guaranteed not to craze, change colour or scale. Imperfections of any kind shall be sufficient reason for rejection and the item shall be removed and an acceptable replacement installed at no additional cost.
- 2.1.5. Provide all lavatory hot and cold-water supply lines with a renewable disc, chromium plated lock shield stop valve.
- 2.1.6. Provide cast brass chrome plated escutcheon plates with set screws on all water and drain pipes where such lines pass through, floors, walls and partitions.
- 2.1.7. Protect fixtures with enamel or glazed surface from damage by covering or coating as recommended in the Bulletin "Handling & Care of Enameled C.I. Plumbing Fixtures".
- 2.1.8. Fixture type is specified below. Refer to plumbing drawings for fixture quantity.

2.2. [L-1] LAVATORY

- 2.2.1. Wall Hung: American Standard "Decorum", vitreous china wall hung lavatory, drilled to accommodate concealed arm supports, 9024.004EC with 4" centers.

- 2.2.2. Waste and Trim: Chicago Faucets Model # 526-317 ABCP C.P. 4" (100mm) cast brass body vandal-resistant aerator, 1.9 lpm (0.5gpm) outlet and cast offset waste assembly with open grid strainer.
- 2.2.3. Trap: McGuire 8872C CP 1.¼" (32mm) cast "P" trap with cleanout, escutcheon.
- 2.2.4. Supplies: McGuire H165LKN3RB CP short rigid angle basin supply with offset braided flex, riser lockshield stop, escutcheon.
- 2.2.5. Carrier: Zurn ZX-1231 concealed fixture carrier with arms.

2.3. [L-2] LAVATORY, BARRIER FREE

- 2.3.1. Wall Hung Barrier Free: American Standard "Murro", vitreous china wall hung lavatory, drilled to accommodate concealed arm supports, and with #0059.0200 semi-china pedestal.
- 2.3.2. Waste and Trim: Chicago Faucets Model # V-317-XK/E2805 C.P. 4" (100mm) cast brass body vandal-resistant aerator, 1.9 lpm (0.5gpm) outlet and cast offset waste assembly with open grid strainer.
- 2.3.3. Trap: McGuire 8872C CP 1.¼" (32mm) cast "P" trap with cleanout, escutcheon.
- 2.3.4. Supplies: McGuire H165LKN3RB CP short rigid angle basin supply with offset braided flex, riser lockshield stop, escutcheon.
- 2.3.5. Carrier: Zurn ZX-1231 concealed fixture carrier with arms.
- 2.3.6. Note: Installation shall meet the O.B.C. requirements for barrier free access. Insulate supplies and drain as required by Code.

2.4. [WC-1] FLOOR MOUNTED

- 2.4.1. Water Closet: Bowl: American Standard "Madera" elongated #3451001, 15" high vitreous China floor mounted elongated syphon jet action bowl, 1-½" (38mm) top spud, bolt caps.
- 2.4.2. Flush Valve: Sloan 111-1.28YG "Regal" factory set, or Teck #81T201-5, external adj. 1.28 gal (4.8 L) C.P. quiet action diaphragm type with vacuum breaker, centre seat bumper on valve, pressure loss check and non-hold open feature.
- 2.4.3. Seat: Centoco #AM500STS, elongated heavy duty solid plastic open front no cover, stainless steel check hinges and chromated steel posts, washers and nuts. Complete with antimicrobial additive, white colour.

2.5. [WC-2] FLOOR MOUNTED, BARRIER FREE

- 2.5.1. Water Closet: (Barrier free) Bowl: American Standard "Madera" elongated # 3461-128, 16.½" high vitreous China floor mounted elongated syphon jet action bowl, 1-½" (38mm) top spud, bolt caps.
- 2.5.2. Flush Valve: Sloan 111-1.28YG "Regal" factory set, or Teck #81T201-5, external adj. 1.28 gal (4.8 L) C.P. quiet action diaphragm type with vacuum breaker, centre seat bumper on valve, pressure loss check and non-hold open feature.
- 2.5.3. Seat: Centoco #AMHL500STS, elongated heavy duty solid plastic open front, 2" raised seat, check hinges and chromated steel posts, washers and nuts. Installation: To meet Code requirements for Barrier free access.

2.6. [WC-3] WALL HUNG

- 2.6.1. Water Closet: Bowl: American Standard "Afwall Millenium FloWise" elongated #3351-101 15" high vitreous China, wall mounted, elongated syphon jet action bowl, 1-½" (38mm) top spud, bolt caps.
- 2.6.2. Flush Valve: Sloan 111-1.28YG "Regal" factory set, or Teck #81T201-5, external adj. 1.28 gal (4.8 L) C.P. quiet action diaphragm type with vacuum breaker, centre seat bumper on valve, pressure loss check and non-hold open feature.
- 2.6.3. Seat: Centoco #AM500STS, elongated heavy duty solid plastic open front no cover, stainless steel check hinges and chromated steel posts, washers and nuts. Complete with antimicrobial additive, white colour.

2.7. [WC-4] WALL HUNG, BARRIER FREE

- 2.7.1. Water Closet: Bowl: American Standard "Afwall ADA Retrofit" elongated #2994-011EC" high vitreous China, wall mounted, 16.5" high seat, elongated syphon jet action bowl, 1-½" (38mm) top spud, bolt caps.
- 2.7.2. Flush Valve: Sloan 111-1.28YG "Regal" factory set, or Teck #81T201-5, external adj. 1.28 gal (4.8 L) C.P. quiet action diaphragm type with vacuum breaker, centre seat bumper on valve, pressure loss check and non-hold open feature.
- 2.7.3. Seat: Centoco #AMHL500STS, elongated heavy duty solid plastic open front, 2" raised seat, check hinges and chromated steel posts, washers and nuts. Installation: To meet Code requirements for Barrier free access.

2.8. [U-1] WALL MOUNTED, MATRIX TYPE

- 2.8.1. Urinal: American Standard "Washbrook FloWise" high efficiency #6590-001, vitreous China, wall mounted, elongated 14" rim, ¾" top inlet spud, 2" threaded outlet connection, complete with strainer and wall hangers.
- 2.8.2. Water Matrix Flush Pipe: Provide chrome exposed pipe connection from new flush tank to inlet spud.

2.9. [U-2] WALL MOUNTED, FLUSH VALVE

- 2.9.1. Urinal: American Standard "Washbrook FloWise" high efficiency #6590-001, vitreous China, wall mounted, elongated 14" rim, ¾" top inlet spud, 2" threaded outlet connection, complete with strainer and wall hangers.
- 2.9.2. Flush Valve: Sloan 8186 "Solis" sensor flushometer, polished chrome, 1.5 GPF, solar powered, infrared sensor with multiple-focused, lobular sensing fields for high and low target detection, fixed metering bypass, ¾" IPS Bak-Chek angle stop with vandal resistant stop cap.

2.10. [U-3] WALL MOUNTED, MATRIX TYPE, BARRIER FREE

- 2.10.1. Urinal (Barrier free): American Standard "Washbrook FloWise" high efficiency #6590-001, vitreous China, wall mounted, elongated 14" rim, ¾" top inlet spud, 2" threaded outlet connection, complete

with strainer and wall hangers. For Barrier Free applications urinal rim to be mounted maximum 17" above finished floor.

2.10.2. Water Matrix Flush Pipe: Provide chrome exposed pipe connection from new flush tank to inlet spud.

2.11. [WF-1] SEMI CIRCULAR, FLOOR MOUNTED

2.11.1. Floor mounted, semi-circular, 4 User Wash Fountain: Bradley Terreon Quadra-Fount #MF2944. Constructed of Terreon, and is resistant to chemicals, stains, burns, and impact. Bowl & pedestal to be constructed of Terreon. Pedestal frame and access panels are constructed of heavy gauge type 300 Stainless Steel. Vandal resistant, all stream formers and sensors are secured to the unit from inside the spray head module. All water and waste connections are concealed inside the pedestal.

2.11.2. Bowl: Circular **46 inch (1168 mm) wide, 26 inch (680 mm) deep.**

2.11.3. Unit Mounting Height: Standard height

2.11.4. Spray Ring: Spray head nozzle activated by sensor provides 0.5 gpm. Operating pressure is 20-80 PSI. Flow restrictor keeps flow constant under any pressure.

2.11.5. Infrared Sensor: Each of the stream formers is controlled by a separate slow-closing solenoid valve. Hands placed within the bowl are detected by an infrared sensor module, which activates a flow of tempered water. Module uses two zone-focused infrared beams, having a detection area that does not exceed the bowl perimeter. The detection range projects 6-9 inches forward at a 30-degree angle to each side and reaches 15 degrees below horizontal. Direct sunlight or bright washroom lights will not activate the sensor.

2.11.6. Water Supply: Standard Navigator thermostatic mixing valve.

2.11.7. Drain and Supply Configuration: Off line vent with supplies from below

2.12. [WF-2] CORNER, FLOOR MOUNTED

2.12.1. Floor mounted, corner use, 2 User Wash Fountain: Bradley Terreon Corner-Fount #MF2922. Constructed of Terreon, and is resistant to chemicals, stains, burns, and impact. Bowl & pedestal to be constructed of Terreon. Pedestal frame and access panels are constructed of heavy gauge type 300 Stainless Steel. Vandal resistant, all stream formers and sensors are secured to the unit from inside the spray head module. All water and waste connections are concealed inside the pedestal.

2.12.2. Bowl: Circular **31 inch (808 mm) wide, 26 inch (680 mm) deep.**

2.12.3. Unit Mounting Height: Standard height

2.12.4. Spray Ring: Spray head nozzle activated by sensor provides 0.5 gpm. Operating pressure is 20-80 PSI. Flow restrictor keeps flow constant under any pressure.

2.12.5. Infrared Sensor: Each of the stream formers is controlled by a separate slow-closing solenoid valve. Hands placed within the bowl are detected by an infrared sensor module, which activates a flow of tempered water. Module uses two zone-focused infrared beams, having a detection area that does not exceed the bowl perimeter. The detection range projects 6-9 inches forward at a 30-degree angle to

each side and reaches 15 degrees below horizontal. Direct sunlight or bright washroom lights will not activate the sensor.

2.12.6. Water Supply: Standard Navigator thermostatic mixing valve.

2.12.7. Drain and Supply Configuration: Off line vent with supplies from below

2.13. [SH-1] BARRIER-FREE SHOWER ASSEMBLY

2.13.1. Shower: Apex surface mounted showers, ADA Compliant. Includes control valve with a ligature resistant ADA compliant tr-lever handler, a quick-disconnect handheld shower, vacuum breaker and flow control, and a surface mounted soap dish.

2.13.2. Shower Housing: 18 gauge, type 304 stainless steel with a #4 satin finish. Top and bottom of housing to have a 30-degree slope.

2.13.3. Handheld shower spray: 60" long stainless steel hose, quick disconnect, vacuum breaker and 1.5GPM flow control.

2.13.4. Standard of Acceptance: Acorn Shower-Ware 450BADA Series

2.14. [SH-2] STUDENT SHOWER WITH BUTTON CONTROL

2.14.1. Shower Head: Conical shower is chrome-plated brass and is ligature resistant. The spray pattern is nonadjustable and includes built-in 1.6 GPM flow restrictor.

2.14.2. Shower Housing: 18-gauge, type 304 stainless steel with a #4 satin finish. Top and bottom of housing to have a 30-degree slope.

2.14.3. Control Valve: Valves to be tamper-resistant. T/P balancing mixing valve with patented ligature resistant tr-lever handle.

2.14.4. Corner Mounting: Provide corner mounted shower housing as applicable to match existing conditions.

2.14.5. Standard of Acceptance: Acorn Shower-Ware 450B Series (straight wall), 420B Series (Corner installation)

2.15. [SH-3] STAFF SHOWER

2.15.1. Shower valve: Single lever handle trim. Lead free solid brass body with corrosion resistant components. Self-contained field reversible cartridge. Commercial quality thermal actuator. Integral check stops to isolate individual valves. Ceramic shut-off components for long term-drip-free reliability.

2.15.2. Standard of acceptance: Acorn SV-16-LVR

2.15.3. Shower head: wall mounted econo-showerhead, chrome plated ABS with 2.5 GPM flow control c/w deluxe bent arm and flange

2.15.4. Standard of acceptance: Acorn ESH-25

PART 3 - INSTALLATION

3.1. EXAMINATION AND PREPARATION

- 3.1.1. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- 3.1.2. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- 3.1.3. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

3.2. INSTALLATION OF FIXTURES

- 3.2.1. Connect fixtures complete with supplies and drains, traps and cleanouts, supported level and square, such as to make them completely functional.
- 3.2.2. Hot water faucets shall be on left. Where indicated and applicable, supply and install the tempering valves in accordance with the manufacturer's instructions.
- 3.2.3. Provide venting for all plumbing fixtures as required by codes.
- 3.2.4. All barrier-free fixtures to be mounted at heights to be in accordance with all codes and local Authorities Having Jurisdiction.
- 3.2.5. Provide chrome plated flexible supplies to fixtures with screw driver stops, reducers and escutcheons.
- 3.2.6. All piping shall be recessed unless otherwise approved. Piping to be installed in recessed areas (such as under cabinetry, counters and other millwork or ceiling spaces) shall be run in neat parallel lines as tight as possible to walls and ceilings.
- 3.2.7. Provide ball isolation valves for connections to all fixtures.
- 3.2.8. All angle valves for fixtures shall be chrome plated.
- 3.2.9. All sanitary drains visible under the counter shall be either chromed or painted to match the color of the wall behind.

3.3. INSTALLATION OF WATER CLOSETS AND URINALS - STANDARD AND BARRIER FREE

- 3.3.1. Mounting Heights:
- 3.3.2. Water closets - standard: 15 in. to 17 in. from top of toilet seat to finished floor.
- 3.3.3. Water closets - barrier free: 17 in. from top of toilet seat to finished floor.
- 3.3.4. Urinals- standard: 24 in. from rim to finished floor.
- 3.3.5. Urinals - barrier free: 17 in. from rim to finished floor, 44 in. maximum from hand operated flush valve to finished floor.
- 3.3.6. Flush Valve: Mount flush valve handle on wide side of stall or room.
- 3.3.7. Apply dual flush instruction plates to wall centered above flushometer.
- 3.3.8. Install toilet seats on water closets.

3.4. INSTALLATION OF THERMOSTATIC MIXING VALVES (NON-EMERGENCY FIXTURES)

- 3.4.1. Install in a location readily accessible for cleaning, adjustment, and valve/cartridge replacement.
- 3.4.2. Install mixing valve after checks and stops are installed. Thoroughly flush all piping immediately prior to mixing valve installation.
- 3.4.3. Install isolation valves on the hot and cold water inlet pipe connections, near the mixing valve.
- 3.4.4. Install check valves between the mixing valve and the mixing valve isolation valves. These check valves are in addition to the mixing valve's integral check valves.
- 3.4.5. Adjust valve temperature set point to 110 deg. F, following manufacturer's adjustment instructions.

3.5. COMMISSIONING

- 3.5.1. Perform the commissioning activities as outlined in the Division 01 Section for Commissioning and other requirements of the Contract Documents.

3.6. ADJUSTING AND CLEANING

- 3.6.1. Flush all water closets and urinals and verify performance. Adjust or clean flush valves to produce proper flow.
- 3.6.2. Back-flush shower heads, faucet aerators/spray heads, and in-line strainers at electric water coolers, emergency fixtures, and wherever installed, and reinstall.
- 3.6.3. Adjust pop-up drains for proper operation.
- 3.6.4. Adjust eyewashes to provide proper flow.
- 3.6.5. Adjust shower control valve limit stops to deliver maximum 120 deg. water.
- 3.6.6. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

- 3.6.7. Replace dead batteries in sensor operated flush valves and faucets. Adjust sensor operation to satisfaction of commissioner.
- 3.6.8. At completion of project, remove excess caulk and sealants and clean plumbing fixtures and equipment.

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

- 1.1.1.1. Planning systematic TAB procedures.
- 1.1.1.2. Design Review Report.
- 1.1.1.3. Systems Inspection report.
- 1.1.1.4. Duct Air Leakage test report.
- 1.1.1.5. Systems Readiness Report.
- 1.1.1.6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
- 1.1.1.7. Recording and reporting results.

1.1.2. Definitions:

- 1.1.2.1. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
- 1.1.2.2. AABC: Associated Air Balance Council.
- 1.1.2.3. NEBB: National Environmental Balancing Bureau.

1.1.3. Hydronic Systems: Includes chilled water, condenser water, heating hot water and glycol water systems as applicable to the project.

1.1.4. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems, as applicable to the project.

1.1.5. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2. RELATED WORK

- 1.2.1. Section 23 05 11, COMMON WORK RESULTS FOR HVAC SYSTEMS.
 - 1.2.2. Section 23 31 00, HVAC DUCTS AND CASINGS.
 - 1.2.3. Section 23 82 16, AIR COILS
 - 1.2.4. Section 23 21 23, HVAC PUMPS
 - 1.2.5. Section 23 37 00, AIR DISTRIBUTION EQUIPMENT
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1.2.6. Section 23 21 13, HYDRONIC PIPING

1.3. QUALITY ASSURANCE

1.3.1. Qualifications:

- 1.3.1.1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
 - 1.3.1.2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Consultant and submit another TAB firm for approval.
 - 1.3.2. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein.
 - 1.3.3. TAB Specialist shall be identified by the General Contractor within 10 days after the notice to proceed. 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:
 - 1.3.3.1. Shall directly supervise all TAB work.
 - 1.3.3.2. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
 - 1.3.3.3. Would follow all TAB work through its satisfactory completion.
 - 1.3.3.4. Shall provide final markings of settings of all HVAC adjustment devices.
 - 1.3.3.5. Permanently mark location of duct test ports.
 - 1.3.4. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. The lead technician shall be certified by AABC or NEBB
 - 1.3.5. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
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1.3.6. Tab Criteria:

1.3.6.1. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.

1.3.6.2. Tolerances:

1.3.6.2.1. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): +/-5% of design values noted in the equipment schedules.

1.3.6.2.2. Air terminal units (maximum values): +/-5% of the design values noted on the equipment schedules.

1.3.6.2.3. Exhaust hoods/cabinets: 0% to +10% of the design values noted on the equipment schedules

1.3.6.2.4. Minimum outside air: 0% to +10% of the design values noted on the equipment schedules

1.3.6.2.5. Individual room air outlets and inlets, and air flow rates not mentioned above: +/-5% of the design values noted on the equipment schedules.

1.3.6.2.6. Heating hot water pumps and hot water coils: +/-5% of the design values noted on the equipment schedules.

1.3.6.2.7. Chilled water and condenser water pumps: 0% to +5% of the design values noted on the equipment schedules

1.3.6.2.8. Chilled water coils: 0% to +5% of the design values noted on the equipment schedules.

1.3.6.2.9. Heat output capacities: 0% to +10% of the design values noted on the equipment schedules

1.3.6.2.10. Cooling output capacities: +/-5% of the design values noted on the equipment schedules

1.3.7. Typical TAB procedures and results shall be demonstrated to the Consultant for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the Consultant) and one hydronic system (pumps and three coils) as follows:

1.3.7.1. When field TAB work begins.

1.3.7.2. During each partial final inspection and the final inspection for the project if requested by the Board

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION.
- 1.4.2. Submit names and qualifications of TAB agency and TAB specialists within 10 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- 1.4.3. Submit Following for Review and Approval:
 - 1.4.3.1. Design Review Report within 10 days after the award of contract from the General Contractor.
 - 1.4.3.2. Systems inspection report on equipment and installation for conformance with design.
 - 1.4.3.3. Duct Air Leakage Test Report.
 - 1.4.3.4. Systems Readiness Report.
- 1.4.4. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
- 1.4.5. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- 1.4.6. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5. APPLICABLE PUBLICATIONS

- 1.5.1. 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.
 - 1.5.1.1. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
 - 1.5.1.2. 2007 HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control
 - 1.5.1.3. Associated Air Balance Council (AABC):
 - 1.5.1.3.1. AABC National Standards for Total System Balance
 - 1.5.1.3.2. National Environmental Balancing Bureau (NEBB):
 - 1.5.1.3.3. 7th Edition 2005 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems
 - 1.5.1.3.4. 2nd Edition 2006 Procedural Standards for the Measurement of Sound and Vibration
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- 1.5.1.3.5. 3rd Edition 2009Procedural Standards for Whole Building Systems Commissioning of New Construction
- 1.5.1.4. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1.5.1.4.1. 3rd Edition 2002 HVAC SYSTEMS Testing, Adjusting and Balancing

PART 2 - PRODUCTS

2.1. PLUGS

- 2.1.1. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2. INSULATION REPAIR MATERIAL

- 2.2.1. See Section 23 07 11, HVAC INSULATION.
- 2.2.2. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.
- 3.1.2. *Coordinate all balancing work with the BAS vendor. Where balancing variable flow systems, fine tune the pressure differential sensor settings to ensure that all end users receive adequate water and air flows.*

3.2. DESIGN REVIEW REPORT

- 3.2.1. The TAB Specialist shall review the Contract Plans and specifications and advise the Consultant of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3. SYSTEMS INSPECTION REPORT

- 3.3.1. Inspect equipment and installation for conformance with design.
-

3.3.2. The inspection and report is to be done after piping and air distribution equipment is on site and piping/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.

3.3.3. Reports: Follow check list format developed by AABC, NEBB 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.

3.4. DUCT AIR LEAKAGE TEST REPORT

3.4.1. TAB Agency shall perform the leakage test as outlined in "Duct leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS.

3.5. SYSTEM READINESS REPORT

3.5.1. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to Consultant.

3.5.2. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to Consultant in standard format and forms prepared and or approved by the Commissioning Agent, as applicable to the project.

3.5.3. 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.

3.6. TAB REPORTS

3.6.1. The TAB contractor shall provide raw data immediately in writing to the Consultant if there is a problem in achieving intended results before submitting a formal report.

3.6.2. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the Board.

3.6.3. Do not proceed with the remaining systems until intermediate reports are reviewed by the Consultant.

3.7. TAB PROCEDURES

- 3.7.1. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
 - 3.7.2. 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.
 - 3.7.3. For air handling systems, perform balancing work when the building envelope is substantially completed (windows and doors installed, ceilings completed, transfer grilles installed)
 - 3.7.4. For air handling systems equipped with hydronic components, make air and hydronic balancing at the same time.
 - 3.7.5. Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.
 - 3.7.6. Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.
 - 3.7.7. Adjust fan speeds to provide design air flow.
 - 3.7.8. 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.
 - 3.7.9. Variable air volume (VAV) systems:
 - 3.7.9.1. Not applicable to this project
 - 3.7.10. Water Balance and Equipment Test: Include circulating pumps, convertors, heat exchangers, boilers, coils, coolers and condensers
 - 3.7.10.1. Adjust flow rates for equipment.
 - 3.7.10.2. Primary secondary (variable volume) systems: Balance systems at design water flow and then verify that variable flow controls function as designed.
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- 3.7.10.3. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. 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.

3.8. LOCATION OF MEASUREMENTS AND MEASURED PARAMETERS

3.8.1. Perform hydronic measurements at each:

- 3.8.1.1. Boiler
- 3.8.1.2. Coil
- 3.8.1.3. Heat Exchanger
- 3.8.1.4. Control Valve
- 3.8.1.5. Balancing Valve

3.8.2. Perform air measurements at each:

- 3.8.2.1. Fan/Air Handling System discharge
- 3.8.2.2. Exhaust fan
- 3.8.2.3. Coil
- 3.8.2.4. Fresh air/Exhaust damper
- 3.8.2.5. Terminal unit
- 3.8.2.6. Air distribution equipment

3.8.3. Measured parameters

- 3.8.3.1. Air flows
- 3.8.3.2. Hydronic flows
- 3.8.3.3. Temperatures entering/leaving coils (hydronic and air)
- 3.8.3.4. Pressure drops at each measured equipment/device (hydronic and air)
- 3.8.3.5. Electric Power drawn by electrical equipment

3.9. MARKING OF SETTINGS

- 3.9.1. Following approval of Tab final Report, the setting of all HVAC adjustment devices including 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.
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3.10. IDENTIFICATION OF TEST PORTS

3.10.1. 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.

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. Field applied insulation for thermal efficiency and condensation control for HVAC piping, ductwork and equipment.
 - 1.1.2. Re-insulation of HVAC piping, ductwork and equipment after asbestos abatement.
 - 1.1.3. Definitions
 - 1.1.3.1. ASJ: All service jacket, white finish facing or jacket.
 - 1.1.3.2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 - 1.1.3.3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
 - 1.1.3.4. Concealed: Piping above ceilings and in chases, interstitial space, and pipe chases.
 - 1.1.3.5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 1.1.3.6. Hot: Hot water equipment or piping handling media above 41 degrees C (105 degrees F).
 - 1.1.3.7. Thermal conductance: Heat flow rate through materials.
 - 1.1.3.8. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
 - 1.1.3.9. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). or the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
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1.2. RELATED WORK

- 1.2.1. Section 23 05 11, COMMON WORK RESULTS FOR HVAC SYSTEMS.
- 1.2.2. Section 23 31 00, HVAC DUCTS AND CASINGS.
- 1.2.3. Section 23 21 13, HYDRONIC PIPING

1.3. QUALITY ASSURANCE

- 1.3.1. Comply with OBC requirements for flame spread and smoke development rates.
- 1.3.2. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
- 1.3.3. 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.
- 1.3.4. 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

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION
 - 1.4.2. Shop Drawings:
 - 1.4.2.1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
 - 1.4.2.2. Insulation materials: Specify each type used and state surface burning characteristics.
 - 1.4.2.3. Insulation facings and jackets: Each type used.
 - 1.4.2.4. Insulation accessory materials: Each type used.
 - 1.4.2.5. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 - 1.4.2.6. Make reference to applicable specification paragraph numbers for coordination.
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1.5. STORAGE AND HANDLING OF MATERIAL

- 1.5.1. 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.

1.6. 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 basic designation only.

1.6.2. National Fire Protection Association (NFPA):

- 1.6.2.1. 101-09 Life Safety Code
- 1.6.2.2. 251-06 Standard methods of Tests of Fire Endurance of Building Construction Materials
- 1.6.2.3. 255-06 Standard Method of tests of Surface Burning Characteristics of Building Materials

1.6.3. Underwriters Laboratories, Inc (UL):

- 1.6.3.1. 723 UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 08/03

1.6.4. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

- 1.6.4.1. SP58-2002 Pipe Hangers and Supports Materials, Design, and Manufacture

1.7. STANDARDS OF ACCEPTANCE

- 1.7.1. Owens/Corning, Knauf, Johns Mansville
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PART 2 - PRODUCTS

2.1. HVAC PIPING INSULATION

2.1.1. Application (as applicable to the project)

- 2.1.1.1. All hot water heating/glycol
- 2.1.1.2. All chilled water/glycol
- 2.1.1.3. All steam piping
- 2.1.1.4. All condensate piping
- 2.1.1.5. All piping conveying water and located in spaces where the temperature can drop below freezing. Also refer to heat tracing specifications
- 2.1.1.6. All other piping conveying fluids warmer than 30°C or colder than 18°C

2.1.2. Mineral Fiber Or Fiber Glass

2.1.2.1. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), class 1, k = 0.037 (0.26) at 24 degrees C (75 deg. F), for use at temperatures from -20 deg. C (-4 deg.F) and up to 230 deg.C (450 deg. F)with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.1.2.2. Thickness:

- 2.1.2.2.1. Piping larger than 75mm (3"): 38 mm thickness
- 2.1.2.2.2. Piping nominal 25mm-75mm (1-3"): 25 mm thickness
- 2.1.2.2.3. Piping nominal 19mm (3/4") and less: 12 mm thickness
- 2.1.2.2.4. Outdoor insulation (any size): increase insulation thickness by 12 mm (1/2")

2.1.2.3. At fittings and flanges (including water meter and body of roof drains), insulate with wrapped fiberglass insulation of same thickness as adjacent pipe, and cover with pre-molded PVC jackets. Seal edge of jacket with self-sealing vapor barrier tape.

2.1.3. Insulation Facings And Jackets

2.1.3.1. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets.

2.1.3.2. Facings and jackets

2.1.3.2.1. Concealed indoor areas:

- Shall be all service type (ASJ) in concealed spaces and PVC Vapor Retarder jacketing in all exposed areas, including mechanical rooms and service areas.
- All service Jacket (ASJ) shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- Standard of Acceptance: Zeston, Ceeco, Proto

2.1.3.2.2. Exposed indoor areas:

- Shall be heavy PVC fitting covers (0.75 mm thickness. Overlap PVC covers on pipe insulation jackets as least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

2.1.3.2.3. Indoor Fittings Jackets

- Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- Adhesive: Compatible with PVC jacket, and recommended by insulation material manufacturer.
- Standard of Acceptance: Zeston, Ceeco, Proto

2.1.3.2.4. Aluminum Jackets – Outdoor Piping and Fittings

- Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.
- Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- Neither rivets, screws, staples nor any other fastener capable of penetrating the underlying vapor retarder shall be used to secure the aluminum jacketing.
- Standards of Acceptance: Childers-Lock-on and Pabco-Surfeit.

2.1.4. Pipe Covering Protection Saddles

- 2.1.4.1. Cold pipe support - indoors: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).
 - 2.1.4.2. Warm or hot pipe supports - indoors: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).
 - 2.1.4.3. All piping – outdoors: Metallic shield shall be made of galvanized steel painted on both sides with a minimum two coats of aluminum paint. 180 degree for clevises and roller type hangers and 360 degree for clamp type hangers and supports. Shield and insert length and gauge shall be 400 mm (16") long and min. 2.75 mm (12ga) thickness.
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2.1.5. Adhesive, Mastic, Cement

2.1.5.1. Insulation manufacturers' published recommendations.

2.1.6. Mechanical Fasteners

2.1.6.1. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.

2.1.6.2. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.1.7. Flame And Smoke

2.1.7.1. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

2.2. FITTINGS, FLANGE AND VALVE INSULATION – HOT AND COLD PIPING:

2.2.1. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place.

2.2.2. For hot piping finish with a smoothing coat of finishing cement.

2.2.3. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

2.2.4. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

2.2.5. Nominal thickness: same as piping of same size.

2.3. EQUIPMENT INSULATION

2.3.1. Applications: all heat exchangers, chilled water pumps, chilled water expansion tanks, chiller headers or evaporator vessels

- 2.3.2. Flexible Elastomeric Cellular Thermal insulation, ASTM C177, C518, $k = 0.039$ (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.4. DUCTWORK INSULATION

2.4.1. Application

- 2.4.1.1. All concealed ductwork, or exposed in mechanical rooms conveying air at temperatures above 30°C or below 18°C and running through heated spaces.
- 2.4.1.2. All ductwork running through unheated spaces (attics)
- 2.4.1.3. All exhaust air ductwork 3m upstream of the point of discharge to the outdoors
- 2.4.1.4. All fresh air supply ductwork
- 2.4.1.5. All ductwork mounted outdoors
- 2.4.1.6. All combustion air ductwork

2.4.2. Round Ductwork or Rectangular Ductwork – any side less than 750 mm (30")

- 2.4.2.1. Insulate ductwork with 40 mm (1½") thick, blanket-type, fiberglass insulation with factory-applied vapor barrier, and 2" stapling and taping flange along one edge. Insulation: ASTM C553, density of 0.75, conductivity of 0.32. Vapor barrier: aluminum foil, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.
 - 2.4.2.2. Apply insulation from outlet of air handling equipment to air distribution equipment
 - 2.4.2.3. Jacket
 - 2.4.2.3.1. A zero permeability, all weather, multi-layered laminate coated with a cold weather acrylic adhesive, superior resistance to weathering, mold, UV and extreme environmental conditions. Designed for use as a vapour barrier for insulation cladding and jacketing applications.
 - 2.4.2.3.2. Zero permeability vapour barrier for insulation cladding and jacketing applications
 - 2.4.2.3.3. Cold weather acrylic adhesive applies easily at temperatures as cold as -23°C (-10°F)
 - 2.4.2.3.4. Puncture and Tear resistant
 - 2.4.2.3.5. Self Adhesive material installs easily with no offsite fabrication required
 - 2.4.2.3.6. Cuts and installs easily on-site, no special tools required
 - 2.4.2.3.7. Flexible, strong, reinforced insulation cladding
 - 2.4.2.3.8. Standard Acceptance: 3M™ VentureClad™ Insulation Jacketing
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2.4.3. Round Ductwork - Outdoor

2.4.3.1. Insulate ductwork with 50 mm (2") thick, blanket-type, fiberglass insulation with factory-applied vapor barrier, and 2" stapling and taping flange along one edge. Insulation: ASTM C553, density of 0.75, conductivity of 0.32. Vapor barrier: aluminum foil, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

2.4.3.2. Jacket

2.4.3.2.1. A zero permeability, all weather, multi-layered laminate coated with a cold weather acrylic adhesive, superior resistance to weathering, mold, UV and extreme environmental conditions. Designed for use as a vapour barrier for insulation cladding and jacketing applications.

2.4.3.2.2. Zero permeability vapour barrier for insulation cladding and jacketing applications

2.4.3.2.3. Cold weather acrylic adhesive applies easily at temperatures as cold as -23°C (-10°F)

2.4.3.2.4. Puncture and Tear resistant

2.4.3.2.5. Self Adhesive material installs easily with no offsite fabrication required

2.4.3.2.6. Cuts and installs easily on-site, no special tools required

2.4.3.2.7. Flexible, strong, reinforced insulation cladding

2.4.3.2.8. Standard Acceptance: 3M™ VentureClad™ Insulation Jacketing

2.4.4. Rectangular Ductwork – any side larger than 750 mm (30")

2.4.4.1. In mechanical equipment rooms and all other areas where visible without removing ceilings or opening access panels, insulate ductwork with 40 mm (1 ½" thick) rigid, fiberglass In mechanical equipment rooms and all other areas where visible without removing ceilings or opening access panels, insulate ductwork with 40 mm (1 ½" thick) rigid, fiberglass insulation board ASTM C612 Class 2, conductivity of 0.26, density of 3.0. with factory-applied vapor barrier. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50

2.4.4.2. In ceiling spaces, building shafts, and other locations where not visible, insulate ductwork with 1-1/2" thick, blanket-type, fiberglass insulation with factory-applied vapor barrier, and 2" stapling and taping flange along one edge. Insulation: ASTM C553, density of 0.75, conductivity of 0.23 @75F. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

2.4.4.3. Jacket

- 2.4.4.3.1. A zero permeability, all weather, multi-layered laminate coated with a cold weather acrylic adhesive, superior resistance to weathering, mold, UV and extreme environmental conditions. Designed for use as a vapour barrier for insulation cladding and jacketing applications.
- 2.4.4.3.2. Zero permeability vapour barrier for insulation cladding and jacketing applications
- 2.4.4.3.3. Cold weather acrylic adhesive applies easily at temperatures as cold as -23°C (-10°F)
- 2.4.4.3.4. Puncture and Tear resistant
- 2.4.4.3.5. Self Adhesive material installs easily with no offsite fabrication required
- 2.4.4.3.6. Cuts and installs easily on-site, no special tools required
- 2.4.4.3.7. Flexible, strong, reinforced insulation cladding
- 2.4.4.3.8. Standard Acceptance: 3M™ VentureClad™ Insulation Jacketing

2.4.5. Outdoor Rectangular Ductwork – any size

- 2.4.5.1. Insulate ductwork with 50 mm (2" thick) rigid, fiberglass insulation board with factory-applied vapor barrier. Insulation: ASTM C612 Class 2, conductivity of 0.26, density of 3.0.
 - 2.4.5.2. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.
 - 2.4.5.3. Jacket
 - 2.4.5.3.1. A zero permeability, all weather, multi-layered laminate coated with a cold weather acrylic adhesive, superior resistance to weathering, mold, UV and extreme environmental conditions. Designed for use as a vapour barrier for insulation cladding and jacketing applications.
 - 2.4.5.3.2. Zero permeability vapour barrier for insulation cladding and jacketing applications
 - 2.4.5.3.3. Cold weather acrylic adhesive applies easily at temperatures as cold as -23°C (-10°F)
 - 2.4.5.3.4. Puncture and Tear resistant
 - 2.4.5.3.5. Self Adhesive material installs easily with no offsite fabrication required
 - 2.4.5.3.6. Cuts and installs easily on-site, no special tools required
 - 2.4.5.3.7. Flexible, strong, reinforced insulation cladding
 - 2.4.5.3.8. Standard Acceptance: 3M™ VentureClad™ Insulation Jacketing
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2.4.6. Kitchen Exhaust Ductwork listed under NFPA-96

2.4.6.1. Not applicable

2.4.7. Accessories

2.4.7.1. Closure Materials: Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.

2.4.7.2. Support Materials: Hanger straps, hanger rods, saddles, support rings.

2.4.7.3. Contact adhesive: quick-setting, non-flammable fire resistive adhesive to adhere fibrous glass to ducts. Flame spread 15 smoke development 0.

PART 3 - EXECUTION

3.1. GENERAL REQUIREMENTS

3.1.1. Required pressure tests of piping and ductwork 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.

3.1.2. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

3.1.3. Insulation materials shall be installed in a first class manner 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).

3.1.4. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

3.1.5. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

- 3.1.6. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
 - 3.1.7. 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.
 - 3.1.8. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.
 - 3.1.9. Hot piping work not to be insulated:
 - 3.1.9.1. Factory pre-insulated components.
 - 3.1.9.2. Over equipment nameplates.
 - 3.1.9.3. Vibration control devices
 - 3.1.9.4. Air chambers, unions, strainers, check valves, flow regulators.
 - 3.1.9.5. Pot feeders, filtration cartridges
 - 3.1.10. Ductwork not to be insulated:
 - 3.1.10.1. Indoor return ductwork
 - 3.1.10.2. Exhaust air ductwork up to 3 m (10 ft) prior to existing the building
 - 3.1.11. Firestop Pipe insulation:
 - 3.1.11.1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed.
 - 3.1.11.2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - 3.1.11.2.1. Pipe risers through floors
 - 3.1.11.2.2. Pipe chase walls and floors
 - 3.1.11.2.3. Smoke partitions
 - 3.1.11.2.4. Fire partitions
 - 3.1.11.2.5. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide where indicated on the drawings
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3.1.12. Provide vapor barrier jackets over insulation as follows:

3.1.12.1. All piping and ductwork exposed to outdoor weather.

3.1.12.2. All interior piping and ductwork conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.

3.1.13. Provide metal jackets over insulation as follows:

3.1.13.1. All HVAC piping and ductwork exposed to outdoor weather.

3.2. INSULATION INSTALLATION

3.2.1. Molded Mineral Fiber Pipe and Tubing Covering:

3.2.1.1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

3.2.2. Flexible Mineral Fiber Blanket - Ductwork:

3.2.2.1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.

3.2.2.2. Blanket insulation shall be tightly sealed at all joints and seams. Insulation shall be cut longer than ductwork perimeter to allow maximum thickness on all areas and avoid excessive compression. All joints shall be over lapped at least 2" and stapled in place. The stapled seams shall be sealed with a minimum 3" wide pressure sensitive tape designed for use with the duct insulation. All breaks in the vapor barrier facing shall also be sealed with the tape. The underside of ductwork 18" or greater in width, and vertical surfaces 48" or greater shall have the insulation additionally secured with mechanical fasteners and speed clips spaced

approximately 12" on center. The protruding ends of the fasteners shall be cut off flush after the speed clips are installed, and then sealed with the same tape as specified above.

3.2.2.3. Finished installation shall provide a continuous and effective vapor barrier.

3.2.2.4. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.

3.2.3. Rigid Board Mineral Fiber Insulation - Ductwork

3.2.3.1. Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.

3.2.3.2. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.

3.2.3.3. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.

3.2.3.4. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.

3.2.4. Duct Wrap for Kitchen Hood Grease Ducts:

3.2.4.1. Not Applicable.

3.2.5. Flexible Elastomeric Cellular Thermal Insulation:

3.2.5.1.1. Not applicable

3.3. INSULATION JOINTS

- 3.3.1. All insulation joints should be sealed with pressure-sensitive joint sealing tape to match the insulation facing. Rub hard with a plastic sealing tool to effect a tight bond.
- 3.3.2. Recommended practice: 3" (76mm) wide tape on flat surfaces or where edges are ship-lapped and stapled. Use 5" (102mm) wide tape in lieu of ship-lapping.
- 3.3.3. All sheet metal joints must be sealed prior to insulating.

3.4. INSULATION AT DUCT SUPPORTS

- 3.4.1. Refer to and conform strictly to insulation and protection jacket manufacturers' instructions.
- 3.4.2. To properly insulate through a roof top duct support; lift duct off of support, insulate duct through the support, install protection jacket through the support and add an additional layer of protection jacket 6" wide on the bottom and both sides at the point of contact with the support system.
- 3.4.3. When it is not possible to lift a duct off the rooftop supports, it is necessary to incorporate the support system into the insulation system by encapsulating the supports with insulation. This same system must be used if duct supports are screwed onto the ductwork

3.5. FIELD-APPLIED JACKET APPLICATION

- 3.5.1. Apply PVC jacket on piping insulation where indicated, with 1 inch (25 mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- 3.5.2. Apply aluminum jacket where indicated (piping and ductwork) and on all piping/ductwork located outdoors, with 2-inch (50 mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel band 12 inches (300 mm) o.c. and at end joints. Provide vapor-barrier jackets. Aluminum jackets shall have seams located below the horizontal plane of the horizontal piping route. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and cover with aluminum jackets.

3.6. OUTDOOR DUCTWORK – RECTANGULAR

- 3.6.1. All roof-top ductwork to must be designed and built with adequate slope (watershed) to prevent ponding water. Ponding water is defined as water that stays in place for greater than 24 hours.
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PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. Ductwork and accessories for HVAC including the following:

1.1.1.1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.

1.1.2. Section Includes:

1.1.2.1. Ductwork materials, plenums, construction, , fabrication, and support

1.1.2.2. Galvanized steel ductwork (rectangular, round)

1.1.2.3. Reinforcing and supports.

1.1.2.4. Flexible duct.

1.1.2.5. Special ductwork construction including exhaust plenums;

1.1.2.6. Duct sealants.

1.1.2.7. Ductwork sealing, inspection, and leakage testing.

1.1.2.8. Ductwork accessories

1.1.3. *Section does not include:*

1.1.3.1. *Dust or particle collection ductwork*

1.1.4. Definitions:

1.1.4.1. SMACNA standards as used in this specification means the HVAC Duct Construction Standards, Metal And Flexible.

1.1.4.2. 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.

1.1.4.3. Duct pressure classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.1.4.4. Exposed duct: exposed to view in a finished room

1.1.4.5. Outdoor duct: exposed to weather.

1.2. QUALITY ASSURANCE

1.2.1. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

- 1.2.2. Duct system construction and installation: referenced SMACNA standards are the minimum acceptable quality.
- 1.2.3. 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.
- 1.2.4. 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.

1.3. SUBMITTALS

- 1.3.1. Provide the following information and product data:

- 1.3.1.1. Sealants and gaskets
- 1.3.1.2. Access doors
- 1.3.1.3. Hangers and supports
- 1.3.1.4. Duct fittings
- 1.3.1.5. Turning vanes
- 1.3.1.6. Flexible duct
- 1.3.1.7. Volume control dampers
- 1.3.1.8. Fire and smoke dampers

- 1.3.2. Applicable Publications

- 1.3.2.1. American Society for Testing and Materials (ASTM):

- 1.3.2.1.1. A167 99(2009) Standard Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip
 - 1.3.2.1.2. A653-09 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
 - 1.3.2.1.3. A1011-09a Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 1.3.2.1.4. B209 07 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
 - 1.3.2.1.5. C1071-05e1 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
 - 1.3.2.1.6. E84-09a Standard Test Method for Surface Burning Characteristics of Building Materials
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1.3.2.2. National Fire Protection Association (NFPA):

- 1.3.2.2.1. 90A-09 Standard for the Installation of Air Conditioning and Ventilating Systems
- 1.3.2.2.2. 96-08 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- 1.3.2.2.3. E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
- 1.3.2.2.4. 2nd Edition – 2005 HVAC Duct Construction Standards, Metal and Flexible
- 1.3.2.2.5. 1st Edition - 1985 HVAC Air Duct Leakage Test Manual
- 1.3.2.2.6. 6th Edition – 2003 Fibrous Glass Duct Construction Standards

1.3.2.3. Underwriters Laboratories, Inc. (UL):

- 1.3.2.3.1. 181 08 Factory Made Air Ducts and Air Connectors
- 1.3.2.3.2. 555 06 Standard for Fire Dampers
- 1.3.2.3.3. 555S 06 Standard for Smoke Dampers

1.4. WARRANTY

- 1.4.1. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1. GENERAL USE DUCTWORK

- 2.1.1. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel of lock-forming quality to ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
 - 2.1.2. Approved factory made joints may be used.
 - 2.1.3. Provide fittings, branches, inlets and outlets in such a manner that air turbulence is reduced to a minimum.
 - 2.1.4. Rectangular Duct Construction
 - 2.1.4.1. Rectangular duct longitudinal seams shall be Pittsburgh lock 3/8 in. minimum pocket. Crossbreak or bead rectangular ductwork
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- 2.1.4.2. Thickness shall be the more restrictive between the SMACANA Standards and the following:
- 2.1.4.2.1. Ducts through 12 in. wide: 24 Gage
 - 2.1.4.2.2. Ducts 13 in. through 30 in. wide: 22 Gage.
 - 2.1.4.2.3. Ducts 31 in. through 84 in. wide: 20 Gage.
 - 2.1.4.2.4. Ducts 84 in. and larger: 18 Gage
- 2.1.4.3. Elbows
- 2.1.4.3.1. Unless shown otherwise on the drawings, install a 1.5 times width to centerline radius elbow (full radius elbow). Where not possible, use lesser radii configurations, with 'radius-proportional' splitter vanes permanently installed within.
 - 2.1.4.3.2. Only where shown specifically on the drawings, provide square elbows with double thickness vanes.
- 2.1.4.4. Transitions
- 2.1.4.4.1. Limit transition angles (for each side) to 15 degrees diverging and 30 degrees converging.
- 2.1.4.5. Offsets:
- 2.1.4.5.1. Radiused elbows, as indicated.
- 2.1.4.6. Take-Off Fittings:
- 2.1.4.6.1. For take-offs carrying more than 25 percent of duct main, provide an increasing branch elbow with an inside radius equal to branch duct width. Size branch and main at elbow for equal velocity.
 - 2.1.4.6.2. For take-offs carrying 25 percent or less of duct main, provide flanged increased area branch take-off (45 degree entry, "shoe" type) or 45 degree lateral wye takeoffs. Conical fittings shall be used for spiral, round, and oval ductwork.
 - 2.1.4.6.3. For take-offs directly to side outlet for register or grille, provide an increased area tap. For take-offs directly to diffusers see appropriate SMACNA figures.
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2.1.4.7. Turning vanes

2.1.4.7.1. Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

2.1.4.7.2. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes in accordance with SMACNA Chart 4-1 and Figure 4-9.

2.1.5. Round Duct Construction

2.1.5.1. All round and oval duct shall be manufactured of spiral lock seams. Ductwork up to 12 in. diameter and 2 in. w.g. can be manufactured with longitudinal lock seams.

2.1.5.2. Minimum galvanized rectangular duct gage shall be the more restrictive between the SMACANA Standards and the following:

2.1.5.2.1. Ducts less than 10" diam: 26 ga spiro duct without ribs

2.1.5.2.2. Ducts 12" to 16" in. diam: 24 Gage

2.1.5.2.3. Ducts 18" through 24" diam: 22 Gage.

2.1.5.2.4. Ducts 26 in. through 30" diam: 20 Gage.

2.1.5.2.5. Ducts 32" diam and larger: 18 Gage

2.1.5.3. Tees shall be conical. Laterals shall be straight. Taps through 10 in. diameter in size shall have a machine drawn entrance and fittings shall have longitudinal seams, continuously welded. Both sides of welds shall be primed with zinc chromate. Tap entrances shall be free of weld build-up.

2.1.5.4. Elbows in diameters 2 in. through 10 in. shall be stamped or pleated. Elbows shall be 5 gore for 90 degrees and 3 gore for 45 degrees. Elbows shall have 1.5 times width to centerline radius (full radius elbow).

2.1.5.5. Flanges, access doors and taps into spiral ducts shall be factory fabricated.

2.1.5.6. Field joints in diameters through 48 in. shall be made with 2 in. long slip-fit, sleeve coupling, or flanges. Duct sealer to be applied on male end connectors before insertion and afterwards to cover the entire joint and sheet metal screws. Sheet metal screws shall be installed at a maximum 300 mm spacing, with a minimum of 3 screws per joint.

- 2.1.5.7. Ductwork 48 in. diameter and over, and for all sizes where disassembly or removal is required, shall be joined with flanges.

2.2. SEALING CLASSIFICATION

- 2.2.1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke 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.
- 2.2.2. 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.
- 2.2.3. Gaskets in Flanged Joints: Soft neoprene.
- 2.2.4. Sealing classification as per the following table

SEAL CLASS	SEALING REQUIREMENTS	STATIC PRESSURE	ALLOWABLE LEAKAGE RATE
A	All traverse duct joints, all longitudinal duct seams and all duct wall penetrations	-4" to +4" w.g. (1,000 to +1,000 Pa)	1% of total design air flow at 4" w.g. (+1,000 Pa) operating pressure
B	All traverse duct joints, all longitudinal duct seams	-3" to +3" w.g. (-750 to +750 Pa)	1% of total design air flow at 3" w.g. (+750 Pa) operating pressure
C	All traverse duct joints	-2" to +2" w.g. (-500 to +500 Pa)	1.5% of total design air flow at 2" w.g. (+500 Pa) operating pressure
D	Not sealed	-1" to +1" w.g. (-250 to +250 Pa)	5% of total design air flow at 1" w.g. (+250 Pa) operating pressure

Note: Dust collection exhaust ductwork not included.

2.3. PRESSURE CLASSIFICATIONS

2.3.1. 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 CLASS	REMARKS
All supply ductwork	-3" to +3" w.g. (-750 to +750 Pa)	B	
All return ductwork	-2" to +2" w.g. (-500 to +500 Pa)	C	
All exhaust ductwork	-2" to +2" w.g. (-500 to +500 Pa)	C	
All other ductwork not listed herein	-1" to +1" w.g. (-250 to +250 Pa)	D	

2.4. PLENUMS

2.4.1. Intake and Exhaust plenums shall be double wall with 2 in. thick duct liner, G-90 galvanized steel solid inner wall (gauge per specified duct minimum standards) and minimum 18 gauge, G-90 galvanized steel outer wall.

2.5. FLEXIBLE AIR DUCT

2.5.1. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

2.5.2. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.

2.5.3. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).

2.5.4. Application Criteria:

- 2.5.4.1. Temperature range: -18 to 93 degrees C (0 to 200 degrees F) internal.
- 2.5.4.2. Maximum working velocity: 1200 m/min (4000 feet per minute).
- 2.5.4.3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.

2.5.5. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

2.6. DUCT ACCESS DOORS

2.6.1. Provide access doors, sized and located for maintenance work, upstream, in the following locations:

- 2.6.1.1. Each duct mounted coil and humidifier.
- 2.6.1.2. Each fire damper (for link service), smoke damper and automatic control damper.
- 2.6.1.3. Each duct mounted smoke detector.

2.6.2. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

2.6.3. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2 12).

2.6.4. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

2.6.5. Access doors to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be aluminum or steel full length continuous piano type. Doors in concealed spaces shall be secured in place with cam sash latches.

2.6.6. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access.

2.6.7. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork.

- 2.6.8. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

2.7. VOLUME CONTROL DAMPERS (MANUAL ADJUSTMENT)

- 2.7.1. Single or multi-blade in opposed arrangement, as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.

2.8. INSTRUMENT TEST FITTINGS

- 2.8.1. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.
- 2.8.2. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

2.9. DUCTWORK HANGERS AND SUPPORTS

- 2.9.1. Generally, hang and support ductwork per the latest edition of SMACNA. Additionally, adhere to the more specific requirements found in this specification section, the Related Sections, and as indicated on the project drawings.
- 2.9.2. Hanging duct, equipment, or accessories with cables or wires is prohibited.
- 2.9.3. Provide vibration isolation as specified in Related Section.
- 2.9.4. Ductwork shall be supported and anchored to structure so that horizontal ducts are without sag or sway, vertical ducts without buckle and all ducts are free from deformation, collapse or vibration
- 2.9.5. Upper hanger attachments:
- 2.9.5.1. For concrete: manufactured concrete inserts.
- 2.9.5.1.1. Standard of Acceptance: Myatt fig 485.
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- 2.9.5.2. For concrete after concrete pour:
 - 2.9.5.2.1. Expanded concrete anchors shall be made of steel.
 - 2.9.5.3. 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.
 - 2.9.5.4. 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.
 - 2.9.5.5. For steel joist: manufactured joist clamp or steel plate washer.
 - 2.9.5.5.1. Standard of Acceptance: Grinnell fig 61 or 86 for joist clamps.
 - 2.9.5.6. For steel beams: manufactured beam clamps:
 - 2.9.5.6.1. Standard of Acceptance: Grinnell fig. 60
 - 2.9.6. Support un-insulated rectangular ducts in sizes up to 600 mm (24 in.) by non-perforated galvanized steel strap or by trapeze hangers. Support insulated rectangular ducts and ducts larger than 36 in. with trapeze hangers. Straps shall be one gauge thicker than the duct material being supported.
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- 2.9.7. Support rectangular ducts in sizes 350 mm (26 in) and larger by galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA. Space the angle supports in accordance with the

DUCT SIZE	ANGLE SIZE (mm)	ROD SIZE (mm)
Up to 750 mm (30")	25 x 25 x 3	6
800-1500 mm (32"-60")	40 x 40 x 3	10
1500-2400 mm (60"-96")	50 x 50 x 5	10
> 2400 mm (96")	50 x 50 x 6	10

following table:

- 2.9.8. For round ductwork the duct shall be supported as follows:

2.9.8.1.1. For duct dimensions 900 mm (36") single strap hangers are acceptable.

2.9.8.1.2. For duct dimensions over 900 mm (36") use trapeze hangers with rods provided on both sides of the duct.

2.9.8.2. Minimum hanger sizes shall be in accordance with table 4-2 of SMACNA.

2.9.8.3. Loading on trapeze bars shall be in accordance with Table 4-3 of SMACNA

2.9.9. Install supports on both ends of duct turns, branch fittings and transitions.

2.9.10. Do not hang ductwork from piping, ducts, other trades hangers, existing hangers, or equipment.

2.9.11. Provide supports on each side of any duct mounted equipment or device, including fans, coils, dampers, etc, to permit removal of item without removal of adjacent duct sections.

2.9.12. Provide supplemental steel required to support ductwork in shafts, mechanical rooms or on the floor where structural steel is not properly positioned.

2.9.13. Beam clamps shall be double sided on ducts over 36 in. by 36 in. Use double sided or single sided beam clamps with retaining clips on all other sizes.

2.9.14. Do not modify existing structural steel without approval and a structural engineer's review.

2.9.15. Provide clamping systems that are compatible with the structural steel system of the building.

2.9.16. Use angle iron "V" construction supports or similarly rigid construction for vertical ducting that requires lateral support.

- 2.9.17. Ductwork mounted on roof or otherwise exposed to elements shall be supported with non-penetrating supports constructed of galvanized steel angles and channels, regardless of duct size. Standard of Acceptance: Portable Pipe Hangers (Canada)
- 2.9.18. Provide angle sway bracing and diagonal cross bracing to the structure to provide support against maximum lateral loads that may be imposed on the ductwork installed downstream of fan discharges and ductwork exposed to wind loads, and any other locations exposed to lateral loads.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
 - 3.1.2. Comply with the provisions of section 23 07 11 INSULATION FOR HVAC
 - 3.1.3. 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 government. 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.
 - 3.1.4. Ductwork shall be installed to true alignment, parallel or perpendicular to adjacent building walls, floors and ceilings, to present a neat and workmanlike appearance.
 - 3.1.5. 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.
 - 3.1.6. Provide bolted construction and tie rod reinforcement in accordance with SMACNA Standards.
 - 3.1.7. 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.
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- 3.1.8. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.
 - 3.1.9. For ductwork mounted outdoors, install duct with slight lateral pitch to prevent water ponding on top of duct.
 - 3.1.10. Install special equipment items in ductwork systems including, but not limited to: control dampers, thermometers, airflow measuring devices and other related items, according to manufacturer's recommendations.
 - 3.1.11. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
 - 3.1.12. Flexible duct installation: Refer to SMACNA Standards, Chapter 3. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.
 - 3.1.13. 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.
 - 3.1.14. Protection and Cleaning:
 - 3.1.14.1. 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.
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3.2. DUCT LEAKAGE TESTS AND REPAIR

- 3.2.1. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor. For maximum leakage rates, refer to pressure classifications and sealing classifications included in part 2 of these specifications
 - 3.2.2. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections.
 - 3.2.3. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.
 - 3.2.4. 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 Resident Engineer.
 - 3.2.5. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.
 - 3.2.6. Duct Leakage Testing Procedures:
 - 3.2.6.1. Prior to fabrication and installation, develop and submit for approval a ductwork testing plan, indicating locations of temporary caps, surface area of ductwork test sections, test pressure, leakage class and allowable leakage in cubic feet per minute.
 - 3.2.6.2. Notify the Client's Representative at least 2 days prior to each test.
 - 3.2.6.3. Provide all blank-off plates, flanges, and safing required to isolate each section of duct to be tested.
 - 3.2.6.4. Provide necessary testing apparatus.
 - 3.2.6.5. For all ducts, pressurize ductwork to the specified pressure class and inspect ductwork for visual and audible leaks, and leaks perceptible to a hand 2 in. from duct. Reseal all perceptible leaks until acceptable to Client's Representative.
 - 3.2.6.6. After completing visual and audible inspection, conduct measured ductwork leakage tests at the specified pressure class for the duct. Reseal and retest as required until successfully achieving the specified leakage class.
 - 3.2.6.7. Submit leakage test report for approval, using SMACNA or other approved form.
 - 3.2.6.8. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.
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3.3. DUCT PAINTING

- 3.3.1. Where the interior of duct is visible through grilles, registers, diffusers or other air diffusion devices, paint the interior flat black. Coordinate work with Architectural Trade.
- 3.3.2. For plenum returns, where equipment and structure above ceiling is visible through return air grilles, provide black sheet metal baffle with turned edges suspended from building construction. Size and position the baffle to prevent restriction of air flow. Where space above ceiling precludes use of a baffle, paint visible building surfaces flat black.

3.4. DUCTWORK EXPOSED TO WIND VELOCITY

- 3.4.1. Provide additional support and bracing to all exposed ductwork installed on the roof or outside the building to withstand wind velocity of 145 km/h (90 mph).
 - 3.4.2. All bracing to be stamped and sealed by a licensed Structural Professional Engineer and submitted for review. All engineering services required for additional strapping to be provided by the roof duct support manufacturer and paid for by the Contractor.
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PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section applies to all sections of Division 26.
- 1.1.2. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.
- 1.1.3. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2. MINIMUM REQUIREMENTS

- 1.2.1. Canadian Electrical Safety Code, (CESC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- 1.2.2. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3. TEST STANDARDS

- 1.3.1. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

1.4. DEFINITIONS:

- 1.4.1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
 - 1.4.2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and
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equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

1.4.3. Certified: Materials and equipment which:

1.4.4. Have been tested and found to meet nationally recognized standards or to be safe for use in a specified manner.

1.4.5. Bear a label, tag, or other record of certification.

1.5. QUALIFICATIONS (PRODUCTS AND SERVICES)

1.5.1. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

1.5.2. Product Qualification:

1.5.2.1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.

1.5.2.2. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.6. APPLICABLE PUBLICATIONS, CODES AND STANDARDS

1.6.1. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.

1.6.2. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6.3. Publications:

1.6.3.1. CAN/CSA C22.1-015, Canadian Electrical Code Part 1 (23rd Edition), Safety Standard for Electrical Installations.

1.6.3.2. Ontario Electrical Safety Code 26th Edition / 2015 or later.

1.6.3.3. CAN3-C235-83 (R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000V.

1.6.3.4. National Building Code of Canada.

1.6.3.5. National Fire Code of Canada.

1.6.3.6. Ontario Building Code 2012.

1.6.3.7. National Fire Protection Code NFPA-70

1.7. MANUFACTURED PRODUCTS

- 1.7.1. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.
- 1.7.2. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- 1.7.3. Equipment Assemblies and Components:
 - 1.7.3.1. Components of an assembled unit need not be products of the same manufacturer.
 - 1.7.3.2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
- 1.7.4. Components shall be compatible with each other and with the total assembly for the intended service.
- 1.7.5. Constituent parts which are similar shall be the product of a single manufacturer.
- 1.7.6. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- 1.7.7. When Factory Testing Is Specified:
 - 1.7.7.1.
 - 1.7.7.2. The Board shall have the option of witnessing factory tests. The Contractor shall notify the Board a minimum of 15 working days prior to the manufacturer's performing the factory tests.
 - 1.7.7.3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Board to witness re-testing.

1.8. VARIATIONS FROM CONTRACT REQUIREMENTS

- 1.8.1. Where the Board or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.9. MATERIALS AND EQUIPMENT PROTECTION

- 1.9.1. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
 - 1.9.2. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
 - 1.9.3. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
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- 1.9.4. Damaged equipment shall be repaired or replaced, as determined by the Consultant.
- 1.9.5. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
- 1.9.6. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.10. WORK PERFORMANCE

- 1.10.1. All electrical work shall comply with the requirements of CESC, NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.
- 1.10.2. Job site safety and worker safety is the responsibility of the Contractor.
- 1.10.3. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
- 1.10.4. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
- 1.10.5. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Consultant
- 1.10.6. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility.
- 1.10.7. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions.
- 1.10.8. Coordinate location of equipment and conduit with other trades to minimize interference.

1.11. COORDINATION AND INTERFERENCE DRAWINGS

- 1.11.1. Provide information and cooperate with the General/Mechanical Contractor for the preparation of interference and coordination drawings.
 - 1.11.2. Interference and coordination drawings to be provided in order to make clear the Work intended or to show how it affects other trades.
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1.11.3. interference and coordination drawings to be provided for:

- 1.11.3.1. Basement corridors
- 1.11.3.2. Attic spaces

1.12. EQUIPMENT INSTALLATION AND REQUIREMENTS

1.12.1. Equipment location shall be as close as practical to locations shown on the drawings.

1.12.2. Working clearances shall not be less than specified in the CEC.

1.12.3. Inaccessible Equipment:

- 1.12.3.1. Where the Consultant determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Board.
- 1.12.3.2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.12.4. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.13. EQUIPMENT IDENTIFICATION

1.13.1. In addition to the requirements of the CEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

1.13.2. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

1.13.3. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm²), required PPE category and description including the glove rating,

voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

1.14. SUBMITTALS

- 1.14.1. All submittals shall include copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Board to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
 - 1.14.2. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
 - 1.14.3. The Consultant's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
 - 1.14.4. The submittals shall include the following:
 - 1.14.4.1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
 - 1.14.4.2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - 1.14.4.3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
 - 1.14.5. Maintenance and Operation Manuals:
 - 1.14.5.1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
 - 1.14.5.2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
 - 1.14.5.3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
 - 1.14.6. The manuals shall include:
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- 1.14.6.1. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
- 1.14.6.2. A control sequence describing start-up, operation, and shutdown.
- 1.14.6.3. Description of the function of each principal item of equipment.
- 1.14.6.4. Installation instructions.
- 1.14.6.5. Safety precautions for operation and maintenance.
- 1.14.6.6. Diagrams and illustrations.
- 1.14.6.7. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
- 1.14.6.8. Performance data.
- 1.14.6.9. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
- 1.14.6.10. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- 1.14.6.11. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

1.15. RECORD DRAWINGS

- 1.15.1. The Consultant will provide to the Electrical Contractor one set of AutoCad computer files and one set of white prints of all drawings relating to the work of this contract, for the purpose of preparing record drawings. As the job progresses, mark up the white prints to accurately indicate installed work, i.e. location and elevations, etc. On completion of the work, the Electrical Contractor to transfer the information neatly onto the computer files based on AutoCad 2007 or higher, and submit the electronic files and one set of prints for review and comment. Correct the files as directed by the Consultant and hand these over to the Board, together with a set of white prints, on completion.
 - 1.15.2. Record, as the job progresses, all approved changes and deviations made to any work shown on the original contract drawings whether by addenda, requested changes, job instructions, and changes due to job conditions.
 - 1.15.3. Indicate on the drawings all conduits, pull boxes, junction boxes, empty conduits, concealed main and sub-feeder conduits and any other equipment not clearly in view, with exact dimensions for future reference. Tie dimensions by measurement to existing topographical features, and include changes in directions as well as at least three points on straight runs of conduits on raceways.
 - 1.15.4. All conduits in slabs, under slab and direct buried are to be shown on the Record drawings.
 - 1.15.5. Record drawings to be kept up to date and be available for checking at any time by Boards and Consultant. Progress draws will not be reviewed unless the record drawing set is up to date.
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- 1.15.6. All equipment schedules, panel schedules, system schedules, riser diagrams, details, etc. to be updated to reflect the as installed condition and included as part of the record drawing submission.
- 1.15.7. Provide a schedule indicating the protective device trip setting of all Air Circuit Breakers and Electronic Solid State Circuit Breakers which are reflected on each of the Power Distribution Single Line Riser Diagram drawings. The protective device trip settings that are to be listed in the schedule are to be those which are based upon the final reviewed and accepted version of the short circuit and protection and coordination as well as the arc flash study.
- 1.15.8. Branch circuiting, lighting zoning, switching, etc. methodology to be the same as that indicated on the electrical contract documents that are issued for construction.
- 1.15.9. Electrical record drawings to be submitted in both AutoCad and PDF format.
- 1.15.10. Record drawings will not be reviewed for acceptance until project substantial completion has been issued.

1.16. ACCEPTANCE CHECKS AND TESTS

- 1.16.1. The Contractor shall furnish the instruments, materials, and labor for tests.
- 1.16.2. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Board.
- 1.16.3. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Board.

1.17. CODES, PERMITS AND INSPECTIONS

- 1.17.1. All work to meet or exceed the latest requirements of the Codes and Standards as listed in PART 1 of these specifications, supplements, local inspection bulletins and all Authorities Having Jurisdiction.
 - 1.17.2. Arrange for inspection of all work and pay all fees in this regard. On completion of the work, deliver the final unconditional certificate of approval of the Electrical Safety Authority (ESA).
 - 1.17.3. It is hereby agreed that all requirements meet CAN/CSA requirements and a complete installation in accordance with these requirements to be provided.
 - 1.17.4. Keep a permanent record of each inspection made by the Electrical Safety Authority showing the date, inspector's name, scope of the inspection and statement of special decisions or permissions granted. Make these records available to the Consultant at any time, and turn them over at completion of the work.
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1.18. WARRANTY

- 1.18.1. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of Substantial Completion of the entire installation by the Board's representative.

1.19. INSTRUCTION

- 1.19.1. Instruction to designated Board personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- 1.19.2. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.
- 1.19.3. A training schedule shall be developed and submitted by the Contractor and approved by the Consultant at least 15 days prior to the planned training.

PART 2 - PRODUCTS

2.1. MATERIALS AND EQUIPMENT

- 2.1.1. All materials and equipment to be new and free from defects.
- 2.1.2. All material and equipment to be CAN/CSA certified. Where CAN/CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- 2.1.3. Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish the standards of desired quality, style or dimensions and to be the basis of the Bid. Furnish materials so specified under this Contract unless changed by mutual agreement. Where two or more designations are listed, the Electrical Contractor to choose one of those listed.
- 2.1.4. Where the use of equivalent, alternate or substitute equipment alters the design or space requirements indicated on the plans, the Electrical Contractor for this contract to include all items of cost for the revised design and construction, including the cost of all the other trades involved.
- 2.1.5. Acceptance of the proposed equivalents, alternates or substitutions to be subject to the review by the Consultant, and if requested, the Electrical Contractor to submit for inspection, samples of both the specified and the proposed alternate items.
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- 2.1.6. In all cases where the use of equivalents, alternates or substitutions is permitted, the Electrical Contractor to bear any extra costs of evaluating the quality of materials and the equipment to be installed.

2.2. EQUIVALENTS AND ALTERNATES

- 2.2.1. Should the Electrical Contractor propose to furnish material and equipment other than those specified, he is to submit in writing through the Bidding System for approval of equivalents at least ten working days prior to the closing of Bids, submitting with his request for approval, complete descriptive and technical data on the item or items he proposes to furnish. Approval for changes in the base bid specifications will be considered only upon the individual requests of the Electrical Contractor. No blanket approval for equipment will be given to suppliers, distributors or contractors.
- 2.2.2. Unless requests for changes in base bid specifications are received and approved prior to the opening of the bids, as defined above, the Electrical Contractor will be held to furnish all specified items under his base bid. After the Contract is awarded, changes in specifications will be made only as defined in the Article dealing with Material Substitution.
- 2.2.3. Replace unspecified materials or rejected equivalents and alternates built into the work with specified or accepted materials at no additional cost to the Owner.
- 2.2.4. If any material or equipment being considered for substitution involves additional design, architectural or engineering fees or other costs in checking whether or not the substitute material or equipment is suitable for the project, such fees or costs to be paid for by the Electrical Contractor. A minimum of five hundred dollars (\$500.00) to be applied to each piece of device or equipment requested for review. There is no guarantee that the reviewed product will be accepted by the Board or the reviewing Consultant.

2.3. MATERIAL SUBSTITUTION

- 2.3.1. After award of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be considered by the Consultant subject to the following:
- 2.3.1.1. The specified material cannot be delivered to the job in time to complete the work in proper sequence to work of other trades, due to conditions beyond the control of the Electrical Contractor.
 - 2.3.1.2. Requests for substitutions to be accompanied by documentary proof of equality, difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment.
 - 2.3.1.3. In case of difference in price, the Owner is to receive all benefit of the difference in cost involved in any substitution and the Contract altered by change order to credit the Owner with any savings so obtained.
 - 2.3.1.4. Materials and equipment substituted or offered as alternatives to have spare parts and servicing available and to fit into the space allocation shown on the drawings.
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- 2.3.1.5. If any material or equipment being considered for substitution involves additional design, architectural or engineering fees or other costs in checking whether or not the substitute material or equipment is suitable for the project, such fees or costs to be paid for by the Electrical Contractor. A minimum of five hundred dollars (\$500.00) to be applied to each piece of device or equipment requested for review. There is no guarantee that the reviewed product will be accepted by the Board or the reviewing Consultant.

2.4. WARNING SIGNS

- 2.4.1. Warning Signs: in accordance with requirements of Authority Having Jurisdiction and Consultants.
2.4.2. Comply with Health Canada/Workplace Hazardous Materials Information System (WHMIS).
2.4.3. Provide warning labels in both English and French where project requires.

2.5. FINISHES

- 2.5.1. Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and two coats of finish enamel.
2.5.2. Paint outdoor electrical distribution equipment green finish to EEMAC Y1-2.
2.5.3. Paint indoor normal power distribution equipment enclosures light grey to EEMAC 2Y-1.
2.5.4. Paint indoor emergency power "Life Safety" distribution equipment enclosures Red.
2.5.5. Paint indoor emergency power "Non-life Safety" distribution equipment enclosures International Orange, RAL #2009.
2.5.6. Paint indoor UPS power distribution equipment enclosures Blue, RAL #5017.

2.6. CAN/CSA/NEMA RATING

- 2.6.1. All electrical equipment provided for this project to be CAN/CSA/NEMA Rated only. IEC Rated equipment is not acceptable and will not be accepted.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Comply with all Codes and Standards listed in PART 1 – GENERAL.
3.1.2. Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, SDS, and product datasheets. Protect electrical equipment from dust and dirt. Plug or cap openings of conduits, fixtures and equipment during construction with approved materials for such use.
3.1.3. The Electrical Contractor to be responsible for the layout of the work of this contract, and for any damage caused to site or existing building, or other Contracts by improper location or carrying out of this work.
3.1.4. Ensure the prompt installation of the work of this contract in advance of concrete pouring or similar work.
3.1.5. No conduits for any power or systems to be permitted to be installed within the concrete slabs or concrete walls for this project except in select identified areas as per the drawings and specifications.
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- 3.1.7. Furnish items to be "built-in" in ample time and give any necessary information and assistance in connection with the building-in of the same.
- 3.1.8. Manufactured products supplied with instructions for their use to be used in strict accordance with those instructions.
- 3.1.9. Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.

3.2. SITE SERVICES

- 3.2.1. Site services: acquire a full working knowledge of the building site, services and any existing conditions thereon that may impact the project implementation. Review and examine the contract drawings and schedules of all trades prior to bid submittal to ensure full knowledge of the contract scope of work is ascertained.
- 3.2.2. The location of equipment indicated or specified is considered approximate. Review proposed locations with Consultant prior to installation.
- 3.2.3. Locate equipment, piping, duct and/or conduit to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

3.3. CONTRACTOR'S SHOP

- 3.3.1. Provide job site office, workshop, tools, scaffolds, material storage, etc., as required to complete the work of this contract and as directed by the Consultant.
- 3.3.2. The electrical contractor's office should as a minimum have the following capabilities, Phone, fax, email, High speed internet connection, router with a spare port and patch cable in order that the consultant can access the internet to deal with project related issues, copier and printer.

3.4. TEMPORARY SERVICES

- 3.4.1. Provide temporary electrical services with all poles, transformer and protection equipment from the locations as coordinated with the Owner. Provide all power panels at various locations on the site required to perform the work and as specified by the Consultant. All temporary services must be coordinated with the Owner. Do not use the permanent service of new or existing building for temporary power for construction unless specific written approval is obtained from the Consultant and coordinated with the Board

3.5. ACCESS TO ELECTRICAL EQUIPMENT, JUNCTION BOXES AND PULL BOXES

- 3.5.1. Clear access of a minimum of 1 meter must be provided for all electrical equipment, junction boxes and pull boxes.
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- 3.5.2. All junction boxes and pull boxes to be within 600mm of an access panel or access luminaire and be easily accessed.
- 3.5.3. All electrical boxes that have free sides (IE: no conduits entering or leaving a side) to be kept clear in order to permit installation of conduits at a later date. Hence free sides of all electrical boxes to be clear of other conduits and services.

3.6. NAMEPLATES

- 3.6.1. Ensure manufacturer's nameplates, CAN/CSA labels and identification nameplates are visible and legible after equipment is installed.

3.7. LOCK OFF TABS

- 3.7.1. Provide lock off tabs on all panel boards for circuits that serve:

- 3.7.1.1. Emergency lighting;
- 3.7.1.2. Exit lighting;
- 3.7.1.3. Fire alarm equipment
- 3.7.1.4. Security equipment.

3.8. FIRESTOPPING

- 3.8.1. Where cables, sleeves or conduits, pass through floors and fire rated walls pack space between wiring and sleeve or opening and seal with Hilti fire stopping system that is appropriate. The fire stopping installation must meet one of the approved details as required to meet the rating of the assembly. Contact the Hilti representative to ensure that the installation meet Hilti requirements.
- 3.8.2. Care must be taken to keep integrity of all assemblies and maintain good finishes of surrounding areas, use tape for finish at edges when apply fire stopping materials. Provide at the end of the project a letter from Hilti indicating that the installation meets all requirements.
- 3.8.3. Meet all requirements of the Codes and fire proofing requirements as specified within the Contract Documents.
- 3.8.4. Provide Shop drawings for the various Fire stopping assemblies that will be utilized on the project to achieve the fire rating for construction assemblies or methods.
- 3.8.5. *Refer (where applicable) to architectural drawings for fire separation diagrams. Such drawings may not be issued as part of the electrical documents; it is the electrical contractor's obligation to review all contract documentation of all involved disciplines (drawings and specifications).*

3.9. BASES AND SUPPORTS

- 3.9.1. Where conduit and equipment is located on walls or slabs which will not permit the support of equipment, provide suitable supports to the building structure. Supports to be constructed of steel members or of steel pipe and fittings designed to safely support the equipment.
- 3.9.2. All equipment bases to be set on pads of kinetic pre-compressed fiberglass or vibration isolators sized to suit the equipment which they ought to support.

3.10. INSERTS, SLEEVES AND CURBS

- 3.10.1. Provide all inserts, sleeves and curbs required for the work of this contract.
- 3.10.2. Use only factory made threaded or toggle type inserts as required for support and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- 3.10.3. Use factory made expansion shields where inserts cannot be placed, but only where approved by the Structural Engineer and only for loads of 50 kg or less.
- 3.10.4. Do not use powder activated tools unless with written permission of the Board's Representative.
- 3.10.5. Supply and locate all inserts, holes, anchor bolts and sleeves in time when walls, floors and roof are erected.
- 3.10.6. Size sleeves to provide 25 mm clearance all around.
- 3.10.7. Pack all sleeves between the conduit or cable passing through the sleeve and the sleeve and all spare sleeves with loose fiberglass insulation. Seal the annular space both sides as follows:
 - 3.10.7.1. For all horizontal sleeves in exposed areas, use a seal of equal or better fire rating than the wall to be sealed.
 - 3.10.7.2. For all horizontal concealed sleeves through fire walls and through walls separating areas of different air pressure, use a permanently resilient silicone base or equal sealing compound.
 - 3.10.7.3. For all vertical sleeves through roofs, washrooms, janitor closets, equipment rooms, use permanently resilient silicone base or equal compound, non- flammable and waterproof. Ensure that the seal is compatible with floor and ceiling finishes. Check the room finishes schedules for further information.

3.11. CUT PATCH AND MAKE GOOD

- 3.11.1. All drilling, cutting, patching, concrete curbs, housekeeping pads and similar work required for installation of the specified systems shall be done under this contract.
 - 3.11.2. Do not use powder actuated tools using explosives, unless permitted expressly by the Board in writing.
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- 3.11.3. All cutting of steel shall be by mechanical cutters or saws. Torches and abrasives will only be permitted if there is no alternative. Prior to using torches or abrasives obtain Hot Work Permit in accordance with the Board's hot work procedure.
- 3.11.4. Scan the walls/floor slabs using ground penetrating radar (GPR) technology prior to making openings to determine the presence and location of embedded conduits or rebar. Clean the floors/walls immediately after core drilling/saw cutting is complete. All core drilling and loud and/or prolonged drilling shall be done after normal working hours (during silent hours) or as permitted by the "hammer drilling" schedule and 48 hour lead notice is to be provided to the building Owner to confirm contractor has met all mandatory conditions.
- 3.11.5. Core drilling through floors and walls shall be done with diamond drills only. The use of pneumatic hammers will not be permitted.
- 3.11.6. Patch and make good all surfaces cut, damaged or disturbed to the Board 's approval. Match existing material, colour, finish and texture.
- 3.11.7. Welding and cutting: conform to Ontario Health and Safety Act O.Reg. 213/91 amended to O.Reg. 628/05 Construction Projects. Obtain a Hot Work Permit from the PM prior to welding and cutting operations. Follow the PM's hot work procedures.
- 3.11.8. Do not dispose of cement, mortar, plaster or other similar materials into drainage system. Contractor shall be liable for all costs associated with cleanup and reinstatement to original condition after doing so.
- 3.11.9. Dispose of sediment-containing liquids such as those resulting from core drilling or concrete cutting into designated drains. Flush drain with sufficient quantity of clean water to ensure that drain is free-flowing and unobstructed. Be liable for all costs associated with cleanup and reinstatement of drain and piping to original condition if found to be blocked by sediment.
- 3.11.10. Firestop all penetrations through wall and floor assemblies with Hilti Firestop solutions having a fire resistance rating not less than the assembly penetrated, colour: red. Unless otherwise noted, use the following assembly ratings: floors 2-hours; walls except around stairways – 1½ hours; walls around stairways: 2 – hours. Submit to Consultant for approval the proposed system detail sheets bearing the UL/CUL system number. Provide specified firestopping compound on both sides of assembly penetrated regardless of UL/CUL detail requirements.

3.12. REMOVALS AND DEMOLITION

- 3.12.1. The drawings indicate the general scope of electrical removals. Verify on site the exact requirements and extent of removals.
 - 3.12.2. Maintain, retain and make good as required all existing systems, branch wiring and feeders intended to remain operational in areas which are affected by these renovations.
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- 3.12.3. Schedule all demolition work with project manager prior to any service interruption in occupied building area.
- 3.12.4. All shutdowns of existing base building systems shall be coordinated with the Board's representative. Pay for any cost incurred. All building services to remain fully operational during construction. Include in tender for off hours to install new breaker in existing panels and connection for feeders.
- 3.12.5. Remove electrical equipment as required complete with wiring up to associated panel. Remove all electrical components to be demolished or to be relocated and make safe all wiring. Hand over removed items to owner if requested. Dispose of the equipment properly which Owner does not wish to retain. Update existing panel directory which is affected.
- 3.12.6. Inform the Consultant and the Board immediately if any contaminated materials are found on site. Remove the items so that they can be packed and removed from the site. Provide assistance and cooperation for the complete removal.
- 3.12.7. The contractor shall be responsible to relocate any existing electrical equipment and/or wiring that will interfere with new construction.
- 3.12.8. The contractor shall be responsible for reconnection of any services that are to remain and have been disconnected during the course of demolition or construction.
- 3.12.9. All systems and components which are affected by the renovation shall remain operational subsequent to project completion. Reinstate immediately any services disrupted during demolition not intended to be removed as part of this contract at no extra cost.
- 3.12.10. Retain continuity of service of the fire alarm system to all occupied areas of the building.
- 3.12.11. The contractor shall advise security in the event that fire alarm system continuity is disrupted such that a fire watch can commence immediately.
- 3.12.12. Repair all damages inside and outside of the renovated areas caused by the demolition/construction without extra cost to the Owner.

3.13. REMOVED MATERIAL

- 3.13.1. All material removed during demolition shall become the property of the Contractor. The contractor shall remove material from the site and dispose of in accordance with provincial regulations. Under no circumstances is the contractor to use the building Owner's refuse containers for disposal.

3.14. NUMBER AND LOCATION OF OUTLETS

- 3.14.1. Provide outlets for power and systems of the number and in the locations shown on the drawings. Locate all outlets accurately with respect to building lines and in centering outlets due allowance to be made for overhead pipes, ducts, equipment and for variations in wall or ceiling finishes, window
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trim, paneling, etc. When necessary, make adjustments to ensure that all outlets are properly centered.

3.14.2. The location of any outlet may be changed without extra cost or credit providing that the new location is within 6 metres (20 feet) of that originally shown on the drawings and that instructions for the change are issued before installation of the outlet.

3.14.3. Do not mount outlet boxes in walls and partitions back-to-back and provide a minimum of 150 mm (6 inch) between boxes. Provide acoustic insulating medium in conduits which join boxes on opposite sides of same wall or partition. Acoustic properties of the wall to be matched or exceeded. Where applicable, for acoustically sensitive/critical rooms, more spacing separation and acoustic box seal is required. Refer to acoustic specifications and electrical drawings for detailed requirements.

3.15. MOUNTING HEIGHTS

3.15.1. The mounting height of equipment is measured from the finished floor to the centerline of the equipment unless specified or otherwise indicated.

3.15.2. If the mounting height of any equipment is not indicated, verify the mounting height before proceeding with the installation.

3.15.3. Install electrical equipment at the following mounting heights unless otherwise detailed or indicated. Refer to Architectural reflected ceiling plans, elevations, sections and details for final device location and to confirm all mounting heights.

3.15.4. All device mounting heights and orientation to be coordinated and confirmed by the Prime Consultant prior to installation.

3.15.4.1. Local switches and control devices: 1100 mm (42 inch)

3.15.4.2. Wall receptacles:

3.15.4.2.1. General: 400 mm (15 inch)

3.15.4.2.2. Above top of counters or backsplash: 175 mm (7 inch)

3.15.4.2.3. In mechanical rooms: 1400 mm (55 inch)

3.15.5. Panelboards:

3.15.5.1. 1800 mm (70 inch) to the top except that the panelboard not to be lower than 150 mm (6 inch) above the floor.

3.15.5.2. Where multiple panelboards are mounted together, align the tops of all the panelboards or trims with the highest panelboard determining the height.

3.15.6. Fire alarm system pullstations: 1200 mm (48 inch)

- 3.15.6.1. Fire alarm system speakers/strobes: 2300 mm (90 inch) and at least 150 mm (6 inch) below the ceiling measured to the top of device, or on ceiling.
- 3.15.6.2. Fire Alarm System end of line resistors as per code requirements. EOL resistors to be grouped in service spaces.
- 3.15.6.3. Fire fighter's phone: 1400 mm (55 inch) measured to the centerline of the enclosure.

3.15.7. Individual starters:

- 3.15.7.1. 1500 mm (60 inch) to the top.
- 3.15.7.2. Where multiple starters are mounted together, align the tops of all the starters or trims with the highest starter determining the height.

3.15.8. Splitters: 100 mm (4 inch) below the lowest equipment connected to the splitter.

3.16. MECHANICAL AND ELECTRICAL CO-ORDINATION OF RESPONSIBILITIES

3.16.1. The following is a list of mechanical and electrical responsibilities for the above mentioned project:

- 3.16.1.1. The Electrical Contractor to provide all starters or combinations starters/disconnects (fused or non-fused, as specified) for Mechanical Motors along with Line and Load side power wiring with the exception of Packaged Mechanical Equipment or Units.
 - 3.16.1.2. Where so specified, Packaged Mechanical Equipment to be provided with its own integral disconnect(s), starters(s) or unit mounted VFD(s). With respect to Packaged Mechanical Equipment or Units the Electrical Contractor to provide the Line Side power wiring and connection(s) to the equipment connection point(s).
 - 3.16.1.3. The Electrical Contractor to provide equipment isolation disconnect switches for all *remote* mechanical equipment unless otherwise indicated within the Mechanical Contract Documents or unless equipment is already furnished with a local disconnect. Where applicable, weather-proof enclosures shall be used. *Remote definition: not in sight, as per NFPA-70 article 430.102*
 - 3.16.1.4. All BAS equipment and devices, to be supplied by the BAS vendor and installed by the mechanical Contractor.
 - 3.16.1.5. The Mechanical Contractor to provide all control wiring, BAS wiring, and 120 volt control wiring for Mechanical Equipment or Units.
 - 3.16.1.6. The Mechanical Contractor to provide all motors.
 - 3.16.1.7. The Electrical Contractor to provide all fire alarm interface wiring to the Mechanical Equipment or Units for fire alarm Fan Shut Down, Fan Start-up as and for fire alarm Smoke Control.
 - 3.16.1.8. The Electrical Contractor to provide all fire alarm wiring.
 - 3.16.1.9. The Electrical Contractor to provide all relays for interface to control wiring for fan shutdown and fan start up for air handling units used as part of the smoke control system(s).
 - 3.16.1.10. The Mechanical Contractor to provide all relays as required by the Mechanical Equipment or Units to connect to the various building systems.
 - 3.16.1.11. The Mechanical Contractor to provide electric pipe heat tracing which to be based upon the self-limited type and be at 208 volts 1 Phase. The Electrical Contractor to provide 208 volts 1 Phase power connection(s) for the electric pipe heat tracing system(s). The Mechanical
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Contractor to provide loads requirements of the heat tracing to the Electrical Contractor prior to final power connection.

- 3.16.1.12. The Mechanical Contractor to provide electric heating, associated controls and control wiring. The Electrical Contractor to provide the Line Side power connection to the electric heating. The Mechanical Contractor to provide any framing required for recessed electric heating.
- 3.16.1.13. Separate Variable Frequency Drives (VFDs) to be provided by the Mechanical Contractor. Should the Mechanical Contractor change or modify motor sizes from what is specified within the Bid Documents during any stage of this project the Mechanical Contractor will be responsible to cover all associated electrical costs such as revised motor starter and feeds, etc.

3.17. FLASHING

- 3.17.1. Coordinate with requirements for roofing, waterproofing and flashing with the Roofing Contractor.
- 3.17.2. Flash electrical parts passing through or built into a roof, an outside wall or a waterproof floor.
- 3.17.3.
- 3.17.4. Provide 8-pound sheet lead flashing for cast iron or wrought iron sleeves passing through roof.
- 3.17.5. Flashing shall suit roof angle and shall extend minimum 450 mm (18 inch) on all sides. Leave flashing as directed by the Roofing Contractor for him to build into roofing, rendering a watertight connection.
- 3.17.6. Provide counter flashing on stacks, ducts and pipes passing through roof to fit over flashing or curb.
- 3.17.7. Provide sleeves passing through outside walls with lead or copper flashing as directed.

3.18. SYSTEM STARTUP

- 3.18.1. Inform Consultant and operating personnel in operation, care and maintenance of systems, system equipment and components.
- 3.18.2. Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- 3.18.3. Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.19. CLEANING

- 3.19.1. Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
 - 3.19.2. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
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- 3.19.3. During the performance of the work and on the completion, remove from the site and premises all debris, rubbish and waste materials caused by the performance of the work for this contract. Remove all tools and surplus materials after completion and acceptance of the work.

- 3.19.4. Vacuum all equipment thoroughly at the time of final acceptance of the work. Clean plastic components and exposed components of luminaires in accordance with the manufacturer's recommendation.

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2. RELATED WORK

- 1.2.1. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1.2.2. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
1.2.3. Section 26 05 33, CONDUITS AND BOXES FOR ELECTRICAL SYSTEMS.

1.3. FACTORY TESTS

- 1.3.1. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

1.4. SUBMITTALS

1.4.1. Shop Drawings:

- 1.4.1.1. Submit sufficient information to demonstrate compliance with drawings and specifications.
1.4.1.2. Submit the following data for approval:
1.4.1.3. Electrical ratings and insulation type for each conductor and cable.
1.4.1.4. Splicing materials and pulling lubricant.

1.4.2. Certifications: Two weeks prior to final inspection, submit the following.

- 1.4.2.1. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
1.4.2.2. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5. APPLICABLE PUBLICATIONS

1.5.1. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

- 1.5.1.1. CAN/CSA-C22.2 NO.38-10, Thermoset-Insulated Wire and Cables (Tri-national
- 1.5.1.2. standard, with UL 44 and ANCE NMX-J-451).
- 1.5.1.3. CAN/CSA C22.2 NO.51-09, Armored Cables.
- 1.5.1.4. CAN/CSA C22.2 NO.75-08, Thermoplastic-Insulated Wires and Cables (Trinational
- 1.5.1.5. standard, with UL 83 and NMX-J-010-ANCE-2008).
- 1.5.1.6. CAN/CSA C22.2 NO.124-04 (R2009), Mineral-Insulated Cable.
- 1.5.1.7. CAN/CSA C22.2 NO.131-07, Type TECK 90 Cable.
- 1.5.1.8. CAN/CSA C22.2 NO. 239-09, Control and Instrumentation Cables.

- 1.5.1.9. American Society of Testing Material (ASTM):
 - 1.5.1.9.1. D2301-10 Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
 - 1.5.1.9.2. D2304-10 Test Method for Thermal Endurance of Rigid Electrical Insulating Materials
 - 1.5.1.9.3. D3005-10 Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

- 1.5.1.10. National Electrical Manufacturers Association (NEMA):
 - 1.5.1.10.1. WC 70-09 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

- 1.5.1.11. National Fire Protection Association (NFPA):
 - 1.5.1.11.1. 70-11 National Electrical Code (NEC)

- 1.5.1.12. Underwriters Laboratories, Inc. (UL):
 - 1.5.1.12.1. 44-10 Thermoset-Insulated Wires and Cables
 - 1.5.1.12.2. 83-08 Thermoplastic-Insulated Wires and Cables
 - 1.5.1.12.3. 467-07 Grounding and Bonding Equipment
 - 1.5.1.12.4. 486A-486B-03 Wire Connectors
 - 1.5.1.12.5. 486C-04 Splicing Wire Connectors
 - 1.5.1.12.6. 486D-05 Sealed Wire Connector Systems

- 1.5.1.12.7. 486E-09 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
- 1.5.1.12.8. 514B-04 Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1. CONDUCTORS AND CABLES

- 2.1.1. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- 2.1.2. All conductors shall be copper.
- 2.1.3. Single Conductor and Cable:
 - 2.1.3.1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
 - 2.1.3.2. No. 8 AWG and larger: Stranded.
 - 2.1.3.3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
- 2.1.4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2. SPLICES

- 2.2.1. Splices shall be in accordance with NEC and UL.
- 2.2.2. Above Ground Splices for No. 10 AWG and Smaller:
 - 2.2.2.1. Solderless, screw on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
 - 2.2.2.2. The integral insulator shall have a skirt to completely cover the stripped conductors.
 - 2.2.2.3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- 2.2.3. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
 - 2.2.3.1. Compression, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.

- 2.2.3.2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
- 2.2.3.3. Splice and insulation shall be product of the same manufacturer.
- 2.2.3.4. All bolts, nuts, and washers used with splices shall be cadmium-plated.

2.2.4. Above Ground Splices for 250 kcmil and Larger:

- 2.2.4.1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- 2.2.4.2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
- 2.2.4.3. Splice and insulation shall be product of the same manufacturer.

2.3. CONNECTORS AND TERMINATIONS

- 2.3.1. Mechanical type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
- 2.3.2. Long barrel compression type of high conductivity and corrosion resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- 2.3.3. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be cadmium-plated.

2.4. CONTROL WIRING

- 2.4.1. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- 2.4.2. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5. WIRE LUBRICATING COMPOUND

- 2.5.1. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.
- 2.5.2. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Install conductors in accordance with the CSEC, NEC, as specified, and as shown on the drawings.
- 3.1.2. Install all conductors in metallic conduits, unless specified otherwise. Where multiple conduits follow the same routing, provide raceway systems.
- 3.1.3. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
- 3.1.4. Conductors of different systems (e.g., 120 V and 347 V) shall not be installed in the same raceway.
- 3.1.5. Install conduit supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- 3.1.6. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
- 3.1.7. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- 3.1.8. Use expanding foam or non-hardening duct-seal to seal conduits entering a building or where penetrating building walls/floors, after installation of conduits.
- 3.1.9. Conductor and Cable Pulling:
 - 3.1.9.1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
 - 3.1.9.2. Use nonmetallic pull ropes.
 - 3.1.9.3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
 - 3.1.9.4. All conductors in a single conduit shall be pulled simultaneously.
 - 3.1.9.5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 3.1.9.6. No more than three branch circuits shall be installed in any one conduit.
 - 3.1.9.7. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2. SPLICE AND TERMINATION INSTALLATION

- 3.2.1. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- 3.2.2. Where the Consultant determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Board.

3.3. CONDUCTOR IDENTIFICATION

- 3.3.1. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.4. FEEDER CONDUCTOR IDENTIFICATION

- 3.4.1. In each interior pullbox, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.5. EXISTING CONDUCTORS

- 3.5.1. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.6. CONTROL WIRING INSTALLATION

- 3.6.1. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- 3.6.2. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.7. CONTROL WIRING IDENTIFICATION

- 3.7.1. Install a permanent wire marker on each wire at each termination.

3.7.2. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

3.7.3. Wire markers shall retain their markings after cleaning.

3.8. ACCEPTANCE CHECKS AND TESTS

3.8.1. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

3.8.1.1. Visual Inspection and Tests: Inspect physical condition.

3.8.2. Electrical tests:

3.8.2.1. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.

3.8.2.2. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.

3.8.2.3. Perform phase rotation test on all three-phase circuits

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- 1.1.2. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by CESC and NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- 1.1.3. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2. RELATED WORK

- 1.2.1. Section 26 05 11, COMMON RESULTS – ELECTRICAL WORK
- 1.2.2. Section 26 05 19, ELECTRICAL WIRING AND CABLES:
- 1.2.3. Section 26 05 33, CONDUITS AND BOXES FOR ELECTRICAL SYSTEMS
- 1.2.4. Section 26 24 19, MOTOR STARTERS AND CONTROLLERS

1.3. QUALITY ASSURANCE

- 1.3.1. Quality Assurance shall be in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with requirements of Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
 - 1.4.2. Shop Drawings:
 - 1.4.2.1. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - 1.4.2.2. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
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1.4.3. Test Reports:

- 1.4.3.1. Two weeks prior to the final inspection, submit ground resistance field test reports to the Consultant

1.4.4. Certifications:

- 1.4.4.1. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5. APPLICABLE PUBLICATIONS

- 1.5.1. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

1.5.2. Canadian Standards Association (CSA)

- 1.5.2.1. CAN/CSA Standard C22.2 No.0.4-04(R2009) - Bonding of Electrical Equipment.
- 1.5.2.2. CAN/CSA Standard C22.2 No.41-07 - Grounding and Bonding Equipment (Bi-national standard, with UL 467).
- 1.5.2.3. Canadian and Ontario Electrical Safety Codes. (Latest Edition).

1.5.3. ANSI/TIA/EIA-607.

1.5.4. Latest edition of IEEE Standard No. 80.

1.5.5. American Society for Testing and Materials (ASTM):

- 1.5.5.1. B1-13 Standard Specification for Hard-Drawn Copper Wire
- 1.5.5.2. B3-13 Standard Specification for Soft or Annealed Copper Wire
- 1.5.5.3. B8-11 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

1.5.6. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

- 1.5.6.1. 81-12 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
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1.5.7. National Fire Protection Association (NFPA):

- 1.5.7.1. 70-17 National Electrical Code (NEC)
- 1.5.7.2. 70E-15 National Electrical Safety Code

1.5.8. Underwriters Laboratories, Inc. (UL):

- 1.5.8.1. 44-14 Thermoset Insulated Wires and Cables
- 1.5.8.2. 83-14 Thermoplastic Insulated Wires and Cables
- 1.5.8.3. 467-13 Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1. GROUNDING AND BONDING CONDUCTORS

- 2.1.1. Install a complete, permanent and continuous system for earthing and grounding of networks, circuits and apparatus. The system shall include electrodes, conductor, connectors and required accessories on drawings to satisfy local authorities.
- 2.1.2. Install connectors according to manufacturer's recommendations.
- 2.1.3. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- 2.1.4. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.
- 2.1.5. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.
- 2.1.6. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2. GROUND RODS

- 2.2.1. Copper clad steel, 19 mm (0.75 inch) diameter by 3m (10 feet) long.
 - 2.2.2. Quantity of rods shall be as required to obtain the specified ground resistance.
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2.3. CONCRETE ENCASED ELECTRODE

2.3.1. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4. GROUND CONNECTIONS

2.4.1. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

2.4.2. Above Grade:

2.4.2.1. Bonding Jumpers: Listed for use with copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.4.2.2. Connection to Building Steel: Exothermic-welded type connectors.

2.4.2.3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.4.2.4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5. EQUIPMENT RACK AND CABINET GROUND BARS

2.5.1. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6. GROUND TERMINAL BLOCKS

2.6.1. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7. GROUNDING BUS BAR

- 2.7.1. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Installation shall be in accordance with the CEC, NEC, and manufacturer's instructions.

3.1.2. System Grounding:

- 3.1.2.1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
- 3.1.2.2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- 3.1.2.3. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2. INACCESSIBLE GROUNDING CONNECTIONS

- 3.2.1. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3. SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

- 3.3.1. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

3.3.2. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

- 3.3.2.1. Provide a grounding electrode conductor sized per CESC and NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
- 3.3.2.2. Provide a supplemental ground electrode to bond to the grounding electrode system.
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3.3.3. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

3.3.3.1. Connect the equipment grounding conductors to the ground bus.

3.3.3.2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

3.3.4. Transformers:

3.3.4.1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.

3.3.4.2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest suitable component of the grounding electrode system

3.4. RACEWAY

3.4.1. Conduit Systems:

3.4.1.1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

3.4.1.2. Non metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.

3.4.1.3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.

3.4.1.4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

3.4.2. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

3.4.3. Boxes, Cabinets, Enclosures, and Panelboards:

- 3.4.3.1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
- 3.4.3.2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

3.4.4. Wireway Systems:

- 3.4.4.1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
 - 3.4.4.2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
 - 3.4.4.3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
 - 3.4.4.4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).
 - 3.4.4.5. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- 3.4.5. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- 3.4.6. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.5. CORROSION INHIBITORS

- 3.5.1. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.6. CONDUCTIVE PIPING

- 3.6.1. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
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- 3.6.2. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.7. MAIN ELECTRICAL ROOM GROUNDING

- 3.7.1. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.8. GROUND RESISTANCE

- 3.8.1. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- 3.8.2. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.9. GROUND ROD INSTALLATION

- 3.9.1. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.
- 3.9.2. For indoor installations, leave 100 mm (4 inches) of each rod exposed.
- 3.9.3. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.
- 3.9.4. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.
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3.10. ACCEPTANCE CHECKS AND TESTS

- 3.10.1. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.
- 3.10.2. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- 3.10.3. Below-grade connections shall be visually inspected by the Consultant prior to backfilling. The Contractor shall notify the Consultant 24 hours before the connections are ready for inspection

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of low-voltage dry-type general-purpose transformers, indicated as transformers in this section.

1.2. RELATED WORK

- 1.2.1. Section 26 05 11
1.2.2. Section 26 05 19
1.2.3. Section 26 05 33

1.3. QUALITY ASSURANCE

- 1.3.1. Quality Assurance shall be in accordance with Section 26 05 11, COMMON RESULTS – ELECTRICAL WORK.

1.4. SUBMITTALS

1.4.1. Shop Drawings:

- 1.4.1.1. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, accessories, and device nameplate data.

1.4.2. Manuals:

- 1.4.2.1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.
- 1.4.2.2. Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the transformers.
- 1.4.2.3. Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
- 1.4.2.4. Certifications: Two weeks prior to final inspection, submit the following.
- 1.4.2.5. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.
- 1.4.2.6. Certification by the Contractor that the transformers have been properly installed, adjusted, and tested.
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PART 2 - PRODUCTS

2.1. TRANSFORMERS

2.1.1. Unless otherwise specified, transformers shall be in accordance with CESC, NEMA, NFPA, UL and as shown on the drawings.

2.1.2. Transformers shall have the following features:

2.1.2.1. Self-cooled by natural convection, isolating windings, dry-type. Rating and winding connections shall be as shown on the drawings.

2.1.2.2. Ratings shown on the drawings are for continuous duty without the use of cooling fans.

2.1.2.3. Copper windings.

2.1.3. Insulation systems:

2.1.3.1. Transformers 30 kVA and larger: UL rated 220 °C (428 °F) system with an average maximum rise by resistance of 150 °C (302 °F) in a maximum ambient of 40 °C (104 °F).

2.1.3.2. Transformers below 30 kVA: Same as for 30 kVA and larger or UL rated 185 °C (365 °F) system with an average maximum rise by resistance of 115 °C (239 °F) in a maximum ambient of 40 °C (104 °F).

2.1.4. Core and coil assemblies:

2.1.4.1. Rigidly braced to withstand the stresses caused by short-circuit currents and rough handling during shipment.

2.1.4.2. Cores shall be grain-oriented, non-aging, and silicon steel.

2.1.4.3. Coils shall be continuous windings without splices except for taps.

2.1.4.4. Coil loss and core loss shall be minimized for efficient operation.

2.1.4.5. Primary and secondary tap connections shall be brazed or pressure type.

2.1.4.6. Coil windings shall have end filters or tie-downs for maximum strength.

2.1.4.7. Average audible sound levels shall comply with NEMA.

2.1.4.8. If not shown on drawings, nominal impedance shall be as permitted by NEMA.

2.1.4.9. Single phase transformers rated 15 kVA through 25 kVA shall have two 5% full capacity taps below normal rated primary voltage. All transformers rated 30 kVA and larger shall have two

2.5% full capacity taps above, and four 2.5% full capacity taps below normal rated primary voltage.

2.1.4.10. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.

2.1.5. Enclosures:

2.1.5.1. Comprised of not less than code gauge steel.

2.1.5.2. Outdoor enclosures shall be NEMA 3R.

2.1.5.3. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.

2.1.5.4. Ventilation openings shall prevent accidental access to live components.

2.1.5.5. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.

2.1.5.6. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated.

2.1.5.7. Dimensions and configurations shall conform to the spaces designated for their installations.

2.1.6. Standard of Acceptance:

2.1.6.1. Eaton

2.1.6.2. Cutler Hammer

2.1.6.3. General Electric

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Installation of transformers shall be in accordance with the CEC, NEC, as recommended by the equipment manufacturer and as shown on the drawings.

3.1.2. Anchor transformers with rustproof bolts, nuts, and washers, in accordance with manufacturer's instructions, and as shown on drawings.

3.1.3. Exterior Location: Mount transformers on concrete slab. Unless otherwise indicated, the slab shall be at least 200 mm (8 inches) thick, reinforced with a 150 by 150 mm (6 by 6 inches) No. 6 mesh placed uniformly 100 mm (4 inches) from the top of the slab. Slab shall be placed on a 150 mm (6 inches) thick, well-compacted gravel base. The top of the concrete slab shall be approximately 100 mm (4 inches) above the finished grade. Edges above grade shall have 15 mm (1/2 inch) chamfer. The slab

shall be of adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit turn-ups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface.

3.1.4. Install transformers with manufacturer's recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be 150 mm (6 inches).

3.1.5. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

3.2. ACCEPTANCE CHECKS AND TESTS

3.2.1. Perform tests in accordance with the manufacturer's recommendations. In addition, include the following:

3.2.1.1. Visual Inspection and Tests:

3.2.1.2. Compare equipment nameplate data with specifications and approved shop drawings.

3.2.1.3. Inspect physical and mechanical condition.

3.2.1.4. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections.

3.2.1.5. Perform specific inspections and mechanical tests as recommended by manufacturer.

3.2.1.6. Verify correct equipment grounding.

3.2.1.7. Verify proper secondary phase-to-phase and phase-to-neutral voltage after energization and prior to connection to loads.

3.3. FOLLOW-UP VERIFICATION

3.3.1. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the transformers are in good operating condition, and properly performing the intended function.

PART 1 - GENERAL

1.1. RELATED INSTRUCTIONS

1.1.1. Refer to Section 26 05 11 -Electrical General Requirements.

1.2. WORK INCLUDED

1.2.1. Provide electrical lighting fixtures and systems scheduled, complete with lamps, drivers and necessary accessories required for their installation and performance.

1.2.2. 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. LAMP AND DRIVER CONDITIONING

1.3.1. Upon first energizing all LED fixtures shall remain energized for a stabilizing period as recommended by manufacturer.

1.4. SHOP DRAWINGS

1.4.1. Conform to requirements of Section 26 05 11

1.4.2. 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.

1.4.3. LED fixture shop drawings must indicate Driver Manufacturer and Model No. for each fixture.

1.4.4. No light fixtures shall be ordered without the review and written approval of the Consultant. Shop drawings should indicate proposed mounting method and hardware required to facilitate a complete and safe installation.

PART 2 - PRODUCTS

2.1. REFERENCE NUMBERS

- 2.1.1. 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

- 2.2.1. Plastic lenses in lighting fixtures shall be acrylic with minimum thickness of 3 mm (.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).
- 2.2.2. 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

- 2.3.1. Refer to the Drawings for the Light Fixture Schedule.
- 2.3.2. Any request for alternate products must be submitted at the Time of Tender for approval. No substitutions will be permitted after tender close.

2.4. LIGHTING HARDWARE

- 2.4.1. 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.
 - 2.4.2. Include, in the tender price, for all lighting hardware required for a complete and safe installation.
 - 2.4.3. 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.
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- 2.4.4. All parts used as a part of the installation must be of the same manufacturer as the respective light fixture. Where ever 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

- 2.5.1. The Electrical Contractor is responsible for obtaining a complete photometric of the entire area of lighting upgrade, both interior and exterior, prepared by a professional, third-party specializing in such work.
- 2.5.2. All fixtures of all makes 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.
- 2.5.3. Photometric statistics shall be prepared for each zone/room. Statistics such as max/min and average foot-candle readings shall be included in the photometric submittal.
- 2.5.4. Photometric shall take into account site condition impacts such as partitions, washroom stall partitions, suspended ceilings, reflectances, etc.

2.6. APPROVED EQUAL PRODCUTS

- 2.6.1. Approved equal products:
- 2.6.1.1. Kennal
 - 2.6.1.2. Cooper
 - 2.6.1.3. Day Brite
 - 2.6.1.4. Eaton
- 2.6.2. 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.
- 2.6.3. 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

- 3.1.1. Do not install or energize lamps until directed by Architect which generally shall be just prior to occupancy of the building by the Owner. Read 'Temporary and Trail Usage'.
- 3.1.2. Provide two (2) new safety chains for all new light fixtures to support the fixture from the building structure. Mount from the building structure. Mounting directly from the roof deck is not permitted. Provide unistrut supports throughout.

3.2. RECESSED FIXTURES

- 3.2.1. 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.
- 3.2.2. Recessed incandescent fixtures shall conform with requirements of Ontario Electrical Safety Code and its latest bulletins. Thermal insulation and combustible materials shall be kept clear of recessed fixtures, unless approved, rated fixtures

3.3. SUSPENSION STEEL

- 3.3.1. Where applicable, provide angle-iron channels welded to the top side of bottom-chord of the L.S.S.J.'s for securing light fixtures.
- 3.3.2. 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

- 3.4.1. 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.
- 3.4.2. Locate and aim emergency lighting remote heads to optimally illuminate egress route.

3.5. COMPLETION

- 3.5.1. Fixtures shall be clean at the time of final acceptance.
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